Articles

In Search of the Psychological Basis for the Biconditional Frame

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Abstract

In this paper a type of mental representation which I call the biconditional frame is interpreted in relation to the discourse processing model presented by cognitive linguists van Dijk and Kintsch (1983). Though their theory was presented almost three decades ago, it has remained one of the most influential theories in cognitive psychology and related fields. Since the theory was proposed before the great advance in computational technology and empirical approaches to the comprehension process in recent years, its significance may admittedly vary according to each researcher's purpose of referring to it. Their approach towards the mental representation based on the notion of strategy still remains one of the most comprehensive and useful source of information for my purpose to identify the types of mental operation which are assumed to contribute to the construction of the biconditional frame.

keywords : biconditional frame, generic knowledge, schema, specification, strategies

1. Schemata as a type of generic knowledge

It is a commonplace that in the text comprehension process generic knowledge relevant to the topic and the situation described in the text plays an important role. Text comprehension depends not only on information explicit on the surface of text but also on the reader's generic knowledge, purposes of reading and various types of contextual information. The reader integrates these different types of information to establish a coherent mental representation of the text. Such a view of text comprehension is also expressed by a group of discourse psychologists in their works: Van Dijk and Kintsch (1983), Grasser, Millis and Zwaan (1997), Van Dijk (2006), etc. As Gallistel (2001) reports, the study of the reader's mental operation was accelerated by what is called the cognitive revolution tied with the emergence of computer science in the 1950's. Advance in computer science made it possible to simulate assumed text comprehension processes by creating computer programs which can perform various activities such as responding to questions about the content of the text as human subjects do.

Traditionally in linguistics, mentalistic notions such as generic knowledge and mental representations tend to be averted since they are invisible and therefore regarded as not physical. Linguists tend to confine themselves to dealing with observable linguistic data

explicit on the surface of text[1], though of course we have seen a relatively recent advance of cognitive linguistics and other related fields of study. The role of generic knowledge in text comprehension has mainly been studied by psychologists. In psychology, knowledge of the world and past experience of similar events are assumed to work as a basis for understanding the event that one newly experiences. Such knowledge is often referred to as schema, frame, script, scenario, etc., which all refer to a generic mental representation of a concept, event, or activity. According to Whitney (2001) the concept of schema dates as far back as to the eighteenth century when the philosopher Immanuel Kant contemplated the conception or schema of triangles. In so doing, Whitney explains, Kant captured the idea that "people need mental representations that are typical of a class of objects or events so that we can respond to the core similarities across different stimuli of the same class."

More recently, Bartlett (1932), one of the founders of modern psychology, noted the important role knowledge plays in reconstructing discourse. Unlike the preceding studies such as those on memorizing meaningless sequences of alphabets, his study on memory used meaningful texts. Studying his subjects' recalling of folktales from unfamiliar culture, he noticed that the reconstructed versions included various differences from the originals. For example, in the reconstructed versions, characteristic syntactic structures of the original story were not maintained; proper names were dropped; information the subjects found illogical was often not remembered or was changed into reasonable forms that fit the subjects' logic; unfamiliar terms were replaced with familiar ones as in the case of the replacement of *seal hunting* with *fishing;* new elements were added as in the case where a moral element, which is conventionally found in the folktales of the subjects' culture, was newly added. Such observations of the subjects' constructive recalling led to his view on schema as an 'active' type of knowledge, and he writes, "Remembering is not the re-excitation of innumerable fixed, lifeless, and fragmentary traces' (ibid. :213). Brown and Yule (1983: 249) comment that the active aspect of Bartlett's notion of schema is unique and is in contrast to the ordinary view of it as fixed 'data structure'.

Bartlett's work was influential to the later generation of schema theorists in the 1970s and the early 1980s such as Minsky (1975), Schank and Abelson (1977), Rumelhart and Ortony (1977) and Tannen (1978, 1985) and Anderson (1977). In their theories, schemata are used in explanations about how generic knowledge in memory is accessed during comprehension. For instance, the generic knowledge known as the restaurant script consists of things (cutlery, tables, etc.) and people (waiter, cook, etc.) commonly found in restaurants and an expectable sequence of events that one usually experiences at restaurants: ordering dessert, having desert served, eating dessert, asking for the bill, etc. The script is activated by certain pertinent words such as *order* and *menu* included in the text. It helps the reader make inferences even when the necessary information is implicit in the text and construct a

[1] Michael Hoey (1983), for instance, describes a macrostructure of text as a sequence consisting of four elements: situation, problem, response and evaluation. Though he briefly mentions the mental operation underlying the pattern, he refrains from stepping out of the surface forms of text by concentrating on describing the explicit linguistic properties of text in his work that was published accidentally in the same year as van Dijk and Kintsch (1983) was. The title of his work is *On the Surface of Discourse.*

coherent text representation. A particular action described in the current text, for instance, is matched with the prototypical action of the script and this matching facilitates the comprehension process. Such a matching process is sometimes explained in terms of the notions of slots and fillers: the prototypical action of a script is seen as a slot while the action described in the current text is seen as its filler which fills in the slot. However, as Garnham (1985: 167) points out, their theories do not "say much more than that information in memory has some structure." Though the body of research generated in the 1970s and early 1980s elucidated interesting aspects of human information processing, it gradually became clear that the notion of schema as a static pre-existing type of knowledge must be modified to deal with more flexible and dynamic aspects of comprehension process.

Thus, scholars such as Schank (1982) started to have a more dynamic view of the use of generic knowledge. According to his theory a kind of framework is variously constructed on the spot reflecting unique features of the current context. Such a framework is constructed to fit the specific context rather than just retrieved as a pre-existing structure, i.e., a schema in its traditional sense. For instance, some variation of the restaurant script can be constructed by incorporating new contextual factors so as to fit the unique situation currently being comprehended: a donation script may be incorporated into the dining part of the restaurant script after a natural disaster hits an area of the country.

Shank's theory reflects a change in the view of information processing among researchers in those days. Cognitive psychologists started to place more importance than before on the data-driven (also known as bottom-up) processing as opposed to conceptually driven (also known as top-down) processing. The former means that comprehension is not appreciably guided by pre-existing knowledge such as schema while the latter means that prior knowledge plays an important role. As Whitney points out, this shit of emphasis is due to various empirical data which showed "our processing represents a more careful balance of conceptually-driven and data-driven processes than claimed by traditional schema theories" (ibid.,2001 :13526). It was also found that during the comprehension process the reader does not make so much use of the schematic knowledge to infer the information that is not explicitly stated in the text as schema theorists used to think. The use of generic knowledge is influenced by the type of text, the goal of the reader and other contextual factors: in some cases comprehension depends heavily on such knowledge but there are many cases where comprehension is dominantly data-driven. It is important to add here that in the critical or evaluative comprehension process, which the biconditional frame is designed to represent, the generic knowledge is assumed to play a crucial role in elaborate inference makings. The process in which the reader tries to understand the intention of the writer and judges the validity of the writer's argument might be more complex and related to higher levels of the comprehension process than the predominantly bottom-up reading process that is relatively easily simulated by computer programs. Such programs generally do not incorporate such critical and evaluative aspects of comprehension.

The notion of schema has influenced many fields of study. Whitney (ibid.) reports its importance in clinical psychology in relation to research on depression and in social psychology in relation to research on the influence of stereotypes on person perception (Hilton and von Hipple, 1996). Also in so-called cultural linguistics, which studies the

relation between language, culture and conceptualisation, cultural schema and cultural models are the most central notions of the research. A cultural schema is considered to be stored in one's memory through his interaction with other members of the same cultural community. Among the members of the same community it is shared and constitutes a collective knowledge of the society, which contributes to the feeling of commonness and the sense of belonging to the same community (Sharifian, 2008, 2011).

2. Logical property of generic knowledge

In the previous section, a mention was made about the change in the view of information processing among researchers. Empirical research showed that the comprehension process is not so predominantly conceptually driven as was assumed by many schema theorists. Conceptually driven (top-down) processing and data-driven (bottom-up) processing are better understood as constituting a continuum or cline with its both ends represented by the extreme cases of each type of processing. The purpose and context of reading determines to what extent generic knowledge is referred to for comprehension. In critical reading, for instance, the reader spends a relatively longer time to process the text to evaluate its content in terms of the validity of the argument presented by the writer. Since evaluation of this type presupposes some kind of judgement about value such as desirability of an action and situation, it is natural to assume that at least on that stage of comprehension the use of generic knowledge plays a crucial role. I claim that in such an evaluation process, a special type of generic knowledge helps the reader to see the point of the argument or the writer's communicative intention clearly. I have been interested in describing such knowledge and have elsewhere referred to some of its representations as biconditional frames[2].

The biconditional frame basically consists of propositions and a type of logical relation established among them. A proposition is roughly defined as the semantic unit consisting of a predicate and its arguments, which will be discussed in detail later. The logical relation established among them is what is called biconditional. In Propositional Logic, it is defined as a logical relation established between the two propositions, *p* and *q*, when the truth table takes the following configuration: *p and q is true;* ¬ *p (= not p) and* ¬ *q (= not q)is true;* ¬ *p and q is false; p and* ¬ *q is false.*[3] This means that from *p* follows *q* and vice versa; from ¬ *p* follows ¬ *q* and vice versa. In other words, for biconditional to be valid *q* must also be true whenever *p* is true (and vice versa); *q* must also be false whenever *p* is false (and vice versa). Because of such logical properties the biconditional relation is also known as the equivalence relation[4].

To illustrate the properties of biconditional, it would be useful to postulate two

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[2] See Ohashi (2010)

[3] See Noordman (1979) for a discussion on the logical property of biconditional. There, he also discusses the distinction between two meanings of conditional sentences: material implication and equivalence.

[4] In propositional logic equivalence relation between two propositions *p* and *q* is symbolically represented as $p \equiv q$.

propositions constituting biconditional relation. Let us imagine that one has a climatologic knowledge about Africa that people there wait for rains which cause the land to be lash for harvesting. Such knowledge might be represented as two propositions, *p* and *q: rains come (p)* and *the land be lush (q)*[5]. When biconditional is established between *p* and *q,* various linguistic expressions can be produced in accordance with different truth values assigned to the propositions. Typical examples of such expressions are as follows: *The rain has come and the land is lush* (both *p* and *q* are true); *The rain hasn't come yet and the land isn't lush* (both *p* and *q* are false/ both ¬ *p* and ¬ *q* are true); *The land is lush since the rain has come* (*q* follows from *p*); *The land isn't lush since the rain hasn't come* (¬ *q* follows from ¬ *p*); *The rain has come and the land will soon be lush* (*q* will follow from *p* <prediction>); *The rain must have come since the land is lush* (*p* must follow from *q* <deduction>).

The affirmation or denial of one of the two propositions in biconditional relation necessitates that of the other: knowing the truth value of one proposition, the reader can predict that of the other. This characteristic of biconditional differentiates it from another type of logical relation, conditional. Unlike biconditional the conditional relation is regarded as valid not only when *p* is true and *q* is true but also when *p* is not true and *q* is true: *the rain has not come and the land is lush.* This expression sounds counterintuitive for one whose biconditional knowledge about the African climatologic phenomenon tells that there is a causal relation between rains and lush lands. One's biconditional knowledge tells that only if rains have come, the land can be lush: rains are thus regarded as the cause of the lush land. If the land is lush without rains, the underlying biconditional is violated: it is a deviation from the general rule. (Conversely, lash lands must occur with rains: otherwise, it is a deviation.) Thus, a sentence that one might find more natural might be *The rain has not come* ***but*** *the land is lush.* The conjunction *but* in the sentence suggests that the observed phenomenon is not in agreement with the generic knowledge, which predicts that the lack of rain will be followed by a dry land. In the case of conditional, on the other hand, given false *p* it is impossible to predict the truth-value of *q* since conditional is valid when *p* is false and *q* is true as well as when *p* is false and *q* is false. In other words, lack of rains may happen either with lash lands or dry lands. Similarly, given true *q,* it is impossible to determine the truth value of *p* since conditional is valid both when *p* is true and *q* is true and when *p* is false and *q* is true. In other words, lash lands can happen either with rains or lack of rains.

The point of this comparison between conditional and biconditional is to emphasise the feature of predictability of biconditional knowledge: determining the truth-value of one proposition automatically determines that of the other. This feature of predictability endows biconditional knowledge with a normative quality: a current phenomenon is judged whether it is in agreement with the norm. If it is, it confirms the normative function of the biconditional knowledge. If it isn't, some reason for the deviation will be required. For instance, if the climatologic norm is violated in the sentence, *The rain has not come but the land is lush,* some reason for the violation will be searched: *The farmers have installed giant*

[5] These two propositions represent a stage where they are neutral with respect to their tense before their truth value is determined.

sprinklers.

The example of norm deviation tells us that the attempt to define the logical property of generic knowledge should not be interpreted in terms of pure logic. In propositional logic logical relations are simply established between two propositions represented by the symbols *p* and *q*, which are totally neutral with respect to their semantic content. They are also neutral with respect to the context in which they are applied. In awarding some semantic property to the symbols, on the other hand, we are applying them in some specific context. Unlike biconditional in logic, which is a universally applicable logical relation, a normative biconditional relation remains valid only under a certain condition: it is not applicable when the condition is not met. In terms of our climatologic example, the causal relation between rains and lush lands is valid only under the condition where there are no sprinklers. The presence of sprinklers in the situation rewrites the context.

The normative function of biconditional is confirmed when the truth of *q* is affirmed on the basis of the truth of *p* or vice versa. It should also be noted here that its normative function is further confirmed by denying the truth of *q* on the basis of the falsity of *p* or vice versa. In terms of our climatological example, again, the norm will be confirmed not only by the case where rains are followed by lush lands but also by the case where lack of rains is followed by dry lands. This is because of the logical property of biconditional, which is valid not only when both *p* and *q* are true but also when both *p* and *q* are false. Since other logical relations such as conjunction (often symbolized as ∧ to represent *and)* also have the truth of *p* and *q* as their truth-condition, this property of biconditional - falsity of both *p* and *q* also makes it valid - is regarded as its distinctive feature. Indeed, the underlying norm may be doubly confirmed both positively and negatively: *When we visited Ethiopia last time, the rains had not come (not p) and the land was dried* (not q). *This time the rains have come* (p) *and the land is lush* (q). In this created example, two occasions on which the writer visited Ethiopia are contrasted and the same normative knowledge is confirmed on both occasions: in one case negatively and in the other positively.

To sum up this section, it is possible to postulate a type of generic knowledge which is characterized by its predictability owing to its quasi-logical property of biconditional. It is applied under a certain context and plays the role of a template for interpreting a current phenomenon expressed in the text. When the new phenomenon matches the template, the normative function of the generic knowledge is confirmed. When it doesn't and the norm is considered to be deviated, some reason must be searched for rewriting the context under which the norm is applied. Because of its unique logical property, such biconditional knowledge might be doubly confirmed both positively and negatively. Both positive and negative confirmations can be explicitly stated in text.

3. Specification

It was discussed in the previous section that a type of generic knowledge which has the logical property of biconditional is considered to be in operation in text comprehension. It was also pointed out that the logical property should not be understood in a purely logical sense since unlike in propositional logic biconditional at issue is not the relation between two

symbols, *p* and *q,* but the relation between two propositions which are semantically specified. The logical relation between such propositions is context-bound and is valid only under a certain condition. The contextualization process might be considered to take place in various stages[6]. For instance, the purely logical relation of biconditional between *p* and *q* might first be specified in such a way that *p* is understood as a cause while *q* its effect. (It should be noted that biconditional in its purely logical sense is totally neutral with respect to this kind of semantic specification.) Then, the cause member and the effect member might be given a specific semantic content related to the climatologic phenomena observed in Africa for instance: *rains come (cause)* and *lands be lush (effect).* The two propositions will be specified in terms of tense in the context where the waited rains have fallen and the land has actually become lush: The *rains have come* and *the land is lush.* Specifications can, of course, vary according to the context. If the land has yet to be lush, the second proposition might be specified accordingly as a situation in the future: *The land will soon be lush.* Not surprisingly, there will be countless ways to specify general propositions to reflect each individual situation of a particular context. Specification connects the abstract knowledge to the actual sentence which reflects the particular context.

Though there will be no finite number of specification, it might be possible to identify some ubiquitous patterns of specification that remain general enough to be applied to the comprehension process of a wide range of texts. What I refer to as biconditional frames is such commonly identified patterns of specification. It is regarded as a quasi-logical structure consisting of four elements: *p, q,* ㄱ *p* and ㄱ *q.* All the four propositions can be explicitly stated in text since biconditional is doubly confirmed. As was discussed in the previous section, biconditional between *p* and *q* is positively confirmed if *p* and *q* are both true; it is negatively confirmed if ㄱ *p* and ㄱ *q* are both true[7]. For instance, the created text below includes the four elements of a biconditional frame:

Text 1
*When we arrived at the village, it had been under a long dry spell (*ㄱ *p) and the land was arid (*ㄱ *q). Finally after a long wait, the rains have come (p) and the land is lush (q).*

In this text, two situations are contrasted: the time of our arrival and the time after a long wait for the rains. In the first sentence the climatologic knowledge of Africa is negatively confirmed while in the second sentence it is positively confirmed. It should also be noted that the negative propositions, ㄱ *p* and ㄱ *q* , do not have to be expressed as negative forms of *p* and *q: the rains have not come* and *the land is not lush.* Generally, negation is less informative than affirmation since it does not assert anything. Thus, to say that a person

[6] The specification process discussed here is simply to illustrate some of its aspects to elucidate the characteristics of biconditional frames and no claim is made on the number or order of the stages postulated here.

[7] In order to reflect this logical property of biconditional, I prefer the symbolic representation including negative propositions , $(p \rightarrow q) \wedge (\neg p \rightarrow \neg q)$, to a commonly used symbolic representation of biconditional, $p \equiv q$. Both of them have the same truth table configuration: they are valid either when both *p* and *q* are true or when both *p* and *q* are false.

isn't clever often means that the person is fool and to say that a person isn't thin often means a person is fat. The symbol ¬ *p (not p)* should be understood as a logical opposite and does not stand for the grammatical form of negation. Affirmative forms represented by ¬ *p* or ¬ *q* should be considered to play the same logical role as negations but their meanings are more specified than negations.

However, simply identifying a biconditional relation among the four propositions in the text does not bring us anywhere. Seeing the two sentences simply as a couple of cause-effect relations does not help us identify any special patterns of specification, either. What we need is to identify some semantic notions that specify the four propositions in such a way that they represent the pattern of a widely observed experience. For instance, Text 1 must be interpreted as a sequence of events which represents the type of experience everyone has in their life: a lucky event puts an end to an undesirable course of event and brings about a happy ending. Such interpretation enables us to suggest a specification pattern: ¬ *p* is specified as *misfortune* (or *unlucky event);* ¬ *q undesirable consequence; p relief; q happy end* (or *desirable consequence*). The four elements are connected with each other by mutually defining the other elements: *undesirable consequence* is the consequence of the *misfortune/unlucky event; relief* puts an end to the undesirable course of event consisting of the *misfortune* and its *undesirable consequence; happy end/desirable consequence* is brought about by the *relief.*

Once this kind of specification pattern is established, its applicability must be checked through the analysis of various texts before it is listed as a type of biconditional frame. It is necessary for a specification pattern to be prevalent enough to be called a frame. In order to illustrate the function of a frame as a template, the analysis of a text is often explained as a process in which the slots of a template representing the elements are filled with relevant information cited or inferred from the text. For instance, the template for Text 1 looks like Frame1:

Frame 1

misfortune/unlucky event <factual>	*undesirable* consequence <factual>
¬ *p: it had been under a long dry spell*	¬ *q: the land was arid*
relief/lucky event <factual>	*happy end/desirable consequence <factual>*
p: the rains have come	*q: the land is lush*

Actually, this fame can be understood as a sub-category of what I call the factual frame. One of the most important factors in the specification process is the factual status of each proposition: whether the proposition is about fact or not. Factual frames are the biconditional frame of which four propositions are all factual. All the four propositions of our example are reported as what actually happened in Africa. One unique point of this frame is that ¬ *p* and *p* are natural phenomena (weather) which are out of human control. Thus, they are respectively specified as *misfortune/unlucky event* and *relief/lucky event* rather than some human actions. Text 2 was created for the purpose of comparison:

Text 2

When we arrived at the village, it had been under a long dry spell. Villagers prayed for rains *(¬ p)* but the land remained arid *(¬ q)*. So we dug a well and installed a sprinkler in their land *(p)*. Now their land is lush *(q)*.

All the four propositions of Text 2 are also factual but unlike in Text 1 *¬ p* and *p* are human actions. This is another specification pattern of the factual frame, which I discussed elsewhere.[8] It is often found in texts which are interpreted in terms of a scenario: learning from the past failure an agent takes an action to solve a problem with a good result. The frame analysis of the text is shown below:

Frame 2

inappropriate response to a problem <factual>	*undesirable* consequence *(problem unsolved)* <factual>
¬ p: Villagers prayed for rains	*¬ q: the land remained arid*
appropriate response (solution) <factual>	*desirable consequence (problem solved)* <factual>
p: we dug a well and installed a sprinkler in their land	*q: their land is lush*

One important point to be discussed here is that the logical relation of biconditional is imposed on text information by the reader who interprets the text. It is not necessarily indicated by explicit signals in the surface forms of the sentences. In Text 2, the two propositions represented by *p* and *¬ p* are, by themselves, not regarded as logically opposite propositions: there are no linguistic signals such as the negative particle *not,* semantic oppositions (dry spell and rains as in Text 1) and lexical repetitions between them. It is only when they are specified as two responses to the same problem that they are established as opposite propositions: *Villagers prayed for rains* is specified to mean that an appropriate solution to the problem was not taken while *we dug a well and installed a sprinkler in their land* is specified to mean that an appropriate solution for the problem was taken. The logical opposition between the propositions is ascribed to the opposition between the specified meanings. It can be concluded that biconditional frames are creatively established by the reader who specifies text information according to a certain scenario or script.

5. Biconditional frames as a product of mental operation.

Up to this point the biconditional frame has been explained as a quasi-logical relation established among the propositions which the reader specifies on the basis of generic knowledge relevant to the context. Constructing such a structure requires a very complex

[8] See Ohashi (2011)

mental operation to say the least. What is referred to as specification here, for example, is related to a type of ability to extract logically opposite propositions from the surface structures even when there are no explicit grammatical or lexical signals for them. Such ability might presuppose various degrees of generalization or abstraction to extract the common semantic element from seemingly unrelated linguistic expressions. Positing such ability implies that the reader attempts to construct a coherent representation of the text consciously. Such a view of the reader as a kind of problem-solver, however, oversimplifies the complex mental process that has been recently investigated by various researchers. Actually, psychologists have not yet reached an agreement even on very basic ways in which generic knowledge is used by the reader in the comprehension process. For instance, on activation of knowledge that is necessary to construct a coherent text representation, there are still controversy on under which conditions the generic knowledge activation process occurs, and whether the activation process is active or passive. The question on how the activated knowledge is integrated into the representation adds another dimension to the complexity. To further complicate the situation, there are still some topics that are relatively untouched, such as, how inference that is not explicit in the text is activated and integrated into the representation.

This state of knowledge about comprehension in psychology implies that though the biconditional frame is postulated as a type of mental representation, it will not, at least at this stage, be so fruitful to attempt to devise a sophisticated psychological model of the mental operation which produces it. It would be more fruitful to attempt to describe the biconditional frame not as a process but as a product. It is possible, for instance, to postulate Frame 1 without deciding whether the generic knowledge that lack of water makes the land arid is actively searched by the reader to establish cohesion between the two propositions p and q or was automatically activated with no particular conscious effort on the part of the reader. Similarly, for the purpose of postulating the frame, it is not necessary to know which is established first in the comprehension process, the contrast between p and $\neg p$ or that between q and $\neg q$.

However, saying so does not mean that assuming that the biconditional frame is a type of mental representation does not require any psychological validation. In order to meet such requirement even partially, it is necessary to consider what kinds of knowledge and operation may be involved in the construction of a biconditional frame setting aside for the moment the exact order and timing of the activation of such knowledge. It is for this purpose that the theory presented by van Dijk TA and Kintsch W (1983) is so instructive. Though their pioneer work was published more than thirty years ago, their model of the comprehension process still remains one of the most influential in the field. They proposed the notion of strategies based on their action theory to approach the complex process of comprehension. It might be possible to see what they describe as strategies in relation to the mental operation assumed to be involved in the construction of the biconditional frame. Their theory is reviewed in rather detail in the rest of this paper.

6. Strategies based on Action Theory

In cognitive psychology text comprehension is often explained as the process in which the reader constructs a mental representation of the text or his interaction with the text. Such representations are variously referred to as situation models, mental models, context models and so on. The properties of such models are diverse but they are characterised in terms of features such as the structural unit (it is often a proposition but sometimes some kind of image), the size (models represent a sentence, a group of sentences or a whole passage) and the type (sometimes they represent only the semantic content of the text but other times they are also concerned with the interactive and contextual information of the text).

van Dijk and Walter Kintsch (1983) explains text comprehension as a process in which the reader applies various strategies to construct a coherent mental representation based on both textual and contextual information. Their notion of strategies are defined in relation to Action Theory (van Dijk, 1977,1980) which was originally designed to explicate general intentional actions of humans. In Action Theory, a strategy is explained to include goal-oriented intentional actions. Such actions are intended to bring about a change in the situation from a state of affairs where the goal has not been achieved yet into another state of affairs where it has been achieved. To represent the situation symbolically, such a change may be represented as one from *not* p_1 to p_1. Actions to achieve p_1 are usually complex in that they can construct a long chain in which each action has unique relations to other actions and the goal. Sometimes hierarchical relations hold among them and some actions are categorised under *macroactions*. It is important to note that there can be many courses of action or alternatives that are supposed to achieve the goal. In such a case the best course of action must be selected on the basis of evaluation of accompanying advantages and disadvantages. The notion of strategies includes as its intrinsic part this evaluation of alternatives. A strategy is a global representation of the means of achieving an optimal goal.

In terms of text comprehension the notion of strategies is interpreted as various mental actions to achieve the goal of constructing the coherent mental representation. Those mental actions change the situation in which there exists no mental representation for the text, which is symbolically represented as *not* p_1, to the situation where there is one, which is symbolically represented as p_1. The reader selects the most efficient way to reach the goal. Strategies are not like rules and algorithms in their strictness of application. They are not methodologically but intelligently applied for the effective and practical purposes. They are also controlled by the limited processing resources of the reader, such as a limited short-time memory capacity (1983:72). In the following sections I am going to explain various types of strategy for constructing mental representations as they are discussed in van Dijk and Kintsch (1983). Intentionally, however, I will interpret various notions in their theory in such a way that they are applicable to the explanation of the biconditional frame, which has been described in the previous sections. I will often refer to van Dijk and Kintsch as the authers in the following discussion.

7. Cognitive Strategies

Since comprehension of a text is a type of cognitive activity, strategies generally used for other types of cognitive activity such as problem-solving are also applicable to comprehension. van Dijk and Kintsch (1983: 69-70) discuss several types of general cognitive strategy related to text comprehension, some of which are mentioned below.

One of the most general strategies is to see situations in terms of means and end. One analyses the nature in terms of the goal/end, i.e., the final state to be reached by the problem-solving process, and the means, i.e., the kind of steps that may lead there. If there are alternative steps to lead to the goal, "steps that are deemed most likely to lead to a goal will be preferred or explored first. If probability of success is believed to be equal, the shortest of easiest action or operation will be taken."

Another general strategy is explained as one's attempt to analyse a complex problem into simpler sub-problems so that one can stepwise reach the final goal by finding a solution to each of the manageable sub-problems. The authors also mention the general strategy of working backward from the known point in the course of action to some preceding point. Backward cognition as opposed to forward searches for alternatives is put into operation, for example, when one notices that errors have been made in the cognitive process. Using generic knowledge is also accounted for as one of the most basic strategies. In the process of problem solving one obtains new information when needed and checks it with old information one has known and integrates it into the knowledge set.

8. Grammatical strategies

Grammatical strategies or sentence strategies are used to produce or understand structures that are specified by the rules of the grammar. They are considered to be dominated by discourse strategies that include higher-level strategies such as semantic, pragmatic, interactional, social and cultural strategies. van Dijk and Kintsch (1983) are mainly concerned with these high-level discourse strategies and grammatical strategies are considered to operate below the levels set for the description of discourse strategies.

The authors emphasise that various higher-level strategies affect grammatical strategies or analyses of a sentence, which might be even skipped in the comprehension process if the reader finds that other strategies make the information of the sentence clear enough. For instance, readers' generic knowledge functions as a type of semantic constraints and makes them understand grammatically different sentences as having the same meaning. The authors cite a case where small children's knowledge that cats chase mouse makes them interpret different sentences such as *the cat chased the mouse* and *the cat was chased by the mouse* as meaning the same.

Examples such as the one above also indicate that grammatical strategies are different from grammatical rules. While grammatical rules apply to structures taken as complete entities a posteriori, grammatical strategies function on line and are of hypothetical and probabilistic quality. Grammatical strategies are used to make a fast and effective guesses about the most likely structure of the incoming data. Such guesses can be wrong and must

be corrected later. Once the relevant data is processed, the reader may use rules to check whether the strategies have been correctly applied. Some examples of grammatical strategies used for parsing sentences are:

> Whenever you find a determiner *(a, the),* begin a new noun phrase;
> Whenever you have identified a verb, search for its corresponding arguments;
> Whenever you find a relative pronoun *(that, which, who, whom)* begin a new clause;
> Try to attach each word to the constituent that came just before; etc.

If the first strategy is applied to the comprehension of sentences such as *The old man the boat,* the analysis ends in NP+NP, which is not the expected sentence structure and requires re-analysis.

The authors emphasise that understanding sentences as part of discourse is a different process from understanding sentences in isolation. Sentence comprehension includes both bottom-up and top-down processes. It should also be added that the notion of strategies in their theory does not necessarily presuppose consciousness on the part of the language users. Some strategies particularly in operation at grammatical levels seem to have been schematised and their application is almost automatic.

9. Propositional strategies

Strategies construct a hierarchical system and the type of strategy that is located one level above grammatical strategies is semantic strategies. They contribute to the construction of a mental representation by providing it with semantic content of the text. They are in turn dominated by other types of strategies that are higher in the hierarchy, such as pragmatic strategies and social strategies. Strategies can be characterised not only with respect to the position in the hierarchy but also with respect to the portion of text they pertain to. Some strategies have global effects on the text as a whole while others have local effects on one or a few sentences. Semantic strategies pertain both to the global and local comprehension of text. In this section a type of local semantic strategy called propositional strategies is illustrated.

Local semantic strategies consist, in part, of the sentence comprehension strategies which involve the construction of propositions. van Dijk and Kintsch (1983) devote one chapter to the description of propositional strategies. They define a proposition as follows:

> ... we will maintain that a proposition is an abstract, theoretical construct, which is used to identify the meaning, or what is expressed by a sentence under specific contextual restrictions (speaker, time, place), and which is related to truth values (ibid. :112).

This definition reflects the authors' view that propositions have both intensional and extensional qualities. They claim that propositions can be defined both in conceptual or intensional terms and in referential or extensional terms. Propositions not only represent the meaning of the sentence but also are true or false relative to a possible world to which they

are related.

A proposition is regarded, like in many other theories such as Fillmore (1968), as a composite unit consisting of a predicate and arguments. A predicate is a concept of a property or relation and an argument is a concept of an individual such as things or persons. From the sentence *John gave the book to Peter* the reader is assumed to create a proposition comprising PREDICATE *gave* and its arguments of various semantic roles: John as AGENT, book as OBJECT and Peter as GOAL.

One of the interesting features is that a proposition thus analysed is further decomposed into what is called atomic propositions. The example sentence can be logically represented as *Gave to (a, b, c) & John = a & book (b) & Peter = c*. *a, b* and *c* in this formula are called argument constants and are interpreted as referring to the individuals in the possible world. One of the elements, *gave to (a, b, c),* means that there exist three individuals that are linked by the predicate *gave to*. *John = a* means that the individual that *a* refers to is John. *Book (b)* means that the individual that *b* refers to is the known book: a parenthesis indicates given information. *Peter = c* means that the individual that *c* refers to is Peter. These are the atomic propositions which are combined by conjunctions (*&*s) to constitute the compound proposition represented by the formula.

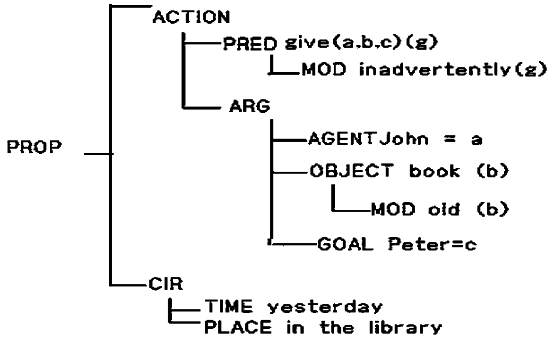
The above description of a proposition is actually a simplified version and there are at least several other important features that should be mentioned here. The structure of a proposition is hierarchical and there are higher and lower level categories. The predicate category and the argument category are organised at a higher level by a specific predication node, such as ACTION, PROCESS, STATE and EVENT. This means that propositions are semantically classified into these general types though the distinction among them is not always clear.

At the same level of the hierarchy where the specific predication node is located, another type of category called the circumstance category is postulated. It specifies the time, place, condition or possible world in which the action, process, state or event occurs. Unless the circumstance category is specified, the action, process, state or event, by itself, is nothing more than a propositional function: unless the possible world is specified, there is no assigning truth value to the information that fills the specific predication node. This point may be better illustrated as the contrast between an imperfect clause *that John gives a book to Peter* or *John's giving a book to Peter* and the perfect version *John gave the book to Peter*. Only with respect to the latter it is appropriate to talk about the truth value to be assigned to the retrieved proposition. If the value assigned is positive or true, we can regard it as representing a fact.

Thus, a proposition can be true or false only if the possible world to which it is related is specified. Facts are true propositions. This view on facts is also related to the authors' view on negation. The authors write, "Negated sentences do not denote negative facts, but should be taken as pragmatic denials about the existence, that is, actualization, of a fact in some possible world" (ibid. :117).

Both the action category and the circumstance category are dominated by PROPOSITION which is the node located at the top of the hierarchy. The authors present a diagram to illustrate the structure of the proposition constructed from the sentence

Yesterday, John inadvertently gave the old book to Peter in the library, which is copied below:



(g) stands for constant that represents the particular action of giving. The authors call this type of schematic representation of a proposition a propositional schema.

The notion of facts is important in the theory since the quality of a mental representation that the reader constructs is not only intensional but also extensional or referential. The authors write that "facts will be postulated as entities in possible worlds, and taken as the referents of propositions" (ibid. :118). This statement ultimately means that facts are created in the cognitive process of the language user who interprets them as such, and, in this sense, are not independent of the language user's cognition.

One and the same entity or phenomenon perceived by the language user can be represented differently according to various factors such as which part of the entity is regarded as important and relevant. For example, the same experience may be described by the writer as any of these:

(a) The professor hired a secretary. She has red hair.
(b) The professor hired a secretary who has red hair.
(c) The professor hired a red-haired secretary.

It is possible that the reader constructs different propositional schemata or mental representations in (a) and (c): in (a) two propositional schemata of the same importance will be constructed resulting in two assertions while in (c) one of the propositional schemata of (a) is reduced to the property of the individual only in one assertion. (b) is regarded as the intermediate case. The importance assigned to the secretary's red hair decreases in the alphabetical order.

The author's point is, however, not only to show the relationship between the surface structures of the sentences and their possible propositional schemata but also to emphasise that various contextual factors can overrule such syntactic constraints. Properties may be expanded to full facts, or full facts may be reduced to properties of individuals. The process in which properties in the syntactic structure are upgraded to separate propositional schemata is called proposition splitting. Conversely, the process in which a proposition constructed for a sentence is reduced to a property and incorporated into another proposition created for another sentence is called proposition fusion.

The authors categorise the strategies for constructing a propositional schema under eight related types, gist of which is shown below (For the exact list see 1983:133):

1. Given some information about a fragment of the world, try to establish a propositional schema.
2. Start construction of schema using given information and knowledge such as: known information from preceding discourse or context, such as circumstantials, individuals and topics; knowledge of predicate schema (stereotypical arguments each verb takes); all the suggestions indicated by the surface structure.
3. Interpret main clauses of surface structures as main propositions and subordinate clauses as embedded propositions. This can be seen as an example of the last item in 2.
4. If modifier information is important, exercise proposition splitting to create a new proposition for it.
5. If new propositional information is not important, reduce it by fusion.
6. Use presupposed information to retrieve previous propositional schemata, which function as the basis for judging the importance of new information.
7. For special surface structures that are used to assign focus to some element such as topicalization and cleft sentences exercise splitting.
8. For ungrammatical or incomplete sentential input, try to fill the missing predicate or arguments by using the above strategies.

10. Local Coherence Strategies

Analyses of coherence and cohesion abound in linguistics and are represented by such classic work as Halliday and Hassan (1976). Generally, it is coherence (underlying semantic relation) rather than cohesion (specific grammatical manifestation) that is more likely to be referred to in various cognitive theories. Coherence means the consistency that relates parts of the mental representation and constitutes a unified and meaningful whole. Though the notion of coherence is related not only to the semantic level but also to various other levels of discourse comprehension such as syntactic, pragmatic and stylistic levels, van Dijk and Kintsch (ibid.) concentrate on the semantic coherence. They explain it both in terms of local and global scales. Local coherence is most basically explained as the semantic relationship that is established between two clauses of a text or between the two propositions that represent these clauses.

The semantic relationship between two propositions has two general types: conditional and functional.[9] Conditional relations mainly pertain to extensional relations. They are

[9] This classification of semantic relationships that are established between two sentences is similar to the classification Winter (1977) makes in his theory of clause relations: Logical Sequence Relation and Matching Relation. Winter's notion of clause does not necessarily mean a conventional linguistic unit in its ordinary sense. It sometimes means a group of sentences or even larger linguistic units which function as a member of the two types of binary relation. Like Hoey (see note 1) who stays on the surface of discourse, Winter also prefers to speak of clause relation rather than propositional relation.

defined in terms of the temporal or causal relation between the facts that are denoted by the clauses. One of the typical relations is the condition-consequence relation: one fact is regarded as the condition for the other that is regarded as its consequence. Relationship between facts will usually be determined by their defining elements, such as predicates, participants and circumstances. Thus, between two propositions connected in this relation elements such as time, place, possible worlds and participants may be identical or have a relation of accessibility to one another. The relation are often marked with explicit connectives such as *because, since, then, but, before,* etc.

On the other hand, functional relations mainly pertain to intensional relations. They are not defined in terms of relationships between denoted facts like conditional relations but are characterised by repetitive or contrastive relation between two clauses or propositions. Some of the typical manifestations are specification, explication, comparison, generalisation and example. Between the following two clauses, for instance, the functional relation holds: *It is cold today. It has been a lousy winter* (ibid. :150). Neither of these clauses can be seen as the condition or consequence of the other. The first clause, on the other hand, might be regarded as expressing an example of the second: today is one of the days that have been lousy.

The establishment of either type of relation, however, is constrained by various factors. The reader's beliefs and knowledge that are activated by the content of the clauses in question play an important role. The preceding discourse defines the context in which the new sentences must be interpreted. It is also constrained by the global structure of the text as a whole: local coherence must contribute to coherence at the macro level. As will be discussed later, we can talk of macro-propositions that are elements of the global semantic structure. If they are given at the beginning of a text, as is often the case with many news articles where the gist of the whole article is briefly stated in the headline and the lead, they constantly affect and control the establishment of local coherence throughout the whole comprehension process. Thus, establishing coherence between propositions, as in the case of the construction of individual propositions, is a cognitive operation exercised in both directions: bottom-up and top-down. Only part of this complicated process is illustrated below from the strategic point of view.

One of the most effective and prevalent strategies applied to the establishment of local coherence is to detect identical participants between two propositions. Identification of the common topic between the two propositions is a particular type of this general strategy. For example, between the following pair of sentences:

John went for a hike in the mountains last weekend. He came back with a broken leg.

the reader may establish coherence because of the shared topic; John. This judgement presupposes various types of knowledge. The reader must know that the pronoun *he* usually denotes a male human individual and in the subject position it has the role of agent or experiencer of the propositional schema. The reader also knows that one of the participants introduced in the previous sentence meets these conditions as its antecedent. In our simple example, the only candidate for the antecedent is the subject of the first sentence, which is

also the sentential topic. The reader's knowledge also includes the fact that the sentence initial position, which is usually filled with the subject, is also the typical slot for the sentence, topic.[10] Based on such knowledge the reader identifies cotopicality between the two sentences.

Not only the agent or experiencer but also other categories of the propositional schemata are common between the two sentences. With respect to the predicate categories of the two sentences, *went to* and *came back* belong to the same semantic class. The generic knowledge of moving between two places enables the reader to see the action described in the second sentence as the consequence of the first. This enables the reader to see the conditional relation holding between the schemata. With respect to the circumstantial categories, both schemata have them filled with *past,* which is determined by the verb tenses of the sentences, though in the first schema the circumstantial is further specified as *last weekend.*

Even in such a simple case, vast amount of knowledge about possible situations is assumed to be matched against the situation denoted by the sentences. Going for a hike in the mountain and coming back with a broken leg might be judged as possible propositions that comprise a possible world. The reader might even associate the propositions with some specific experiences in the past. The particular experience denoted by the sentences as well as personal experiences in the past might be seen as instantiations of the generic knowledge, which might be called "mountain hike" script (ibid. :159).

Breaking a leg may, on the other hand, not be perceived as a normal consequence of going for a hike since there is no direct cause-effect relation between them. Such an evaluation of the relation between propositions may prompt the reader to construct the propositions that mediate between them. The authors call this cognitive process a proposition insertion strategy. In our example, the reader may construct such a proposition as *John fell from a height.*

It should be noted that local coherence is not established only after two propositional schemata are individually constructed completely. Various types of constraints briefly introduced above exert their influence on its establishment at the moment the processing of the sentences starts. On-line construction on the basis of available data is the principle of the strategic view of coherence establishment. Strategies are applied for the sake of their efficiency and are different from rules in that they are not always applicable with a definite result. If the second sentence of our example is *It was his happiest weekend this year,* the general strategy to identify the antecedent of the sentence-initial pronoun *it* with the topic of the preceding sentence is not applicable.

To return to the notion of sentence topic it serves to signal the information fragment that has already been established. The current proposition should be connected with the old or known information which has been expressed or implied by previous sentences. The rest of the information expressed in the current proposition is seen as new information that

[10] The authors emphasise that the "topic" of a sentence is a discourse function, meaning that it is determined not by the syntactic positions but the semantic relationships of the elements in question to the previous part of the text. Strategically speaking, however, the initial position of the sentence is a typical slot for the sentence topic and if a pronoun fills this slot the reader knows that its antecedent is found in the preceding text.

functions as a comment on the old information. The most important part of the comment is regarded as focus. The topic-comment-focus structure of the sentence is referred to as the relevance structure schema. The relevance structure is represented by assigning functions such as *topic* or *focus* to the constituent nodes of propositional schemata interrelated.

11. Macrostrategies

Local coherence is semantic relations basically established between two propositions. On the other hand, global coherence is established among semantic units called macropropositions that are topics or themes of the text as a whole. They must be distinguished from sentence topics which are, as was explained earlier, one of the elements of the relevance schema found in a proposition. Macropropositions are semantic units that subsume a locally coherent sequence of propositions. Once established, macropropositions constrain the interpretation of those subsumed sentences. It is only through the mediation of macropropositions that local coherence is awarded any global function.

Macropropositions are located in a semantic hierarchy: they semantically subsume propositions expressed in individual sentences that are locally coherent, and constitute an episode while they may with other macropropositions of the same level be subsumed under a more general proposition, which is a macroproposition at a higher level in the hierarchy. Global coherent structures that macropropositions constitute are referred to as macrostructures. In order to construct macrostructures the reader applies various strategies at the global level, which are named macrostrategies.

Macrostructures are regarded as a type of summary or gist of the whole text. A number of locally coherent propositions are subsumed under a macroproposition and are thereby reduced to a single proposition. This reduction process can be repeated many times. It constructs a propositional hierarchy and climbing it upwards is a process of replacing propositions with more general ones and deleting unnecessary ones. In relation to the specification of Frame 2, it is interesting to note here that the authors' analysis of an example text shows that at a certain level of generalisation, macropropositions inferred by the reader can include such lexical items as *situation, problem* and *solution.* They are general terms to refer to a sequence of episodes that constitute the whole event. Thus, they could also be included in summaries of the whole text.

The reduction process is explained in terms of three types of macrorules: deletion, generalisation and construction. Deletion is to delete unrelated propositions; generalisation is to replace a group of propositions with one proposition that is commonly entailed by each of them; construction is to replace a sequence of propositions with the proposition entailed by the sequence (ibid. :190). These general rules underlie various strategies the reader actually uses in comprehension. The reader may use the strategy of finding or creating an interesting macroproposition that would subsume subsequent propositions. The reader may delete information from the macrostructure under the assumption that it is just a descriptive detail of the circumstances. If need arises, such information may be retrieved later in case it turns out to be relevant. If the reader cannot use these strategies since the role of a proposition is not immediately clear, a wait-and-see strategy will be applied until a proper

macroproposition is derived.

Macrostructures are distinguished from another type of global structure which is referred to as superstructures. Superstructures are schematic structures that are prevalently identified in particular types of discourse. Some of the well-known superstructures are a narrative schema, an argumentative schema and a news schema. Like macrostructures they organise the whole text and constrain the interpretation of text at lower levels. However, the elements of superstructures have conventionally been determined and their presence in text is highly expectable if one of them is identified. On the other hand, macrostructures are uniquely constructed by the reader for each individual text not constrained by a stereotypical scheme.

Macrostructures are constructed on the basis of both textual and contextual information. Accordingly, it is possible to talk about textual macrostrategies and contextual macrostrategies. Only a few of each type are illustrated below. There are various ways in which macropropositions or their relationships are identified in the text or inferred from it. The most direct sign is, of course, the direct expression of macropropositions in text. Direct expressions of macropropositions are conventional in news articles as their titles and leads.[11] Sentences that play this macro-function often appear either at the beginning or end of the text for practical purposes: providing the frame for interpreting the rest of the text and checking and reminding the already established macropropositions.

In the construction of a macrostructure it is important to identify changes in topics or episode boundaries. The identification of boundaries prompts the reader to construct a new macroproposition. A transition from one episode to another is often signalled by the introduction of different agents, places, times, objects or possible worlds. Some examples of topic change markers used for this purpose are: *X dreamt that ..., X pretended that...* (change of possible world); *the next day ..., the following year ...* (change of time); *in Amsterdam ...* (change of place). Just as local coherence is signalled by various conjunctions, macropropositions are also signalled by various types of connectives: sentence initial *but, however, on the contrary, moreover* etc. signal new macropropositions. Exploitations of various textual signals for the construction of macrostructures are generally referred to as textual macrostrategies.

Just like the establishment of local coherence the construction of macrostructures is constrained by various contextual factors and world knowledge. The authors write about this point as follows:

> ...even without particular information from the discourse itself, language users establish at least topic sets for each communicative situation-topic sets that are progressively constrained by the culture, the social situation, the specific communicative event or speech act, the various social dimensions (roles, positions, status, sex, age, etc.) of the speaker (ibid. :198).

This means that the reader does not construct a macrostructure of a text from scratch but at

[11] To say this implies that the notion of macrostructure is not incompatible with the notion of superstructure. The latter might be regarded as genre-specific and schematised versions of the former.

the start of processing the reader usually possesses some representation of the global and local context in which it is comprehended. This kind of representation works as the frame that monitors the processing of the textual information. Exploitations of various contextual factors to predict what topics can be discussed in the text by the writer are generally referred to as contextual macrostrategies.

Contextual information is not shared by all the readers and accordingly, resultant macrostructures can vary among different readers. Strictly speaking, macrostructures - and for that matter, representations at lower levels as well - can be seen as only a personal creation. The authors' position about this point is that admitting personal differences, they can still postulate a macrostructure that will be created by an average reader who tries to be faithful to the intention of the writer of the text.

12. Superstructures

Macrostructures consist of semantic relations among their components, i.e. macropropositions. If the constituent macropropositions are considered to be categories of a schematic structure that is conventional in particular types of text, the schematic macrostructure is referred to as a superstructure. As was briefly mentioned in the previous section, there are well-known superstructures consisting of various conventional categories. Some of the well-known superstructures are the news schema, the argumentation schema, and the narrative schema. All of them have been studied and described in terms of their constituent categories that are conventionally identified in each type of text. For example, the news schema includes categories such as *Headline, Lead, Main Events, Consequences, Circumstances, Previous Events, Expectations* and *Evaluations* (Dijk, 1988). The narrative schema includes *Setting, Complication, Resolution, Evaluation* and *Coda* (Labov & Waletsky, 1967). The argumentative schema includes *Premise* and *Conclusion.* Below I will discuss from a strategic viewpoint only general characteristics of superstructures without giving any details of each type.

Superstructures are organisational patterns of a whole text. Since they are conventionalised schemata, identification of one of the constituent categories let the reader activate the knowledge of the schema and predict the presence of the other categories in the same text. If the reader knows the type of text beforehand, as is often the case with our ordinary reading activities, the organisational function of the superstructure will constrain the comprehension process from the start. Categories of superstructures are presented in conventional orders in texts. It should be remembered, however, that the order may be transformed according to some factors such as relevance of categories.

Superstructures, just as other semantic structures, are affected by cultural, social and pragmatic factors. The range of possible discourse types has been culturally determined and the reader as a member of a community could expect what types of text, and thus what types of superstructure, he may come across. Similarly, social factors such as participants' status, age, sex, etc. also affect superstructures in such a way that some of the categories become obligatory or optional, or some become more complex and longer, because of the participants' social status. A greeting category in letters, for example, might be affected by

such factors.

It is important to note that categories of superstructures are often accompanied by some speech acts or illocutionary forces. In this sense, relations among categories are not only semantic but pragmatic. Just as macropropositions are subsumed under the higher-level macroproposition, speech acts assigned to propositions at a lower level are considered to be subsumed by a higher-level speech act. The global speech act at the top of the hierarchy is assumed to be the writer's pragmatic intention of the whole text. In order to understand the categories of superstructure, therefore, the reader must identify not only its semantic but also pragmatic functions.

One semantic interpretation of a text as an argumentative schema comprising a premise and a conclusion, for instance, may end up in very different interpretations according to what speech act is assigned to each category. The reader may variably take the conclusion derived from the premise to be the writer's affirmation, assumption, recommendation, etc. since various factors such as purposes of reading and attention focus can affect the reader's speech act assignment. Such differences in the type of speech act assigned to the category definitely affect the reader's comprehension and subsequent attitudes.

Admitting subjectivity involved in the reader's identification of various categories, it is linguistic signals found in the surface structure that allow us to talk about the comprehension process most confidently. There are various types of signals the reader can use for the identification of superstructures and their categories. Some types of scholarly discourse may conventionally indicate the characteristic categories such as *Introduction, Theoretical Framework, Experiment* and *Conclusion*. There are expressions that signal schema categories such as *This story takes place in ..., We may conclude that ..., Before I start with ...,* etc. Some formulaic expressions indicate the type of texts: *Once upon a time...* indicates the opening of children's stories. It should be added that linguistic devices to signal episode boundaries such as various types of connectives can also signals categories of superstructures since the units of macrostructures and superstructures frequently coincide.

One theoretical problem related to the notion of superstructures is that it is not necessarily clear whether in actual comprehension the reader strategically uses this organisational knowledge that is specific to particular types of text or he simply uses general schematic knowledge of action, which is characterised by elements such as *actions, goals, intentions, purposes* and *motivations*. The authors claim that the reader makes use of both types of knowledge but knowledge of superstructure categories must be distinguished from that of general action. With respect to a narrative schema they emphasise that it includes many things that action theories don't:

> The culturally determined ordering of the descriptions in a story, their completeness and level of detail, principles of perspective in storytelling, and even the narrative categories go beyond the actions themselves. We know more about action descriptions than we know about actions (ibid. :253).

This statement implies that the superstructure is common knowledge of how to describe actions: it derives from the intention to communicate the content or action effectively. The

authors also point out that the reader is inclined to impose superstructures most familiar to them on texts which are not supposed to be analysed in terms of them: the narrative schema, for instance, is imposed on argumentative texts. This could be another piece of evidence that supports the view of superstructures as an independent resource that the reader can use strategically for comprehension. The authors also report some psychological experiments that verify the claim that knowledge of superstructures has facilitating effects on free recall and reading speed of texts.

13. Strategies for the use of knowledge as schematic structures

The language user's knowledge of the possible world the text is about, i.e. knowledge of the person, objects, states of affairs, actions or events, is an integral component of text comprehension. In order to construct a mental representation of the possible world, the reader is assumed to constantly refer to this stock of world knowledge. The generic knowledge plays the role of background against which the text information is matched and interpreted.

One of the important features of the matching process mentioned above is that textual information always includes something new. The relationship between the background generic knowledge and the textual information cannot be seen as a simple repetition. With respect to this feature, the authors write as follows:

> ... if comprehension implies finding a suitable knowledge structure that fits the to-be-comprehended material, we must not forget that actions and events, as well as the discourse about them, are always new in some respects. Hence the preestablished knowledge schemata will in general not fit the new event or new discourse precisely. They can provide a basis or a background for comprehension, but no more. Everything really new and unexpected must be constructed on the bases of this background information. Therefore, knowledge schema cannot be rigid, but must accommodate many possible variations in the observed or textually presented objects, persons and events. Somehow, for the purpose of comprehension, whether we are comprehending discourse or events and scenes, we need a memory organization that is flexible and responsive to contextual demand (ibid. :304)

It is presumed that the matching process between the generic knowledge structure and the text information on one hand includes various cognitive processes such as abstraction, generalization, decontexualization and recombination of the textual information. On the other hand, it includes specification and instantiation of the generic knowledge by the new text information. Matching is a comparative operation which includes the identification of the common factor between the two things to be compared and of the difference between them by means of both generalisation and specification. It is generalisation and specification that keep the memory organization (generic knowledge) flexible and responsive to contextual demand.

This characteristic of generic knowledge can also be explained as its schematic nature.

The authors explain the notion of schemata together with its synonymous notions of scripts and frames as follows:

> A schema (script, frame) is a knowledge structure which ties together information in memory. It is a label with slots that stand in some prearranged relation to each other. Each slot accepts information of a given type. "Information" here may mean concepts, propositions, or even other schemata. One can think of the slots of a schema as variables, which can be replaced with specific instances. This is precisely what happens when a schema is instantiated in discourse comprehension: Specific information fills the appropriate slots of a schema. The instantiated schema will in this way be one of the knowledge sources that contribute to the strategic construction of a text representation in episodic memory (ibid. :307).

Though schemata are typically considered to consist of actions to be taken in particular situations in a fixed order, such as a restaurant schema consisting of ordering, eating and paying, etc., the authors emphasise flexibility of schemata. A schema may incorporate another schema into it: for example, a fire schema is incorporated into the restaurant schema to represent the newsworthy incidence that occurred during eating at the restaurant. The schematic world knowledge must be flexible enough to be a useful resource for constructing both locally and globally coherent representations of new and unexpected situations.

The notion of schema is not only related to episodic knowledge such as dining at a restaurant and a fire but also knowledge of superstructures, local coherence and propositional structures. At the global level of superstructures we have already regarded narratives as consisting of several elements, which can be seen as predetermined slots to be filled with macropropositions of certain types identified in individual narratives. At a local level the conditional relation between two propositions is understood as comprising the condition and consequence slots to be filled with the appropriate propositions. The internal structure of propositions has also been referred to as a propositional schema. It is explained in terms of various slots such as predicate, argument and circumstance categories to be filled with atomic propositions. The notion of schema is, thus, an essential concept to characterise and specify the knowledge system in general.

The background knowledge that has not yet been organised as schematic structures is understood simply as a network of related information. Such a network is often graphically represented by nodes to show the elements of the network and lines connecting those nodes to show some kinds of relation among the elements. The network is sometimes a linear relation among several nodes but can be a more complicated web. The network becomes more complicated with the inclusion of hierarchical relations among the nodes. A group of nodes are dominated by a higher-level node, only through the mediation of which the subsumed nodes are related to another node. The hierarchy may be multi-layered.

The group of nodes that are dominated by the common node is seen as a chunk, which is another important notion to characterise various types of knowledge. With regard to macrostructures, we can say that a group of semantically related propositions function as a chunk to construct a macroproposition. With respect to superstructures we can say that a

group of macropropositions function as a chunk to construct an element of the schemata, such as a complication element and a resolution element of the narrative schema. One important characteristic of chunks that psychological experiments have shown is that the capacity of short-term memories restricts the number of the elements that constitute a chunk to only several. It is also important, however, to remember that hierarchical chunking structures are used to overcome this limitation (ibid. :312).

Fragments of the network gain a schematic status if their nodes have been analysed into slots and their fillers. Slots are labelled with information which constrains the quality of the information to fill them and can semantically be connected with other slots. Fillers are specific information that fills the slots and instantiates the labels. Below is illustrated from a strategic point of view a simplified schematisation process. For example, if the reader has travelled to Paris by train, this experience will be remembered and become part of his knowledge. As the reader perceives it as an individual episodic memory, he has not yet applied a schematic analysis to it. It gains the status of schema if it goes through the process of de-contextualisation: it is analysed into a slot, which is, for instance, labelled *my train travel* and the filler, *my train travel to Paris,* which instantiates the slot. This schema implies that there will be other fillers such as *my train travel to London, Munich, Rome,* etc. This schematic knowledge will be the basis for interpreting not only the reader's new experience but also other people's experience described in texts he comprehends. It is only one step further in the de-contextualisation process to construct a slot to be also filled with other people's travel, such as *somebody's travelling to some destination by train.*

It is important to note that schematisation is a context dependent process. The structure of slots is determined only by the context of individual texts. It is possible that transportation rather than the agent or destination is the information in focus in the context and the label defining the slot of the schema may be *Tom's travelling to Paris by some transportation.* This slot may be instantiated by a filler *Tom's travelling to Paris by bus.* The point of this example is that the schema used for text comprehension is always constructed for each individual text. It depends on to what extent the reader de-contextualises or generalises the textual information to retrieve the slot that functions as the given background knowledge for its interpretation. Schematisation is a strategy for incorporating new information into the general knowledge.

In cognitive psychology one of the important topics is to explain how a particular fragment of the associative network is cut out for matching with the new information, with the rest of the network discarded as irrelevant. The authors tentatively propose several general principles or strategies that are related to this process. Spreading activation is one of them. When some node of the network is activated, other nodes closely associated with it in the network also become active though perhaps not so active as the original node. Activation spreads through the network until it fades out completely at certain nodes that are many nodes away from the original. It is also pointed out that matching is only partial and missing links must be supplemented by problem solving since the existing knowledge structure never quite fits the new information. Another useful strategy is based on a bias for global over local matches: If possible, find a match at the level of schemata, which will take precedence over lower order matches and guide them to the exclusion of matches that do not

conform to the schemata (ibid. :316). The most basic strategy is to use argument overlap as a cue.

14. Types of mental representations

Up to this point mental entities that the reader constructs in text comprehension have generally been referred to as mental representations. Actually, the construction of mental representations is assumed to occur at different levels and accordingly various types of mental representations have been proposed by researchers without any consensus. Here, following the authors' proposal, it is important to distinguish among at least three types of mental representations: situation models, textbases and communicative context models.

14.1 Situation models

Situation models[12] are mental representations of facts or events that occur in possible worlds. As part of general knowledge they function as the basis for text comprehension in such a way that the new textual information about a fact or event is compared with the relevant situation model. This comparative operation is also understood as a process of schema construction. What is regarded as common between the existent situation model and the textual information defines the semantics of the slot, while what is new or unrepeated between them defines the fillers that instantiate and specifies the slot. With the slot filled with new information, the original situation model is modified and revised. Theoretically speaking, the reader may not have the pre-existing situation model for interpreting the new situation described in a text and has to create a totally new situation model from scratch based on only the current textual information. However, the reader usually has some situation models to bring into text comprehension. Though situation models used for comprehension are activated by some particular textual information that is currently being processed, they are, as a type of generic knowledge, independent of particular texts or surface forms. Facts and events described in particular texts are incorporated as instantiations into the schema and they themselves become part of the newly established situation model.

The authors present various kinds of support for postulating situation models that are independent of surface structures of particular texts. Mentioning some of them briefly here may be useful to illustrate the general characteristics of situation models. They write, for instance, that coreference relation between two different linguistic expressions presupposes the common individual of a situation model: the expressions *my brother* and *the lawyer* in a text may have different conceptual meanings, but both may refer to the same individual, say J*ohn* in the situation model.

Situation models are also what make translation possible since translation is not a direct relationship between linguistic expressions of two languages but a relationship established between them by the medium of the common situation model. This becomes clearer when the cultural code of the source language is very different from that of the target language.

[12] Situation models are also referred to as event models in later works such as van Dijk (1999).

When we talk about different viewpoints or changing perspectives found in a text, we are also presupposing a situation model. These notions do not make sense unless we presuppose the commonly accepted fact, of which specification differs between different participants or different points in time. Situation models are representations of facts, about which different persons can have different opinions or make different judgements.

In the schema theoretic terms, the slots are defined by the commonly accepted fact while the fillers are defined by the different opinions and judgements. The contrast between facts and opinions seems to be related to the well-known contrast between the two notions: given and new information[13]. About both contrasts it can be said that the second is understood on the basis of the first. Seeing situation models as corresponding to given or known information, however, does not imply that situation models are free from subjectivity. Since situation models are mental entities, different individuals may construct different representations of the same fact. Through the constant updating in relation to the comprehension of new texts, situation models are assumed to integrate not only factual information but also opinions, attitudes and emotions.

Various psychological experiments also support the notion of situation models that are independent of particular structures of texts. For example, some experiments show that people who are told a story in which the order of events have been disarranged often retell the story in its canonical order. Similarly, when a story given to them includes very complex grammatical structures, such as a chain of comparative sentences connected with relative pronouns, people don't use the same structures in recalling the story but they replace them with simpler structures.

14.2 Textbases

Textbases represent semantic properties of texts. Usually, they are regarded as mental representation of the semantic meaning of what was explicitly stated in the text. They are structured both at global and local levels as a result of the reader's application of various semantic strategies for text comprehension. Thus, textbases can be both globally and locally coherent. It is extremely important to remember that during the construction of textbases textual information is constantly matched with relevant situation models. This matching process, as was described above, enables the reader to integrate new textual information into the given relevant situation model, thereby creating a newly modified situation model.

The relationship between situation models and textbases implies that text comprehension means understanding both what the text means conceptually and what it is about referentially. In other words, text comprehension is related to both intensional and extensional semantics. This further implies that the language user can assign such fundamental notions as truth and falsity to textual information based on whether it is matched with the relevant situation model or not.

[13] Another similar contrast is found between the two notions: topics and comments.

14.3 Communicative context models

Thus, text comprehension includes understanding both what the text means (textbases) and what it is about (situation models). However, they do not account for all that is included in text comprehension. Besides these factors text comprehension at least includes the construction of what is called communicative context models, which represent speech acts and their underlying intentions, as well as other information about speaker, hearer, and the context. Communicative context models are assumed to form the link between the situation model and the text representation in this sense: "the text representation is, so to speak, the semantic content of the communicative act, of which the situation model is the referential basis" (ibid. :338).

In his later work, van Dijke (1999, 2006) develops his sociocognitive approach toward discourse and expands the notion of communicative context models into what is simply referred to as context models, which are defined as subjective participants' constructs of relevant properties of communicative situations. He claims that context models show many aspects of interaction that cannot be accounted for in autonomous approaches to discourse which totally focus on language, talk or text itself. Context models must be described in relation to the relevant structures of institutions, groups, power and other aspects of society and culture. The emphasis on the sociological context in which discourse is created has influenced various researches on style such as a study of politicians' rhetorical strategies by De Wet (2010).

15. Conclusion

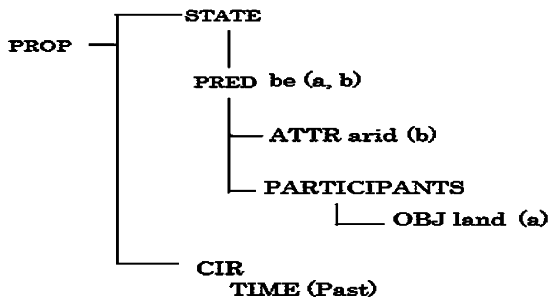
In this conclusive section, the biconditional frame is interpreted in relation to van Dijk's and Kintch's theory discussed in the previous sections.

In Section 6-15, van Dijke's and Kintch's comprehension model has been reviewed in order to identify relevant mental strategies that are also assumed to be exploited by the reader in the construction of the biconditional frame described in Section 2-5. In Section 6, the notion of strategies were explained as having derived from the action theory which allows us to see the comprehension process as an action attempting to achieve a goal with the most efficient means. As explained in Section 7 such means are based on general cognitive strategies and we can have a view of the reader as a problem-solver who exploits various strategies to achieve the goal of constructing a coherent mental representation. Though the notion of strategies derived from the action theory emphasises the active aspect of the comprehension process, it is also important to remember that the application of strategy is not always a fully conscious effort. As briefly discussed in Section 2, later empirical research showed that the intentional use of generic knowledge was more limited and implied that consciousness on the part of the reader should be understood as a continuum. The degree of consciousness varies between the application of lower-level strategies such as grammatical or propositional strategies and that of higher-level strategy such as macrostrategies. With respect to the biconditional frame, its construction can also be interpreted as a goal to be achieved by means of both conscious and unconscious applications

of various strategies on different levels of the comprehension process.

Grammatical strategies discussed in Section 8 are related to the most basic bottom-up or data-based processing of the text at sentential levels. For instance, in the process of constructing the biconditional frame for Text 2, it is presumed that the grammatical knowledge that NP follows the indefinite article *an* is used to identify the grammatical property of the lexical item *well* included in the clause *So we dug a well.* Though grammatical strategies may not be directly concerned with the semantic specification of the biconditional frame, obviously they are in operation at the most basic level of its construction.

Propositional strategies discussed in Section 9 are also presumed to be in operation to construct the basic sematic unit of the biconditional frame. For instance, the sentence of Text 2 *the land was arid* will be schematically interpreted in terms of the propositional representation shown below:



Propositional node dominates the state category and the circumstance category. Time is specified as past based on the surface form of the predicate: was. The predicate *be* takes two arguments: attributes and participants. Participants in this case are instantiated by the object, land.

Local coherence strategies described in Section10 are in operation when two propositions are connected in either of the two general types of semantic relation: conditional and functional. With respect to the relations among the propositions constituting the biconditional frame, the relation between the propositions represented by p and q or that between the propositions represented by $\neg p$ and $\neg q$ are conditional. The relation between p and $\neg p$ or that between q and $\neg q$ are functional. It can be said that the biconditional frame is understood as a unit comprising one pair of conditional relation and another pair of functional relation. Local coherence strategies are in operation to establish this propositional complex of the biconditional frame.

The biconditional frame consisting of four propositional elements can be regarded as a macroproposition explained in Section 11. Since it is established not between two propositions but among the four propositional elements, it is considered to contribute to global coherence. In Text 1 and 2, which was created for explanatory purposes, all the information plays some role in the construction of the biconditional frame. However, in authentic texts, the whole text information is reduced by means of macro rules such as deletion, generalization and construction until the biconditional frame is created. As a type

of macroproposition, the biconditional frame might subsume another lower-level macroproposition. Conversely, it might be subsumed under another higher-level macroproposition. That is to say the biconditional frame can be a macrostructure or an element of a macrostructure.

With respect to the notion of superstructures discussed in Section 12, the biconditional frame cannot be regarded as one of them. Its elements are not conventionally determined in such a way that those of news stories or narratives are: headline, lead, episode, background, conclusion, etc., in the case of news stories (van Dijk,1988); summary, setting, complication, resolution and coda in the case of narratives (Labov & Waletsky, 1967). They are determined during the comprehension process of each text and specified with more general terms that are neutral with respect to genres: response (a solution to the problem) and consequence (a desirable/undesirable consequence), etc.

In Section 13 matching between the text information and the background generic knowledge was explained in terms of the notion of schema. A schema should be understood not as static knowledge but as flexible knowledge responsive to the current situation and context. It must be modified by means of generalisation and specification in comparison with the current text information so that the common factor between them is extracted as the slots of the schema and the differences between them are regarded as fillers. The biconditional frame is also interpreted in terms of the notion of schema consisting of responsive slots and fillers. The unique property of the biconditional frame as a type of schema is that among its elements the logical relation of biconditional is established.

In terms of the types of mental representation discussed in Section 14, the matching process between text information and relevant generic knowledge is interpreted as comparison between a textbase and a corresponding situation model. Van Dijke and Kintch also mentioned communicative context models which include the representation of the writer's speech act or underlying intentions. Biconditional frames have often their elements specified by semantic and pragmatic characterisations such as *attributed recommendation of a response to a problem*. This means that the proposition is specified as a recommendation, which is attributed to some participant other than the writer himself, of an action to be taken to solve a problem. Inclusion of speech acts such as recommendation and distinction between the writer's own information and attributed information to reflect the extent of the writer's commitment to the information indicate that the biconditional frame can also be understood as a type of communicative context model.

In conclusion, the biconditional frame can be understood as a type of mental representation called a communicative context model. It represents the writer's communicative intention based on the four propositions among which the logical relation of biconditional is established. In the process of its construction, various types of strategies are considered to be in operation: grammatical strategies, propositional strategies, local coherence strategies and macrostrategies. The process takes place both in conceptually driven (top-down) and data-driven (bottom-up) manners.

16. Appendix

An authentic text (a news article) is analysed in terms of the biconditional frame. The frame is specified as Recommendation-Gain-Rejected alternative-Loss. All the information is attributed to somebody other than the writer, which is one of the most conspicuous characteristics of news reports. Another significant characteristic of the specification pattern is that all the elements are nonfactual/hypothetical as opposed to the specification of the factual frame discussed in relation to Text 1 and 2. One of the most typical effects of this type of biconditional frames is hortatory force intrinsic to speech acts such as recommendation and warning. All the sentences in the text are numbered for referential purposes.

-HEADLINE- (1)Barristers' leaders call for fresh legal aid fund
-TEXT- (2)A CONTINGENCY legal aid fund should be set up to ensure more people can afford justice, barristers' leaders said yesterday. (3)The fund would be self-financing mainly from a small fixed proportion of damages awarded in successful civil court cases, the Bar Council said. (4)The Bar rejected the Government's proposed civil legal aid 'safety net' scheme as unworkable and wrong in principle. (5)Under the proposed scheme, clients would have to pay legal fees to a limit and only apply for legal aid if costs passed that level. (6)It was unfair to expect clients to commit their own resources first without a reasonable certainty that they would receive legal aid to continue their case, the Bar said. (7)The Bar Council chairman Anthony Scrivener QC, said: 'Action is needed to ensure that more people can afford to get justice in our courts and in our tribunals. (Independent on CD Rom)

Recommended action (nonfactual) <attributed to barristers' leaders>	Gains/bases for recommendation (nonfactual): (2)(7) desirable consequence; (3)practicality <all attributed>
p: (1) (2)setting up a fresh contingency legal aid fund	q: (2)more people can afford justice (3)The fund be self-financing mainly from a small fixed proportion of damages~ civil court cases (7) more people can afford to get justice in our courts and in our tribunals
Rejected alternative (nonfactual) <attributed to the government>	Loss/reasons for rejection (nonfactual):(4)(5)(6) undesirable consequences <all attributed>
¬ p: (4)civil legal aid 'safety net' scheme	¬ p:(4) the scheme be unworkable and wrong in principle (5) clients would have to pay legal fees to a limit and only apply for legal aid if costs passed that level (6) it was unfair to expect clients to commit their own resources first ~ to continue their case

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