THE INFLUENCE OF SCHEMA THEORY ON FOREIGN LANGUAGE READING COMPREHENSION

Xuping Xie
Nantong Teachers University, China

ABSTRACT

The process of reading comprehension is to select schemata and variables to explain input information. Schema, a data structure to illustrate the general ideas stored in memory, plays an important role in editing and planning for retrieval. Schema selection is a process of inference, which quickens reading comprehension. Since schema difference is one of the factors in the failure of reading comprehension, the teaching of language and sociocultural background should be equally strengthened to guide the students to construct schemata helping them assimilate, extract and consolidate knowledge. It is the essential task of teaching reading to enable students to move quickly from lower schemata to higher ones.

Schema Theory

Schema, originally a term in cognitive psychology, was generally thought to be put forward by Bartlett (1932) based on Gestalt psychology. Modern schema theory emerged in the middle of the 1970s with Minsky (1975), Rumelhart (1980) and Shank & Abelson (1977) as its representatives. After its appearance, modern schema theory was soon applied to the research of speech and reading, pointing to a new direction in the research of complicated speech (Freedle, 1979). Rumelhart, Smolensky, McClelland & Hinton (1986) claim that the idea of schema is one of the most important concepts in cognitive science.

Modern schema theorists believe that schema, a data structure of general ideas stored in memory, consists of variables and slots. According to such a principle, meaning exists neither in oral nor in written language itself, but in the reader's mind, depending on the activation of his or her brain schemata whose controlling structure or basic moving pattern is navigated through bottom-up data-driven-processing and top-down concept-driven-processing.

According to the schema theory, in reading, the operations of bottom-up and top-down processing are simultaneous (Rumelhart, 1977). When input information, or particular cases, verifies the relevant concepts or fills the slots in a schema structure, or when input information is consistent with the reader's schema knowledge which

he or she uses to make predictions, 'top-down' processing facilitates the assimilation of new information into the information already stored and if it is not, the operation of 'bottom-up' processing helps the reader to make appropriate responses. In addition, 'top-down' processing with known ideas helps the reader to clarify misunderstandings and to select reasonable explanations from the input. A conversation from Band 4 listening illustrates this point:

A woman's voice:	'I'd like to get some pills to make me relaxed.'
A man's voice: '	OK, I'll write out a prescription for you and you can take it to a drugstore to be filled.'
Question:	Where did this conversation probably take place?

There are four choices:
A. In a doctor's office.
B. At a drugstore.
C. In a hospital.
D. At a man's house.

Making a correct selection depends on whether there is a 'going to see a doctor to get prescription' schema. When we hear the phrases 'like to get some pills', 'write out a prescription', 'to be filled in a drugstore', the schema about seeing a doctor is activated so a quick prediction of the relationship between them and a correct judgment can be made; otherwise, without this schema, no matter how good the grammar or how large the vocabulary, the conclusion that the conversation is in a doctor's office cannot be reached.

The experiments done by psychologists (eg Brewer & Treyens, 1981) show that human's cognition is related to schemata and is affected by knowledge stored in one's mind.

Schema and Reading Comprehension

Rumelhart (1980) believes that comprehension is the process of selecting the schema illustrating input information and variable constraints. Reading comprehension is first of all inputting some amount of information and then searching for the schemata illustrating the information. Comprehension is generated when such schemata are found or some schemata are specified or slots are filled. Just as various concepts operate at different levels, schemata in human's mind also have different levels, and the comprehension process is bound to reflect the levels, that is, the input information

has to be processed at different levels successively from lower level schema specification to higher level one.

In detail, the main functions of schemata for reading comprehension are in editing and planning for retrieval. Here, editing is to select, abbreviate, abstract, arrange, organise and polish reading materials. While schema selection, abbreviation and abstracting are the first stage editing, schema arrangement, organisation and polishing are the second stage editing. The first stage editing accommodates information related to schema and filters the irrelevant. However, the accommodated contents are not the reproduction of the original but the abstraction of its basic meanings, as Bartlett (1932) shown through experiences.

For example, he showed the recall of the North American Indian folktale, *The War of the Ghosts*, is quite different from the original: the story is reorganised, simplified and stereotyped. Details "that fit in with a subject's preformed interests and tendencies" (Bartlett,1932: 93) were recalled. Other details were either omitted or "rationalised by linking them together and so rending them apparently coherent, or linking given detail with detail not actually present…"(p.94). In other words, the first stage editing encodes the text meaningfully and the second stage editing reorganises and modifies the accepted material according to the reader's own special schema knowledge.

Schema is the base of planning for retrieval. In reading comprehension, proper schemata need to be activated to search for information in memory and to rebuild representation of memory. The experiments done by Anderson and Pearson (1978) have provided adequate proofs for the hypothesis of plan for retrieval (p.1-12). In their study the subjects were divided into two groups: one group read the story as robbers, and the other as house-purchasers, and was asked to recall the story. Afterwards, the subjects were required to change their roles. The results of the second recall have shown 10% more than the first recall revealing that, with the change of the viewpoint, many details which were not recalled and not seen as important previously but now important have been recalled. Why can it be explained that the information not recalled previously was retrieved when the participants changed their role? The reason is that the schema in accordance with the new viewpoint was activated and the information related to the new schema was searched in a 'top-down' way and retrieved.

Schema and Inference

One of the crucial points in illustrating cognition with the schema theory is inference in language understanding, which not only links different components in reading,

but conforms reading contents with the reader's stored knowledge as well. There are two main relationships between schema and inference:

Schema Selects Inference

The selection of schema in reading is a process of inference; based on inference of a small amount of known information or through filling in some of the slots (it is not necessary to fill all the slots to activate a schema.), the schema will be activated. For example, at one glance at the sign of Mcdonald's fast-food restaurant, the whole schema of it will be activated. Another example: "John cut the juicy steak. He was enjoying his meal." Although what tool was used to cut steak is not mentioned in these sentences, the reader naturally infers that John used a knife to cut steak and a fork to eat it, for the reader has the knowledge already stored in his or her mind: the schema of eating steak is to use a knife and a fork.

The reader's experience influences which schemata are chosen. In an experiment (Anderson, Reynolds, Schallert & Goetz, 1976) college students of different majors were asked to read the same article:

> Rocky slowly got up from the mat, planning his escape. He hesitated a moment and thought. Things were not going well. What bothered him most was being held, especially since the charge against him had been weak. He considered his present situation. The lock that held him was strong but he thought he could break it. He knew, however, that his timing would have to be perfect. Rocky was aware that it was because of his early roughness that he had been penalized so severely—much too severely from his point of view. The situation was being frustrating; the pressure had been grinding on him for too long. He was being ridden unmercifully. Rocky was getting angry now. He felt he was ready to make his move. He knew that his success or failure would depend on what he did in the next few seconds.

After reading this paragraph, students studying educational psychology regarded Rocky as a criminal planning escape from the prison, whereas Weight Major students from the Physical Educational Department thought Rocky to be a wrestler in a wrestling match. Why is there such difference in understanding? According to the schema theory, students from the two majors have formed different subject knowledge so that they have two different forms of understanding of the same passage. In fact, they have only inference without exact cues. When reading begins, each reader will find some cues from the reading material to infer suitable schema. With reading on, the schema is either substantiated or rejected. If the schema is rejected, the reader will try again to select other schemata.

Inference Speeds Comprehension

Bransford and Johnson's psychological experiment (1973) tested the subjects' understanding of a text and it turned out that most subjects found it very difficult to understand. But once they were told that it was about 'washing clothes', they could use the schema of washing clothes to understand the meaning of the text. The subjects' difficulty was not that they did not have a proper schema but that the cues in the text did not seem related to the schema of washing clothes. And 'bottom-up' information did not help much to activate a proper schema. However, generally, if a title or more cues are given, the reader is provided with a top level schema so that he or she can infer from top down with only a small part of the content. Once the predicted information is discovered and the inference is confirmed, the reading behaviour is successful. Here is another example:

> The cutter selects the shape that is most advantageous to his stone—the cut that will create the greatest play of light, that will best show the colours we call fire. It is the simple design that gives the most brilliant play of light.

There is nothing difficult either in vocabulary or grammar, but even English major Grade Two students had trouble understanding it. The main reason is lack of language hint of schema knowledge, so that when the reader is predicting the theme of the article there are too many uncertain factors which cannot activate the reader's schema. Imagine that if the article is given a heading 'Precious Stone Making', each word in the article at once becomes meaningful. We often see that some science and technology workers are not very strong in grammar, but with their specialised knowledge, when reading the heading they associate their existing knowledge within the heading, which also helps them draw inferences in reading.

Recognising the author's point of view when reading, they can immediately judge its value and look for proofs supporting the viewpoint to judge whether the author's conclusion is right or not as well as the article's value. Thus, the reading behaviour is ended. The whole process is full of the comparison between the old and new information and full of top-down inference. Therefore, the reading speed depends on the reader's ability to infer smoothly, and the base of inference is the reader's own previous knowledge.

Sociocultural Background Differences of Schema

Knowledge is generally common to all people, and so are schemata. It is because of the same schemata that people can communicate and understand each other. However,

there are differences in people's knowledge, and also in schemata, especially among people from different cultural and language backgrounds. Since understanding requires common knowledge, the difference in knowledge could cause failure to understand. In fact, schema difference is seen as one of the major factors failing to do foreign language reading comprehension. In Bartlett's (1932) experimental study, the material comes from the Indian cultural background, but the subjects who read and recall the story are of British cultural background. It turns out that their recall obviously tends to reflect British culture. Look at another example:

> Professor Wheatcroft, of the London School of Economics, in the current issue of BANKER, pounders the question if, as a nation, we are overdoing the Robin Hood act. He has made a study of how income tax and surtax are hitting the big income earners . He is sure that the States is [sic] grabbing too much. (Mackin & Carver, 1971)

If one does not have sufficient knowledge or understanding of western economy and a folklore schema of Robin Hood robbing the rich to relieve the poor (well known in British culture), the true implication of the words is hard to understand. Similarly, many sentences are obscure if there are no situational schemata:

1. A: What time is it?
    B: Well, the postman's been already.

2   A: Can you go to Edinburgh tomorrow?
    B: B.E.A. pilots are on strike.
        (Brown & Yule 1984: 227)

Except for B, E and A, all the other words are common words, yet without conversational background knowledge, the reader does not think that the answers match the questions. Once the reader knows that the postman passes regularly, he will know that B's answer in Example 1 suggests an approximate time, whereas B's answer in Example 2 actually indicates that he cannot go to Edinburg due to British European Airline pilots' strike.

Thus it can be seen that the difficulty in reading lies in bottom-up inference. If the reader's knowledge cannot make up for the insufficient information in the reading material, he or she cannot conduct bottom-up inference or find a proper top-level schema. Without this, the process from top down cannot be carried out, the contents between sentences cannot be linked up, and the paragraph is not easy to be understood.

It is a pity that there are many such articles in foreign language reading, when the writer considers native readers' understanding and strives for writing that will be appreciated by his or her readers, he or she makes his or her reading material succinct, implicit, rhetorical and novel, so that he or she integrates many contents into the background and makes some variables of schemata appear not so obvious. Foreign language readers have to be adapted to such a situation and this, unfortunately, is not easy.

Enlightenment of Schema Theory to Foreign Language Reading Teaching

As other foreign reading theories, we, the teachers of English as a foreign language, can draw inspiration from the schema theory to make our teaching frame richer, especially keeping the following two points in mind:

1. A reading process is an interactive process between the reader and the reading material or the writer. The meaning is not attached to the surface of the language form but depends on the reader's ability to use schema knowledge through both bottom-up and top-down prediction and inference.

2. In reading the reader's world knowledge schema (background knowledge, cross-cultural knowledge, the reading structural knowledge) is as important as his language knowledge (our teaching is very successful in this respect.).Adequate language knowledge, quick activation of word-meaning schemata and the techniques using background schemata to predict and infer –such are necessary conditions for the reader to read efficiently.

I believe that the above two points can be regarded as the theoretical basis for foreign reading instruction. In teaching a course, a teacher requires students to understand the concepts of the course; meanwhile, students are also required to know the concepts in other courses related to this one. Textbooks and the teacher's instruction must explicitly expound the relationship between the teaching contents, events as well as concepts. In instruction, the teacher should foster students' ability of inference and association to enable the students to obtain systematic knowledge or structural knowledge, which can be concentrated as frames to form network and to facilitate memory.

Next, from the schema point of view, the teacher should instruct students how to find and use passage rhetoric schema frames. For example, the teacher may help the student draw the heading as a sketch map and with regard to possible schema frames the article is using, use transitional words, such as therefore, so that, however, on the other hand, first, next, finally, etc., to find the structure of the article and to discover

its theme. If there is no such hints, the teacher may pointedly put forward questions and encourage students to infer how the thoughts in the article are related; the teacher may also use a diagram to summarise the structure of the text and focus the students' attention on the details related to the theme so that they can understand and remember the reading contents better.

Finally, the selection of reading material should proceed from the easy to the difficult and in an orderly way and step- by-step. When available language materials are difficult to understand, the teacher may provide extra language information and language knowledge, such as grammar, cultural background, and world experience, to bring new knowledge into students' previous schema frames to achieve schema internalisation. It is the fundamental task of the teacher's instruction to train students' systematic command of knowledge and their ability of activating schemata from lower to higher level.

References

Anderson, R.C., Reynolds, R.E. , Schallert, D.L. and Goetz, E.T. 1976. *Comprehending Discourse* (Technical Report No. 12) Urbana: University of Illinois Labortory for cognitive Studies in Education.

Bartlett, F. C. 1932. *Remembering*. Cambridge: Cambridge University Press.

Brewer, W.F. & Treyens, J.C. 1981. role of schemata in Memory for Places. *Cognitive Psychology,* Vol.13.

Freedle, R. 1979. Introduction. In R. Freedle(ed.), *New Directions in Discourse,* Vol. II. Norwood, NJ: Ablex.

Mackin, R. & Carver, D. 1971. *A Higher Course of English Study.* London: Oxford University Press.

Minsky**,** M. 1975. Framework for Representing Knowledge. In P.H. Winston (eds.), *The Psychology of Computer Vision.* New York: McGraw-Hill.

Rumelhart, D.E. 1977. Understanding and summarizing brief stories. In D. LaBerge & S.J. Samuels (Eds.). *Basic processes in reading: Perception and* Hillsdale, N.J.: Lawrence Erlbaum Associates.

Rumelhart, D.E. 1980. Schemata: The Building Blocks of Cognition. In R. Spiro, B.Bruce and W. Brewer(eds.), *Theoretical Issues in Reading Comprehension.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Rumelhart, D.E., Smolensky, P., McClelland J.L. and Hinton, G.E. 1986. Schemata and Sequential Thought Processes in PDP Models. In D.E. Rumelhart, J,L. McClelland and the PDP Research Group(eds.), *Parallel Distributed Processing: Expplorations in the Microstructure of Cognition Vol. 2.* MIT Press.

Schank, R.C. and Abelson, R. 1977. *Scripts, Plans, Goals and Understanding.* Hillsdale, NJ: Lawrence Erlbaum Associatees.