Full Length Research Paper

Schema-based text comprehension*

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Schema is one of the most common terms used for classifying and constructing knowledge. Therefore, a schema is a pre-planned set of concepts. It usually contains social information and is used to represent chain of events, perceptions, situations, relationships and even objects. For example, Kant initially defines the idea of schema as some natural structures that enable us to comprehend nature. According to the perspective of Kant who is a strong nativist, the provided opportunities of human mind help us to comprehend temporal relations and their components. In the 1930s, a content of schema idea similar to Kant's was represented again in a more planned and intentional way by Bartlett from Cambridge University in his study "Remembering: A Study in Experimental and Social Psychology (1932/reprint,1950)" Therefore, it is vital for readers to compute information using textual or discourse-related means and integrate their background information in the boundries of textual content and context. Although it is related to the past, Bartlett's approach "[s]chema is an active organization of past experience and reactions. Environmental stimulus contribute to these organized schema" is successful to protect its effects even in today thanks to abstraction of linguistic ideas (cognitive psychology and language), language processing and examination of memory in its natural context. Considering that children who attend elementary school constantly live in close contact with "verbal or written discourse products", the only certainty for all these efforts to comprehend is that it is necessary to continue to produce data for all grade levels until a more integrated approach, supported by more comprehensive and reliable data, is developed. Considering that the research on text interpretation processes have not yet provided an applicable, stand alone alternative, it is evident that such an alternative must benefit from a versatile and interdisciplinary network of information. Furthermore, it is known in the literature on the subject that countless discussions have been and will be held around the scope in question. For instance, despite all the scientific discussions, no assumptions on the nature and processes of text interpretation independent of statements of other fields can be developed.

Key words: Schema, world knowledge, text/discourse structure, information processing.

INTRODUCTION

Cognitive psychology, a field of psychology associated with information processing and how humans use it, focuses on how such mental faculties as senses, memory and reason work (Britton and Black, 1985; Dirven, 2002). This field was first pointed out by Glass et al. (1979). In the early 80s. They associated cognitive psychology with

the question, 'how knowledge is activated and used by humans' and studied senses, memory and reason' (Dirven, 2002; Ashcraft, 2002; Eysenck and Keane, 2003). Therefore, cognitive psychologists are actually interested in how knowledge is stored in human mind. They are striving to unravel this mystery. Hence they need some descriptions of knowledge. Another important distinction is between exemplary description and analytic description. To account for this, Werth (1999: 29) proposes that the exemplary description of an item is the description of which specific ways look like that item and exemplifies this by showing a map and how it symbolizes places. According to Werth, similarity can actually be based on theoretical and cultural models. Furthermore, it can be figurative – the reason why Gardner thinks it is a mistake to consider emphasis in culture. He states that this can be exemplified by such numeric units as the speed, degree and forward/backward moving time of the description of the continuous properties. Therefore, he suggests considering mental descriptions as exemplary (integrity), experimental (such as the content of stored according to perceptual integrity) or as complex movements (such as doing your shoe laces). He also sees some of the codes in language as analytic descriptions.

There is plenty to say about human knowledge apart from the descriptive and associative concepts. Most of what is known is structured in a complex manner. Humans trying to interpret the world frequently use categories and mental schema associated with them. For example, Bilgin (2003: 55) argues that people use two different types of approach depending on the properties of their motives and the situations they find themselves, posits that these approaches are either theory driven or data driven, and every human has some specific conceptual knowledge. Humans will both foresee what is going to happen and acquire new information that will enable them to interpret what is happening right now by using this knowledge. Also, this knowledge will take effect in every new acquisition. Asch reports that groups of subjects who were handed lists of adjective where only a single word differs from the other list had different impressions of the target subject. Asch argues that this is due to the fact that different mental structures or schema were stimulated in the subjects.

To prove the aforesaid mental framework, Bartlett attempted to restructure the concept of schema[1].

Accordingly, a schema or schemas are the graphical representations of outlines or models. They are also organized facts on a specific element in the world. Therefore, it is implied that stereotype information is more or less, similar for all language users in a specific culture. For instance, the word 'house' is associated with a different thing for all language users. However, the stereotype or encyclopedic information is unchanged for everyone. A house comprises a kitchen and rooms. It may have a front door and a leaky roof. It can be rented or purchased. Hence, the Schema Theory points to information clusters about well-associated world, events, people and actions. In this respect, possibilities (Deals with information on events and the consequences of events) and frameworks (Deals with information on the properties of objects and places) are types of more detailed schemas (Sanacore, 1985; Lorch and van den Broek, 1997; Ashcraft, 2002; Eysenck and Keane, 2003).

Bartlett had a special interest in how the memories and reminiscences of people are shaped by their expectations. As such, he defended that the expectations are mentally presented with schematic models and somehow take effect to shape experiences. In a famous experiment, a North American Indian Folk Story was presented at different times to English subjects to be memorized. Although the folk story comprised numerous elements and causal structures that are foreign to the western style expectations, the subjects re-told the story instead of remembering it word-for-word (Eysenck and Keane, 2003: 252-254). However, this re-telling did not

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[1] Despite the issues with Bartlett's processes, Eysenck and Keane (2003) indicate that the evidence affirming his fundamental findings are attained from well-checked studies, presenting their remarks based on the said studies as follows:

For example, Sulin and Dooling (1974) provided some participants with a story about Gerald Martin: "Gerald Martin struggled with the underground administration to realize his political purposes... He became a cruel, uncontrolled dictator. The latest effect of his rules was the collapse of his country" (Sulin and Dooling, 1974). Other participants were given the same story, but the character's name was changed to Adolf Hitler. When the participants that were told a story about Adolf Hitler reading the sentence "He hated the story characters and tortured them", they, to their mistake, believed it more than the other participants. Their schematic knowledge of Adolf Hitler distorted the information about the story. Bartlett estimated that such distortions appear in the long-term memory rather than the short-term memory. There are doubts that some of Bartlett's findings can be repeated under more natural conditions. Wynn and Logie (1998), in various interviews of intervals varying from two weeks to six months, conducted tests to remind students of their "real life" experiences in their first weeks in college. Their results were: "The emergence that occurs throughout this timeline without any change after a time points to the use of very little configuring processes" (Wynn and Logie 1998). The reason for such failure in part may be that the students can only utilize a limited amount of schema-based processes. Whatever the explanations are, the findings demonstrate very little applicability of Bartlett's findings. Another assumption by Bartlett (1932) is that memory distortions are generally caused by schema-based reconfiguring processes activated during recalling. As we have seen in Bransford and Johnson's (1972) work, diagrams frequently influence perception processes rather than remembrance processes. However, schemas also occasionally affect recalling information in the long term memory. Pichert (1978) asked participants to read a story in terms of a robber or someone who wants to buy the house. After memorizing the story, they were asked to take the alternative aspect and to re-memorize the story. In the second memorizing, the participants memorized more information or schemas, compared to the first one, which is more important in the second aspect. Such evidence supports the idea of remembering schemas (pp. 353-360).

Comply with the western style of narration, as demonstrated in the example below.

An original part of the story war of the ghosts and the same story retold by a subject (Bartlett, 1950, P. 65-76)

War of the ghosts

One night, two young men of Egulac went down to the river to hunt seals, at which time the fog came down to the river and became quiet. Then, they heard sounds of battle and thought "It may be a war party". They ran to the shore and hid behind a tree trunk. Canoes arrived and they heard oars. They saw a canoe coming towards them. There were five persons in the canoe and they said "What are you thinking? We wish to understand you. We are going to fight the folk up the river".

One of the young men went along, but the other returned home…(It turns out the five men in the boat are ghosts and the young man accompanies them in their war, then returns to the village to tell his story) … Take care, I have accompanied ghosts and we fought. Many of our comrades were killed, many of the attackers died. "They said I was shot, but I did not feel it", he said. He told all then stopped. When the sun rose, he collapsed. Something black came out of his mouth. His face bent over… He died.

Brief presentation of the story

One night, two young men of Egulac went down to the river to hunt seals, at which time the fog came down to the river and became quiet. Then, they heard sounds of battle and thought "It may be a war party". They ran to the shore and hid behind a tree trunk. Canoes arrived and they heard oars and saw a canoe coming towards them. There were five persons in the canoe and they said "What are you thinking? We wish to understand you. We are going to fight the folk up the river".

One of the young men said "I don't have any arrows".
"The arrows are in the canoe", they answered.
"I cannot come with you, I could be killed. My relatives don't know where I went", turning to the others "But you can go with them", he said.

Thus, one of the young men went with them. But the other returned home. So, the warriors went up the river, while the rest returned to the town. The villagers came near the shore and began to fight and many were killed. But the young men suddenly heard one of the warriors say, "Let's go back, the villagers are hit" and thought "they are ghosts". He did not feel injured, but they said he was hit. Thus, the canoes returned to Egulac and the young man went home through the shore. He lit a fire. He told what happened to many people and said "Take care, I accompanied ghosts and went to fight alongside them. Many of our friends were killed and many of those attacking us were killed. They said I was hit, but I did not feel injured". He told all of these then stopped. When the sun rose, he collapsed. Something black came out of his mouth. His face became grim. People jumped and cried. He was dead.

The story retold by a subject (two weeks later)

There are two ghosts. They are by the river. There is a canoe in the river holding five men. There, the war of the ghosts began… As it started, many were injured and many died. A ghost was injured, but did not feel sick. He returned to the village in a canoe. The next morning, he felt sick and something black came out of his mouth and they shout "he's dead".

A brief presentation of the story retold by a subject (two weeks later)

Two young men of Egulac went to catch fish. While they were busy with the work, they heard sounds from a distance. One of them said "These are war cries" and "there will be a battle nearby". As they went up the river, some warriors appeared who asked them to join in.

Due to his family, one of them asked them to excuse him and said "I cannot come", "I could be killed". So, he returned home. On the other hand, the other men joined the party and went up the river in canoes. As they were landing, the enemies emerged, running towards them. One of them was finally injured and the group realized they were fighting ghosts. The young man and his friends went back to their homes in their boats.
The next morning, he was telling his adventures to his friends. Suddenly, something black came out of his mouth and he fell down in screams. His friends surrounded him. Unfortunately, they realized he was dead.

The differences in the presentations of the above story are quite remarkable. Many details in the original story disappeared in the other versions. In the story taking place in Egulac, the men hear the sound of oars and hide behind a trunk. But this piece of information is not present in the story as it is retold. Furthermore, the presentation of the story took a more modern shape. For instance, "due to his family". Also, in the original story, a war party

is set to make war on people. In the other version, this is a trip. In the original story, the protagonist is hit, while in the retold story, that person is plainly "someone". Moving on the question of "How can this and many similar variations be explained?", Bartlett defended that the remembering of the stories is affected by the recipient's mental framework. In this, he thinks of associating the processing of new information with the use of old information. Thus, this mental framework presents evidence that new events are integrated with existing information structures (With respect to the story above, the information relates to the Indians). However, this mental framework also leads to warping or distorting new facts (Ashcraft, 2002; Eysenck and Keane, 2003).

According to Bartlett, western subjects reading this story will adapt to their own information framework. "Hunting seals" in the original story will turn to the more familiar "fishing", "war cries" (shouts) and "warriors" will be transformed to "enemies". Therefore, Bartlett (1932) believes such information can be analyzed using the various categories listed below (Solso et al., 2005):

> *Transformed Information*: *Unknown words are replaced by known words.*
> *Transformed Sequence*: *Some events in the story will be shown to have taken place before and after others.*
> *Omissions*: *Information that seems meaningless or not fulfilling the subject's expectations will not be remembered.*
> *Logicalization*: *Some information is added to the story to make the non-complying parts of the story compliant or reasonable.*
> *Prominent Subject*: *Some subjects become more prominent and some features are associated with that subject.*
> *Participant's Attitude*: *The degree of remembrance is determined by the participant's attitude towards the material (p. 334).*

On the other hand, schemas are also important for processing linguistic information. For instance, Schank and Albelson (1977) pointed to the possibility of a restaurant that involves going to the restaurant to eat (information on the general chain of events). Because, most of the information used to facilitate understanding what is heard and read, consists of schemas. Another significant function of diagrams is to enable establishing expectations. For instance, we expect to be shown to the table and the waiter to take our orders for food and beverages in a restaurant. If any of these expectations are interrupted, we take the necessary action, such as, if the menu isn't provided, we expect to make eye contact with the waiter. As our expectations are generally fulfilled, the schemas help us to make the world more predictable (Abhcraft, 2002).

Schank and Albelson worked on how people gather the information they use –as can be seen below- in understanding a text (Werth, 1999: 103-105). To this end, they developed the Scenario Theory that aims to focus on the ways to gather information in understanding daily activities, such as going to a restaurant. In this schema, walking and sitting are activities, whilst roles[2] – waiter, etc.- or other sub titles –entering, etc.- are the structural gaps in the schema. Role gaps are filled with values as waiter, customer, cook, etc., by certain people in the environment (situation). For instance, it is unexpected and unusual to see a dog as a waiter, and this unforeseen event causes extra activity (in the brain). General components of the schema are the different versions of structural gaps – taking activities like walking, sitting, etc. into consideration. In this case, it is possible to create structures to complete people's knowledge about daily events (Werth, 1999). For this, Schank and Albelson (Eysenck and Keane, 2003) worked on gaining the knowledge people use to grasp the meaning of a long text, such as the one below.

> *Ruth and Mark were having lunch in a restaurant today. They really liked the food. But they were worried about the price. They were shocked to see the bill that came after the ice-cream was rather reasonable (p. 252).*

When we read the text, we infer that the food (mentioned in the second sentence) is the lunch they had in the restaurant and it included ice-cream, and that the bill did not come on its own, most probably brought by a waiter and we infer these by using our knowledge. Schank and Albelson argue that we need forecasting outline to deduce and uncover the hidden sides of the events. These special outlines they claimed are called schema. They are also knowledge constructions that organize conventional clusters of daily events. For instance, if you occasionally eat in a restaurant, you have an "eating" in a restaurant schema, that is "Restaurant Schema" (Lorch and van den Broek, 1997; Ashcraft, 2002; Eysenck and Keane, 2003). This Restaurant Schema developed by Schank and Albelson has four main parts; "entrance, order, eating, leaving. These main parts have subparts as

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[2] For instance, an occasion where the food is served by a chimpanzee or a unicycle rather than a waiter. Schank proposed more versatile information schema organizations like memory organization packages. But symbolic information blocks, even the ones proposed by Schank (1973, 1975, 1977), are not versatile enough to explain human cognition. For this reason, cognitive psychologists focused their attention to neural networks, that is to computer models that (more or less) simplifies our understanding of human neural system (Werth, 1999; Ashcraft, 2002; Eysenck and Keane, 2003). In these neural network models, information is programmed by the researcher but it is perceived as he processes the input and gets a feedback about its performance (McClelland, Rumelhart, & PDP Research Group, 1986). Output produced by the system in supervised learning paradigms (i.e. a positive response to confirmation) is considered right or wrong by the supervisor (Anderson and Lebiere, 2003: 591-592).

well, such as entering the restaurant, looking for a table, thinking about where to sit, heading to the table and sitting" (Eysenck and Keane, 2003: 254).

It is better understood by the example above that, neither genre specific knowledge nor more special linguistic clues are enough on their own to define the processes of grasping. Comprehenders use different versions of older knowledge to understand the defined situations. Besides, using older knowledge is necessary to comprehend the expression (Anderson and Lebiere, 2003). This example also shows that comprehenders sometimes need to change or shunt their previous knowledge to grasp the true meaning of an expression. Thus, fully grasping different expressions require lowering our expectations of the reality of the defined situation (fairy tales, science fiction novels, etc) and predicting special violations of normal expectations. For instance, in a fairy tale, it is expected to see characters with magical powers or talking animals, but not spaceships or other futuristic technologies. Similarly, futuristic technologies are expected in a science fiction story, but not talking animals or magic wands. For this reason, acquisition and application of former knowledge is more important in grasping expressions (Zwaan and Rapp, 2006: 726-728).

It can be seen that main problems in Schema Theory were not ignored. Because of the unscrupulous nature of Schema Theory, many researchers agree on its being unprincipled. Eysenck and Keane (2003: 256-257) present a comprehensive analysis of views on problems of schema theory introduced by researchers by taking integrity problem and coordinating schema fact into consideration as follows:

Schema theory has been used as it is always possible to create a certain concept for information blocks. Schank has been working on this problem by aiming to limit probable blocks in long-term memory, but the theory is still not clear. Problem still exists. For example, what are the certain contents of these blocks? So in general, schema theory is good at analysing results, but it is not as forecasting as expected. There are two solutions to this. First, theorist can at least demote the contents of the used blocks to definable condition. So, if you are using dynamic memory theory, you can identify possible schema to be used. Unfortunately, when we take vastness of human knowledge and possible changes of knowledge blocks in different people into consideration, this becomes almost impossible. Another option is to be more vivid than today in how to gain these blocks. If we have more information on this, we can be able to test how chosen experiences transform into more controlled form. Although dynamic memory theory was presented to overcome the integrity of Schema Theory, some leading theorists still believe that intuitive integrity of the approach is still not noticed in any current schema (Rumelhart et al., 1986a). For instance, Rumelhart and Ortony (1977) claimed that structural gap variants in schema have two differentiating properties. First, as stated before, a certain object must be tested to see if it is a suitable filler for a structural gap or not. Second, structural gaps must have mutual attachment, that is, if a gap fills a specific value, then value in the schema must start a change in the faulty value of the structural gap. For instance, let us assume a room schema with gaps for furniture. There are small objects in the room and the room is of normal size; then the following structure would be faulty for a kitchen schema; furniture, a kitchen table, chair; small objects, cup, bread box; size, small. There would be different faults in the other rooms. Bathroom is also small. But there is toilet, shower and washbasin. There are toothbrushes as small objects. Rumelhart et al. (1986a) solved these problems with a connecting approach of the schema. According to this, schema emerged after a need out of relationship between numerous interconnecting parallel processing parts. In this framework, there are no clear schema but action models that affects schema in the previous study. When the input is taken from a parallel path, some components in the path are active while some are passive. Rumelhart et al. showed the usefulness of the framework by coding schema-like info in a connecting path. Firstly they chose 40 definition (i.e. door, small, washbasin, walls, medium, etc.) for four different room types (i.e. kitchen, bathroom, bedroom, etc.). Test subjects were asked if each defining word completed the room in their imagination to get the main information, that is the path (pp. 256-257).

Bartlett states that textual information is systematically distorted by the reader to cross match –in the memory- it with his cultural and real knowledge and this distortion increases in time. In fact, various following researches in textual processing period are based on the theoretical framework he developed. Moreover, Bartlett differentiated the mental presentation of the reader with the text's surfacing presentation. This differentiation is backed up by pioneering researches on textual processing. On the other hand, Bartlett states that readers are trying to make meaning out of both their pre-existing knowledge (rendition) and internal organization (Bransford and Franks, 1971; Schnotz, 1984; Britton and Black, 1985; Britton and Gulgoz, 1991; Lorch and van den Broek, 1997; Berman and Nir-sagiv, 2007). In various studies in harmony with his statement, it is seen that in understanding a text reader's memory for a text, that is text's topic, is important. Mentioned studies also show that a reader's under-

standing a text mainly depends on his accomplishment in associating[3] his pre-existing knowledge with the text's content (Schnotz, 1984; 54-55; Bransford and Johnson, 1972). In connection with these findings, many studies on educational psychology point out that suitable pro-regulators help readers in analyzing textual consistency (Ausubel, 1960; van Dijk and Kintsch,1983; Mannes and Kintsch, 1987: 91-93; McNamara et al., 1996: 1-4; Halldorson and Singer, 2002: 145-146; Berman and Nir-sagiv, 2007: 90-93; Tracy and Headley, 2013).

There are two more non-behaviorist centered and interconnected sources different from Bartlett's Schema-Theoretic Approach (Anderson and Bower, 1973). Both sources have been examined by education psychologists that aim to apply the experimental studies on memory to classroom learning. For instance, in one of these studies, it has been analyzed if the Interference Theory, developed to explain Paired Associate Learning, satisfactorily defines forgetting a text. In fact, testing conditions and interference effects, when a text made carefully, are correlated to their connected expression (Myrow and Anderson, 1972). But the conditions that the argument is observed are proportionally limited. Hence, theory is viewed as "lacking qualifications to explain memory for a text". In short, Schema Theory was very popular in the 1970s and was tried to be updated. These theories came up in different forms. For instance, Schank's (1972) Conceptual Dependency Theory associated schema with connectional theories. Rumelhart et al. used it to present Story Grammar, that forms a basis to story comprehension (Rumelhart, 1975; Stein and Glenn, 1979; Thorndyke, 1977). In terms of developmental psychology, Piaget (1967, 1970) used schema thought to explain cognitive changes in children. Schema also includes organized sentence patterns, suggested by Schank and Albelson (1977) to test people's knowledge about daily situations, named as scenarios. Rumelhart and Ortony (1977) and Rumelhart (1980) argue a use of a general schema. For artificial intelligence, Minsky (1975) suggests a similar structure named framework, included to

visual perception (Lorch and van den Broek, 1997: 213-217).

In addition to these in terms of on which topics schema theory focuses, Akyol (2006: 36-37) focuses on how new knowledge is integrated with the older, how it is learnt, how the learnt is changed and developed, and how they are used. Akyol also emphasizes, "This theory suggests that schema are always open to development. There is never a complete schema. When the concepts in the schema are considered in terms of their relationship with other concepts, there is always a development and an enlargement. It is seen that there is only one thing certain for these understanding efforts, that is the notion of continuing to develop data for every possible condition, whether it is controversial or not, until obtaining a more integrative approach supported by more comprehensive and reliable.

Conclusion

Although there is a short history of the study in understanding text, an important portion of elucidatory ideas was implemented by schema, script and frame (Schank and Albelson, 1977; Minsky, 1975; Werth, 1999: 103-105). According to this notion, knowledge merges with other information that can be connected around an object's main features or the main point or action of a suitable and available clusters of a thing. The effectiveness of schema rationale in terms of teaching applications, although they are less effective today than before for comprehension studies, became more perceivable because of the development of connecting learning processes by the researchers (Linderholm et al., 2000). This is more tangible today than before. As it can be understood by this, the essence of schema centered comprehension depends on the coupling of text and schema.

Considering that children who attend elementary school constantly live in close contact with "verbal or written discourse products", the only certainty for all these efforts to comprehend is that it is necessary to continue to produce data for all grade levels until a more integrated approach, supported by more comprehensive and reliable data, is developed. Considering that the research on text interpretation processes have not yet provided an applicable, stand alone alternative, it is evident that such an alternative must benefit from a versatile and interdisciplinary network of information. Furthermore, it is known in the literature on the subject that countless discussions have been and will be held around the scope in question. For instance, despite all the scientific discussions, no assumptions on the nature and processes of text interpretation independent of statements of other fields can be developed.

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[3] A similar situation is also viable to a descriptive texts, some kind of a template. When the plexal connection of the descriptive text is made schema relationship is used, just like story texts. Along with these, whether the readers have a mental schema about the content of the text or not makes the understandability of the text easy or difficult (Bartlett, 1932/1950; Bransford and Johnson, 1972; Schnotz, 1984: 55; Berman and Nir-sagiv, 2007). Thus, schema not only includes information about tangible elements but also the relationship between various elements. Hence, if the readers have pre-existing schema related to the information provided in the text, they understand the text more easily than those who have not. This is the reason why Anderson (1984) "defines schema as the organized form of earthly knowledge" (Lorch and van den Broek, 1997; Linderholm, Everson, van den Broek, Mischinski and Samuels, 2000: 532-533; Ashcraft, 2002; Eysenck and Keane, 2003).

Conflict of Interests

The author has not declared any conflicts of interest.

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