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SCHEMASES AND COGNITIVE MODELLING OF NARRATIVE

Abstract. Understanding the meaning of a word in particular and a narrative story in general requires the presence of a scheme, a mental model or a mental image, a frame that structures simple and multi-component concepts. The schema or frame theory has its origin in a number of related fields. The ideas of philosophy, cognitive science, cognitive psychology, and artificial intelligence theory appeared to be fruitful in unfolding cognitive modelling of a narrative as a fictional text. The topicality of the article reveals the interest in mind modelling embodied in a fictional text, which unveils esthetic reality and admits certain perception, understanding, and interpretation of human experience. In hermeneutic phenomenology, the schema is studied as an interpretative structure of the experience, which is directed at understanding the objects of the surrounding world and fictional and aesthetic objects, for example, fictional literary text. It is a specific environment where knowledge has to be organized. Schemas, or mental models, are cognitive structures that represent generalized knowledge and do not contain information about specific subjects, cases, or events, but only about their general form. The speaker uses schemes to understand the meaning of linguistic expressions, the reader understands fictional events and actions of characters due to receiving general information. Schemas organize the knowledge base of individuals, they are culturally significant, and function as collective repositories of knowledge. The cognitive scheme is a productive means of realizing the writer’s experience, a factor of understanding and interpreting the meaning of the fictional text from the point of view of cognitive narratology. Frame is the term, which is close to a schema theory, but has a different
scientific tradition. Frame narrative is a literary technique in terms of fictional text perception and understanding. Narrative is the communicative environment that enables application of both schemas and frames in order to make interpretation possible.

**Keywords:** text, discourse, frame, schema, cognitive modelling, cognitive psychology, knowledge

**Setting up the problem.** Cognitive ability of a person to conceptualize situations at different abstract levels using schemas is indisputable [20]. The notion used by researchers in the field of narratology for knowledge modeling is varied. The term “schema” is generic for interpreting a wide range of knowledge structures, including frames, scenarios, and plans [1]. The word “schema” comes from the Greek skhēma — “schema”, which means “model”, “form” or “plan” [20]. A schema is a linguistic “template”, “frame” or “pattern” along with a rule for its use to define a potentially infinite number of phrases, sentences, or arguments called “copies of the schema” [16]. The term “schema” was used in the 1930th both in psychology and in literary theory, but in the 1970th it came into wider use in the field of artificial intelligence, later it was again included in psychology, and then in linguistics within of the general field of cognitive science (cognitive linguistics).

Schemas are used in logic to define rules of inference, in mathematics they describe theories with an infinite number of axioms, and in semantics they provide conditions for the adequacy of truth definitions [6]. Therefore, the term “schema” is synonymous with the term “frame” in terms of the designation of a mental representation of objects, environment or situation [25]. Researchers point out the differences between the concepts of “mental model” and “scheme”, as they believe that a mental/mental model “is used to predict events, causes, form explanations” and is “a human reasoning mechanism” [18]. The schema had a significant impact on the development of cognitive psychology, emphasizing the role that cognition plays in internal mental processes, not just stimuli [14]. Following F. Bartlett, we consider the terms “mental model”, “scheme” and “cognitive scheme” to be synonymous within the field of structuring knowledge and organizing human experience – cognitive modelling a narrative [2].

**Analysis of recent groundworks and publications.** The theory of schema is studied by the researches in a number of related scientific fields. First of all philosophers payed attention to the notion “schema” and presented it as abstract idea [33]. Later, psychologists developed schema theory [2]. Cognitive linguists used schema theory to explain the nature of concepts [19]. Schema played a great role in a cognitive psychology as a means of knowledge organization [28]. Artificial intelligence theory uses schemas to model human mind [31]. Linguists, psychologists, and narratologists apply schema theory to manifest the meaning of a literary fictional text [17]. The concept of “frame”, which is similar to the concept
of “schema”, appears as a technical method of artificial intelligence [7, 10, 25]. Frame semantics is connected with empirical study of semantics through language and experience [9]. Cognitive modelling of the narrative embraces both: schema and frame theories in attempt to explain the meaning of a literary fictional text [11, 15].

The article aims to give theoretical grounds for role of the schemas (or/and frames) play in cognitive modelling of the narrative through ties of the notion with philosophy, cognitive science, cognitive psychology, and artificial intelligence theory.

Delivery of essential information. Cognitive modelling of the narrative presupposes production and understanding of fictional textual meaning and is banded together to a number of related fields. Philosophical idea of schemas goes back to I. Kant and is looked upon in Gestalt psychology. J. Piaget defined this term for the first time in 1923, denoting “schemes of action”, which differed from figurative (representational) schemas, although together they can be considered as “schematic duality”. Schema theory was popularized in psychology and the educational field thanks to the work of the British psychologist F. Bartlett used the term “body schema” proposed by the neurologist H. Head to explain unconscious changes in the details of a folk tale. Thus, it was experimentally proven that the memorizing is not reproductive, but constructive one and is based on the creation of an internal image (scheme) of the environment during memorization of meaningful material (narrative). The concept was extended by psychologist R. S. Anderson, who induced the scholars to the use of schema description terms (for example, “frame”, “scene” and “script”) in the theory of schemas [30].

In cognitive science, a schema represents a model of thinking or behavior that organizes categories of information and the connections between them [3]. A schema is also a mental/psychic structure of pre-formed ideas; a formation representing a fragment of the world, or a system of organization and perception of new information — a “cognitive schema”. Schemas influence the assimilation of new knowledge and help to understand the rapidly changing world and environment [4]. People organize new perceptions into schemas because most situations require automatic thinking. Schemas organize existing knowledge and create a framework for future understanding. Examples of schemas include cognitive schemas, mental models, social schemas, stereotypes, social roles, scripts, worldviews, heuristics, and archetypes. One of the types of schemas are image schemas; they are repeated patterns of physical experience. Examples of image schemas include the concepts of “restraint”, “support”, “balance”, “orientation” (up/down), “whole/part”, movement as “source → goal”. The image schema, which has a spatial structure, is the most important in cognitive semantics. Such image schemes are like “container”. The pattern “source → path → goal” and “connection” are among the most fundamental abstract structures of meaning (Lakoff, Johnson, 2003). Most image schemas are related to kinetic experiences, structuring the experience of interaction with the
world using metaphors. Notions/concepts are image schemes if they are abstract or form and organize information including many details.

Within cognitive psychology, a schema is a data structure for representing general notions/concepts stored in memory. The schema summarizes the concepts underlying subjects, situations, events, actions, sequences of events, and sequences of actions. Schemas are higher-order cognitive structures, which presuppose human knowledge and skills. They play a decisive role in ensuring the interaction of new and acquired knowledge through perception, speech, thinking and memorization. According to D. Rumelhart, the following features of schemas are important: (1) presence of variables; (2) possibility of mutual embedding; (3) representation of knowledge at all levels of abstraction; (4) representation of knowledge, but not its definition; (5) reproduction of an active process; (6) arrangement of recognition aimed at assessing the compliance of data schemas [28].

Schema-based artificial intelligence theory explains how a reader makes inferences by using general knowledge when processing individual parts of a text. Schemas are important structures for establishing the coherence of a text, they are dynamic, accumulating details and changing in the course of experience. The computational aspect of understanding was proposed by R. Schenck and R. Abelson, who used the term “scenario” to denote situational knowledge. A script is a temporally ordered schema; it describes the reader’s knowledge of the stereotype sequence of events “which define a well-known situation” [31]. R. Schenk used the concept of a script as a dynamic tool for discourse processing, dividing it into constituent parts (packages of memory organization), which can be combined into larger structures when necessary.

In addition to the structure of the sequence of events, most scenarios have additional “slots” describing “roles” (customers, waiters, cooks), “slot props” (menu, table, food, money, bill), “entry conditions” (the customer is hungry, he/she having a meal in the restaurant), and “results” (the customer is no longer hungry, the restaurant has less food) within the scenario. A “plan” consists of knowledge about a set of actions necessary to achieve goals and is used during non-stereotypical events when there is no corresponding scenario of understanding the situation. The reader refers to the scripts while processing the discourse. The relationship between texts and schemas is two-way: schemas determine the ground rules for how discourse will be interpreted, and discourse can prompt the reader to change existing schemas and create new plans approaching the script unfolds [5].

Linguists, psychologists, and narratologists use schema theory to explain the interpretation of a text when discourse alone does not provide all the information needed to process it, because cognition does not exist as an isolated process within an individual, it is “sociocultural” phenomenon. A writer of a fictional text cannot describe all actions, activities of characters and situational information necessary for the reader to understand it. If new circumstances and events contradict the acquired,
formed schemes, then they can be “adjusted taking into account new details and generalizations” [29].

Schemas and scenarios involve filling in the gaps in the reader’s knowledge, which is denoted by the term “gap-filling”. A literary text is characterized by the incompleteness of the subject and the incompleteness of the structure, which is essential for its understanding. R. Ingarden refers to “spots of indeterminacy” and argues that there is a layer of “schematized aspects” of literary texts in perception. Later these ideas were developed by W. Iser and M. Sternberg, who used the concept of “expository gaps”, explaining how the reader completes construction of fictional reality [17].

The cognitive scheme is a means of modeling the experience in the discourse of a fictional text, integrating knowledge about the narrative levels of the text and the experience of verbal and non-verbal communication. The cognitive scheme provides data recognition, variability of elements and narrative levels, flexibility of structure; it combines the understanding of the text in the perspective of a structured object of knowledge with the internal mental structures of the individual reader.

The concept of “frame” is similar to the concept of “schema”, but it has another source of origin – it arises as a technical method of artificial intelligence based on logical approach. Philosophy of mind interpreted the term more broadly, debating in the 1980th and 1990th as to interpretation of the frame in cognitive science.

D. Dennett was the first scholar to discover the problem of the frame in philosophy, connecting it to the “updating of beliefs about the world by a person being a subject of knowledge” [7]. J. Fodor raises the same question: “how does a machine program determine which beliefs the computer program should reevaluate taking into account a given course of action?” One of the philosophical legacies of the frame theory is that it drew attention to a number of ideas related to “holism”. A frame in the sense of artificial intelligence constructs an object using first-order logic (a set of formal systems used in mathematics, philosophy, linguistics, and computer science) to express facts about the world with computing devices.

Study and analysis of frames (frame analysis or framing) is a theoretical approach in the field of communication, media and politics. Frame analysis is an interdisciplinary method of social science analysis that focuses on the ways people understand situations and activities; examines images, stereotypes, metaphors, participants in communicative interaction and messages, and takes into account the importance and reasons for choosing these components [23]. E. Hoffmann developed scientific observations and explorations of frame analysis in the structure of experience related to the theory of social movement.

In literary studies, “frame narrative” (frame tale, frame narrative, sandwich narrative, or intercalation) is a literary technique that serves as a supplement to a “narrative within a narrative”, where an introductory or main narrative creates a
basis for distinguishing another narrative or a means of distinguishing shorter stories. A frame story "leads" the reader from the first story to the second one or several other stories within it. A frame narrative is also used to inform the reader about a secondary narrative [27].

Frame semantics is a research program in empirical semantics that analyzes the meaning of words, emphasizing continuities rather than discontinuities between language and experience. The idea of semantics associated with the concept of a frame differs from the standard approach of formal semantics based on semantic features and truth conditions. The field of frame semantics provides an explanation of how meanings are structured and associated with words in a semantic structure and how they provide access to a conceptual system — a list of structured knowledge of interaction with the world [9].

Frame semantics explains the connections between words not as structural semantic connections (hyponymy, synonymy, antonymy), but as interdependence between words based on basic knowledge that people acquire through experience and store in long-term memory. “Regarding the meaning of words, frame semantics is seen as an effort to understand what reason a speech community might have found for creating the category delineated by a word, and to explain the meaning of the word by presenting and clarifying that reason” [10, p. 2]. In addition to the systematic relationships between words and certain basic concepts, frame semantics proves that knowledge is based on human interaction with others and with the world. Therefore, frames are prior expectations and knowledge about the world that is constantly changing according to the information that the brain receives from sense organs.

A frame, according to M. Minsky, is a data structure for representing a stereotypical situation — “the experience of perception activates the frame structures obtained as a result of the acquired experience” [10, p. 112]. M. Minsky’s theory of frames belongs to several areas: control of thought, imagination, speech, understanding of narrative, learning, memory and visualization. Each frame has different types of information. Some of this information is about how to use the frame [24].

A frame is a network of nodes and links in the form of a “skeleton” containing gaps, or slots that must be filled. The upper levels of the frame are fixed and they represent the things corresponding to the actual “default” situation. The lower levels have a series of terminals or slots designed for specific samples or data. General and specific knowledge about the object forms a hierarchical structure; that is super-frame → frame → sub-frame structure. Each terminal “suggests” conditions for the tasks for smaller sub-frames. Simple conditions are defined by markers pointing to an object or sub-frame of a special type. More complex conditions form connections between objects belonging to terminals [25, p. 2]. Linked frames are a system of
frames. Different frame systems share the same terminals, which enables coordination of information collected from multiple sources.

Frame systems are consistent with information and search network. If the proposed frame cannot be adapted to reality – when the subject cannot find terminal assignments that properly match the conditions of the terminal marker – the network provides a frame replacement. Frame constructions enable ways to represent knowledge about facts, analogies, and information attached to understanding. As soon as a frame is proposed to represent a situation, a matching process begins, assigning values to the terminals of each frame according to the definite markers. The coordination process is partially controlled by information related to the narrative frame and knowledge of the current system goals.

Following M. Minsky in his grasp of frame (schematic) modelling, we conclude logical reasoning to be not flexible enough to serve as the basis of thinking: heuristic methods are more effective in connection to the form of schematic plans, which are a tools for harmonizing linguistic signs through the ways of their presentation and use in the discourse of a fictional text.

In narrative schema theory as the cognitive equivalent of textual narrative grammar is important in explaining gap-filling in reading and in relation to the reader’s knowledge of the general structure of narratives, called “narrative schemas”. Story schemas contain expectations about how a narrative will unfold, but psychologists doubt whether there are cognitive structures existing beyond common reasoning [22].

Knowledge in the form of texts is interpreted as an analysis of “super-coherence” (R. de. Beaugrande’s term); it is a means for thematic awareness in postulating schemes for specific genres and in testing knowledge of intertextual links. Schema theory is handled to construct new theories as a feature of narrative. M. Fludernik uses the schema in defining the concept of “narrative”, assuming that cognitive parameters, or “substantial prototypical human experience” is the main criterion for the formation of a narrative, and not a sequence of actions. In the schematic model “narratives can exist without a plot, but there can be no narratives without a person or an active subject of experience perception” [11].

Gender stylistics examines patterns that challenge texts written by men/women. In humoristic, incongruous schemes are studied as a source of humor. In detective and mystical stories “clues” are hidden as descriptions that are not consistent with the scheme, but the information that is added later complements it. When analyzing science fiction and absurdist texts, schema theory explains how alternative/fanciful worlds are created.

D. Herman defines “narrative” as a term used to denote the difference between “stories” and “non-stories” bringing into play the concept of scenarios [2002, p. 85-86]. Because scripts present only stereotypical and expected information, the gaps in the text provided by the script are not exclusive, and therefore do not create narratives.
Where the gap is not filled with stereotypical information, it “focuses readers’ attention on the unusual and the uncanny” events and calls for a narrative explanation. Narrativity is a binary characteristics, it is opposed to the graded nature of narrative.

Narrativity is achieved by balancing the appropriate amount of “canonicity and violation”. If most of the events in the story are stereotypical, they will be untold by the narrator as uninteresting, but if the events are too unusual, the text may not be perceived as a story by the reader. Regarding deviations from the scenarios, narratologists use the term “event” and consider these deviations as unexpected events and cases when the expected event does not occur. Deviations are evident in the context of cultural and historical factors, which serve as schemes for assessing the degree of deviation from a stereotypical situation/event.

Schema theory embraces the debate about “literariness” or “discourse deviation”, arguing that a narrative acquires literary status when it causes a change in the reader’s schemata. Literary discourse is a “schema renewal”, that is, old schemas are destroyed; new connections are made between existing schemas, as opposed to “maintaining or reinforcing a schema” as a form of discourse. The theory of literariness is intertwined with the formalist idea of defamiliarization as an essential feature of literary writing and understanding the content of fictional text.

Literary text can both challenge and confirm the reader’s beliefs about textual communication offering a scale for updating complex schemas [32]. However, this depends on the historical period: during the Middle Ages, the assumption about the “truthfulness” of the schemes of the time dominated; in modern times, on the contrary, deviations are more common. Currently, the author-narrator pays attention to the “affirmation of the scheme”, its importance for the reader’s “recognition” of a familiar experience in fictional text. The emotions and evaluative attitude of the reader help to understand and interpret the meaning of a fictional text; emotions stimulate the creation of new schemes, and are not a consequence of their cognitive processing.

In stylistics, one of the main applications of schema theory is the description of “thinking style” (mind style) [12], which uses linguistic analysis to examine the mental representations of characters trying to make sense of the world around them. The technique used by writers is to underspecify key aspects of the context of the character’s actions in order to convey his misunderstanding or uncertainty, so the author-narrator must provide the reader with enough clues to interpret the situation using familiar schemes. A. Palmer goes beyond focusing on special types of thinking style and proves that all fiction must be cognitively constructed with the help of “continuation or frames of consciousness” to unite the various thoughts of different characters [26].

Conclusions. In recent years, the emphasis within the cognitive modelling of narrative has changed. The theory of schemes is important, but there is a growing
interest in how the reader needs to supplement general knowledge with accumulated knowledge from the text itself, which K. Emmott calls “textual knowledge”. The researcher argues that the reader must not only build mental/psychic models, — “contextual frames” — using this knowledge, but update the representation when necessary and use the information in subsequent stages of constructing the meaning of the text. We find similar ideas in the analysis of R. Gerrig’s narrative worlds [13], P. Werth’s theory of the textual world [34], and D. Herman’s presentation of narrative worlds [15]. Topics for further research include exploring the relationship between knowledge of the overall narrative scheme and knowledge of textual communication; methods of modelling a cognitive scheme in order to implement individual experience as objectified knowledge in a fictional text. Narrative theories that use schema theory establish the ways common knowledge originates from the real world and the role it plays in cognitive modelling.

References: