Refining Mental Models Through Adaptive Learning
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Abstract
Due to his limited cognitive capabilities, the decision maker resorts to the use of mental models, which represent reduced versions of real world dynamics. Furthermore, the human cognitive apparatus is inherently subjective. Reason for subjectivity of perception is limited information processing capacity. The limited cognitive capacity is also the most significant reason the complexity of the world around us. If the limitation of conscious thinking is fundamental obstacle to understanding the world, the question is which methods are available to improve decision-making? This paper approaches the question in hand through the concept of adaptive learning described as a process of thinking in action. We argue that, in order to be useful, the initial mental model needs to be improved by adding additional schemata and additional connections between schemata. Mental models are therefore constantly updated with new experience and knowledge which is basically a learning process. Through the learning process, mental models can be refined to better represent real dynamics of decision making situation. Learning about the concepts is about building set of expectations which enables us to deal with the situation in hand.

Keywords: Decision making, Learning, Mental models

Track: Management

Word count: 3,496

1. Introduction
The term cognition refers to how people collect, modify and interpret information from the surroundings or the information already stored in their minds, and how they retrieve them in order to created knowledge (Neisser, 1967). Cognition examines various processes associated with making sense of the situation such as categorization, usage of the structure of knowledge (cognitive schemas) and development of mental models (scenarios) (van der Heijden, 2005, Spender, 1998). Therefore, all activities which we use to comprehend the world and act accordingly are a matter of cognition. Theories of rational expectations and managerial choices, which continue to dominate the curriculum of business schools through the world, provide a very specific view of managerial cognition and organizational rationality. Paradigm of managerial and organizational cognition in principle rejects the assumption that managerial decision-making can be adequately analyzed through rational assumption of complete data, well-defined objective function and the rigorous logic of the selection process. To an experienced leader, decision making is a continuous process of reasoning, evaluating the validity and importance of the situation. The process connects decision makers with previous experiences, knowledge, and possible implications. This psychological process does not lead to the situation where it means everything that the decision maker wants it to mean. The mental schemes must be actively used in order to make sense out of the experience. Also, people are using different schemes for handling same experience and that leads them to different interpretations. This paper poses question of how the mental models are refined by the use of such novel mental schemata.
2. Cognitive paradigm of business decision making

In order to understand how the leader who wants to enact radical change creates understanding of the environment that he is facing, we need to comprehend a set of well-founded knowledge about human cognition. In the debate on the foundations of cognitive science Simon and Kaplan (1989) report that cognitive science is based on three approaches of studying intelligence and intelligent process: in the abstract sense, in computer research, and in the research of human thinking. From this point of view we need to develop models of the human mind as well as the knowledge that is processed in such mental models. We also need to understand the relationship between the content, the modeled process (between knowledge and choices) and human behavior. In respect to organizational dynamics, the main objectives of cognitive paradigm are to define ways in which people in organizations define the situation, become aware of alternative courses of action, evaluate the consequences of these actions, and consider the significance of the action in a socially constructed world (Eden et al 1979). The scientific approach to these questions through the research paradigm of managerial and organizational cognition is focused on the development of models and knowledge structures as well as on their implications for the organizational context. Although the application of cognitive theory to the study of organizations is a relatively new phenomenon, the need for cognitive approach to managerial and organizational analysis can be found in many “classics” of organizational theory and the theory of strategy. Thus, Weick (1995) notes that Barnard's text on the functions of the executive (Barnard, 1938) introduced the idea of the organizations as systems of action, consciously coordinated through the controlled information processing and communication. Simon (1947), on the other hand, lays the foundations of modern cognitive theories in organizational studies by introducing the idea that decisions are never entirely rational due to limitations in the capabilities of information processing. Furthermore, March and Simon (1993) emphasize the cognitive dimension of managerial work through the elaboration of the ways in which organizational routines release the attention that can be put in use for the non-routine decision making. Although the foundations of application of the cognitive perspective in management can be found in these and other classic works, it is only in the last fifteen to twenty years that the discipline of organizational and managerial cognition has grown into a separate research area.

The need to focus on the cognitive paradigm of organizational behavior has led to the development of the set of theories within the area of naturalistic decision making. Naturalistic models emphasize cognitive processes associated with creating images on the situation, mainly through categorization (Mervis and Rosch 1981, Klein 2008), the use of knowledge structures (cognitive schemas) (Eden and Ackerman 2011) and the construction of mental models (scenarios) (Lipshitz, 1993, van der Heijden, 2005). Approach to decision making from the perspective of managerial and organizational cognition differs from the previous approaches precisely in the fact that it focuses on real managerial action, not the abstract rational models. For instance, the concept that has played a major role in research of individual and organizational decision making is the concept of bounded rationality (Simon, 1947). Namely, the idea that managers make decisions in a situation of complete information, well-defined and logical information process is not consistent with the reality of organizational life. Managers do not have complete information, knowledge or the competence to process a large amount of available information (March, Simon, 1958).
3. The Constructivist Paradigm of Human Understanding

The constructivist paradigm of human understanding deals with the ways through which people make sense of the situation and act according to it. The key perspective that personal construction theory offers to the implementation of radical decisions is that people do not work in some kind of primal reality, independent of our mind and the minds of those around them. Constructivist paradigm is set forward by the personal construction theory introduced by George Kelly (1955). The constructivist viewpoint is at the same time the philosophy of science, art and knowledge. The central thesis of constructivism is that contrary to the common sense there is no single reality which is independent of human mental activity and human symbolic language. In other words, what we call the world is the product of our mind, within which we construct the world by the symbolic processes.

This leads us to the conclusion that one’s world is no more real than others, none of the mental representations of the world, no one’s truth, is ontologically more correct than the other. Personal constructions of reality are particularly important in the social sciences; such is the organizational theory, where reference framework has the largest influence on what we see, how we explain it and how it directs our activities. The process of personal construction of reality starts with the perception continues with the construction of mental models, but its real importance is gained through interpretation. As discussed in the last chapter, interpretation can be described as a form of explanation that requires a special understanding or knowledge. In some forms of the functioning of the mind, such as perception, it is quite obvious that a large part of what we distinguish is a constructivist process. What we perceive is very directly affect by our expectations, desires, and a number of other similar influences.

Most of the things we know about the elements of organizational choice as well as on their probable consequences are reflected in our interpretation, which is also a constructivist process. Daft and Weick (1984) “interpret the interpretation” as a means of decoding external events to internal categories that are part of the culture of the community that the decision maker belongs to. The act of interpretation involves creating mental representations that simplify certain territory in the interest of facilitating action. Different interpretations of the same situation lead us to the conclusion that there is never only one possible explanation of the decision making situation. Each formed interpretation is in principle a special world, constructed by the individual.

4. The Cognitive Problem Solving Apparatus

While it is possible to perceive the given situation in numerous ways it is always structured of the same elements. These elements include language, behavior, images, and the like. The fundamental concepts of human understanding are called mental schemata. The concepts are applied to a specific situation and form “ideas” or mental models. The process of mental model construction starts from the already elaborated premise of “perceived reality. Through the process of perception, to a certain extent, people choose what they see. They select certain objects to focus attention to, while the others are ignored. Perception is directed by the existing mental structures - mental schemes. When a problem occurs, collection of anticipatory schemes is formed from the existing schemes that are stored in the long-term memory (resulting from previous perceptual experiences). The selective nature of perception and the process of retrieval of existing schemes allow the leaders to construct simplified mental conceptualizations of decision-making situations called the mental representations (Rumelhart and Norman 1988). Specific kind of mental representations - that expresses overall representation of the surrounding world, the relationships between its various parts and a person's intuitive perception about his or her own acts and their consequences are called
mental maps (Tolman, 1948) or mental models (Johnson-Laird 2010, Johnson-Laird 1983). Through the process of construction and crystallization of mental models the decision maker reduces the complexity associated with the business environment and, in that process, determines which stimuli from the environment will be observed and which will be ignored (Starbuck and Milliken 1988). Cognitive view on decision making assumes that the leaders build models of the decision making situation in his mind and that these models help him to find meaning which consequently directs his action.

First we will explore the role of mental schemes. Reading, listening, observing and dealing with reality at every level depends on existing cognitive structures - mental schemes. The concept of mental schemes comes from the British cognitive psychologist Bartlett (1932), who defined the concept as an active organization of past reactions or past experiences. Mental schemes are structures that represent certain aspects of the world. They are impartial units that carry meaning. The scheme can be a causal relationship, the single element of experience as well as a complex set of elements. The thread of coherence between the elements is what makes an amalgam of experience a mental scheme. People use schemes to organize existing knowledge and provide frameworks for future understanding of the world such as stereotypes, social roles, archetypes, and the like. Through the use of schemes, most everyday situations do not require intensive thinking. Mental activity, therefore, can be reduced almost to level of automation. People can organize new objects of perception in the mental schemes and can operate them effectively without much effort. For example, most people have in my mind the mental scheme of the stairs and are therefore perfectly able to climb the stairs which were never climbed before. Each person has unique capabilities of perception and action, because no one occupies the same position in the world and no one has the same history. With regard to the organizational processes that we deal with, it is particularly important to emphasize that Neisser (1976) argued how mental schemes go through the process of accommodation. In the course of this process the decision maker becomes what he is through what he had perceived and did in the past. Mental schemes influence our perception, memory and behavior in the most profound way. Bartlett (1932) described memory as a creative process of reconstruction of such schemes. According to the theory of mental schemes, perception, understanding, interpretation, and memory are based on these structures of knowledge organization. The importance of expectations in the search for meaning in a new experience is well known. The mental schemes incorporate these expectations. In the case of reading, for example, schemes provide mental frameworks that help the reader to understand what they read (Bruner 1990). As we mentioned in discussion on the nature of perception, information can be collected only if there are already developed formats that can accept them, the information that does not fit into these formats are not used. In other words, mental schemes act as filters – they keep put the information which is not in accordance with them. The impact of mental schemes to remembering is characterized by the fact that we only remember information that is consistent with our existing schemes. One interesting consequence of this phenomenon is known as a self-fulfilling prophecy (Snyder 1984). According to this mental process our mental schemes become reality because of our unconscious behavior towards others that is conducted in a way that leads them to behave in accordance with our schemes. Hodgkinson and Sparrow (2002) expound that mental schemes can be extremely useful if properly organized. Proper organization of mental schemes implies high quality information and dense and sophisticated links between interconnected structures. If these kind of schemes exits, the manager is able to understand the events of the environment, can decode and effectively pull the information for flow of experience, can work out more convenient and more accurate interpretations and resolve problems faster. However, too much reliance on
such knowledge structures can result in many negative connotations and can restrict manager's understanding of the environment. Potential hazards include stereotypical way of thinking, uncontrolled processing of information, incorrect data filtering, and rejection of unusual but important information or overall inhibition toward solving problems. These dangers are particularly pronounced in the case of radical decision making.

5. Mental Models and Adaptive Learning
The usage of mental models is notoriously challenging activity. Crook and al (2005: xxiv) depict the process in this way: “The first step is to recognize the power and limits of the models. The second step is to test the relevance of the mental models against changing environment and to generate new models. The third step is to overcome inhibitors such as lack of information, lack of trust, desire to hold on to old patterns, and the expectations of the others. The final step is to implement the model, assess the model and continuously strengthen the model”. Each stage of the process is characterized by uncertainty and ambiguity. In order to be useful, the initial mental model needs to be improved by adding additional schemata and additional connections between schemata. Mental models are therefore constantly updated with new experience and knowledge which is basically a learning process. Through the learning process, mental models can be refined to better represent real dynamics of decision making situation. Learning about the concepts is about building set of expectations which enables us to deal with the situation in hand. Language is used to sum up this body of expectations. Learning models are quite important for radical decision making because, as I will discuss in more details in the next chapter, in order to think differently firstly we need to be good at thinking. As argued before, the mental models are not direct impressions of reality to the clean the surface of our awareness. They are results of complex processes of sorting, manipulating and converting that shape present knowledge, intentions and interests.

The mental models arise from activities and are based on interpretations, continuing active role in the formation of organizational context and the impact of social context on the individual. In a decision making situation the leader builds a mental model through the collection of specific signals and information with the aim to amend the existing situation. As a first step the leader builds a mental representation that is based on already collected signals. Such mental representations represent the world as the leader “sees” it at that point. The leader then wants to gather as much useful information as possible in order to build a new mental representation. There are two possibilities in respect to clarity of the initial conceptualization of the problem of choice. Firstly, the initial leader's conceptualization of the situation can be characterized low level of uncertainty and ambiguous. In these situations the leader can quickly and easily decide on what action to take. But the initial conceptualization can also be confusing and incomplete, and the leader will not instantly rely on it while making the decision. In such cases it is necessary to conduct further research and modifications in the conceptualization of the decision making situation. The second case of mental model evolution is characteristic of radical decision making process.

The learning process is a process of interpretation, which Weick (2001) describes through three steps. Each of the steps have its place in the radical decision making process. The first phase of the organizational interpretation is called scanning. Scanning can be defined as monitoring of the environment in order to provision the information for decision making. In the second phase, by use of the mind, meaning is assigned to the collected data. We are going through the process of interpretation when a new construct is introduced to the existing cognitive map. Same happens in organizations. Organizational interpretation is defined as the
process of translating events and developing shared understanding and shared conceptual schemes among members of senior management. Interpretation gives meaning to data prior to the organizational learning and activity. Learning is therefore the third phase of the process of interpretation. Learning differs from interpretation because it incorporates the concept of action. Based on the interpretation, learning requires a new response or a new activity. Learning is a process of converting a cognitive theory into action (Argyris and Schon 1978, Argyris 1976). In that way, from the feedback by activities, the act of learning provides new data for interpretation.

Daniel Kahneman (2013) points out that we have two different thought processes. One is slow, based on expertise-building that allows us to organize and access a body of evidence about the decision making situation. The other style of thinking is the rapid decision making that we might have to do when we are forced to recognize new patterns or respond to the emotional urges that govern how we treat people around us. The key to learning is to recognize patterns for what we use already mentioned anticipatory mental schemata. They prepare us to accept a particular type of information, and not the other, and thus control the activity of observation. Because we only see what we’re looking for, it is the scheme, together with the available information what determines what will be perceived. A set of existing mental scheme prepares the mind to the perception of the elements from the environment and can be viewed as a control structure for the processes of perception, attention and categorization. That is from where the constructivist nature of perception comes.

The process of connecting objects or stimuli to categories is called pattern-recognition or stereotyping. The mind, in the process of perception, provides a way in which incoming information is organized. In the process the mind functions as a self-organizing information system that enables the input experience to be organize in patterns. As soon as the pattern is formed, the mind no longer has to analyze and classify information. It just takes enough information and the pattern is activated. However, this process is not automatic, as Neisser (1976) notes, we will categorize the object or event only if the situation demands it of us. If there is no competitive pattern, everything that even vaguely resembles the established pattern, will be considered as such. Once the pattern is formed, all information that is received by this pattern or channel will “flow” through it – always in the same way, enhancing the pattern in the process.

6. Conclusion

Due to his limited cognitive capabilities, the decision maker resorts to the use of mental models, which represent reduced versions of real world dynamics. The paper argues how the human cognitive apparatus is inherently subjective. Reason for subjectivity of perception is limited information processing capacity. The limited cognitive capacity is also the most significant reason the complexity of the world around us. If the limitation of conscious thinking is fundamental obstacle to understanding the world, the question is which methods are available to improve decision-making? According to Eden et al (1979), there are two basic ways in which the decision-maker can overcome cognitive limitations. First one is to improve information collection and increase their quality, and second one is to enhance the process of reasoning in the decision making process. The reasoning is actually the process of upgrading and using mental models.

We often hear people saying: “Why do I always go through the same problems and make same mistakes all the time.” The answer is – because you are not able to break the patterns of your thinking. But they can be broken. Making change happened is about establishing new mental pathways, new frames of pattern recognition. The entire conscious life is based on recognizing patterns and changing old ones with new. Literature, film and other fiction
crystallizes patterns of experience so that they can be absorbed without living them or without learning it through the slow process of induction. Art can also provide us with a range of experiences that we would otherwise not have had. Reading a good fiction book or watching a good movie is not only matter of relaxation but can be very useful for our business as well.

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