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TYPICAL COGNITIVE ERRORS IN INFORMATION PROCESSING: A THEORETICAL APPROACH

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Abstract:

The cognitive error represents the human tendency of drawing incorrect conclusions in certain circumstances, based on cognitive factors rather than on what is clear and rational. This is a form of a “cognitive shortcut”, often based on the “finger rule” and it includes errors in the statistic judgment, social attribution and memory. The cognitive errors are often present in the human thinking and they are studied by the cognitive science, social psychology, economic psychology etc. These errors are frequently caused by heuristic approaches, logical simplifications and decision rules, used in solving complex problems. When these simple decision approaches are employed in inappropriate situations, they lead to systematic and foreseeable mental errors, incorrect estimates and failed evaluations. Cognitive errors do not appear due to a pathological aspect but they are systematic errors of logic.

Key words: human cognitive system, information processing, cognitive schemes, cognitive errors, heuristic

1. Introduction

How are decisions made? How could we be sure that we understood correctly and took into consideration all factors before making a decision? What are our decisions based on when we do not have sufficient information or when there is too much information? Do you think you are a fair person? Do you trust your own judgment? Are you 100% rational? Do you think you can be easily manipulated? How is social perception formed? Is it possible that we are “prewired” in order to make systematic judgment mistakes?

Cognitive science appeared a few decades ago as a interdisciplinary domain of research, dedicated to the study of intelligence and intelligent systems, either natural or artificial. Psychology, neuroscience, artificial intelligence, linguistics, philosophy and anthropology interact within the framework of cognitive science, tending towards an integrated theory of the brain and cognition. Lately, however, there reappears under the microscope, in the cognitivist theory, the question “what is cognition?”

2. Brief history of cognitive science

2.1 The main idea of cognitive science in information processing

In traditional cognitivism, the cognitive system was separated from the sensory-motor aspects or from the context and the accent was placed on cognitive representations and processes that we use to operate on them. This approach can be easily understood if we

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think that the cognitive paradigm appeared as a reaction to behaviorism and, in a way, it returned to the philosophical traditions that emphasized reason.

The main idea of cognitive science was that the information processing obeys syntactic, logical and universal mathematical laws. The social context and the emotions are not essential, the knowledge model is an algorithmic machine, epistemology and knowledge being understood as aspects of "Human information processing" (Brier, S., 1992)^[1].

Thus, according to Lindsay and Norman, (Lindsay, P., Norman, D.A, 1977)^[2], the principles of information processing are relevant for all systems that use information, including the human mind. These general principles must be applied to all systems that manipulate, transform, compare and find information. But such an approach raises problems and has its redoubtable detractors. For examples, Searle Searle (Searle, J., 1989)^[3] believes that the common link between the human and the electronic (computer) information processing does not consist, as it was accredited, in the fact that both follow some rules. The machines act according to some causalities, but only conscious human beings can choose to obey or not the rules. According to Soren (cited in Brier, 1992), knowledge is a much more complex "thing" or process than a simple product of the information process.

2.2 New ways in information processing

The last years of research in cognitive psychology led us to the idea of a cognitive system in which the emotions and social aspects are to be found when we process the information, thus towards an interactive processing and not only towards some abstract logical capacities (Riegler, 2002)^[4]. While taking the form of a paradigm, in the cognitive psychology there appeared more and more data showing that, in fact, cognition cannot be separated from other aspects: the studies emphasized the influence of the context, emotions, of the action or of the perception over the manifestation of the varied cognitive functions considered as being superior (see studies regarding the dependence of memory on context, Godden & Baddeley, 1975^[5], or the affective states, Bower, 1981)^[6]. Important etological research on the relation between reality, perception and information showed that perception is not a process in which information is overtaken mechanically but, on the contrary, it needs motivation. People's perceptions and the way they process information are strongly influenced by education, experience, cultural values, job requirements, organizational rules as well as by the specific of the received information. All these form "lenses" (models, patterns, mental fixations or "analytic presuppositions"), through which the individuals relate themselves to objective reality but which can also distort perceptions, offering nothing more than a (subjective) representation of what people think they know about the exterior world. As Hanson N.R.^[7], Kuhn T.^[8] and Popper K.R.^[9] wrote, the observations are always interpreted within the framework of pre-requisite knowledge. Kuhn^[10] stated that the history of science provides numerous examples related to the fact that "what a man sees depends on what he is looking at and also on the visual-conceptual experience that taught him what to see" (cited Malhotra, 1994)^[11]. Knowing information is controlled by interests that partially derive from the nature of the perceptual apparatus and also from the innate release mechanisms found in our body (Brier, S., 1992)^[12]. According to Fransman, the information can be defined as data regarding the state of the surrounding world and possible consequences of the events taking place in the surrounding world, while knowledge can be defined as convictions, beliefs. Convictions are influenced by the information processed by the individual, but they are not entirely determined by it; there is

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place for intuition, creativity and error (Fransman M. 1994)^[13]. Lave J. amplifies this observation, stating that knowledge always undergoes a process of construction and transformation while being used (Lave, J., 1994)^[14].

3. Theoretical aspects of cognitive errors

3.1 Strategies to simplify information processing as limits of the cognitive system

In a hipercomplex world, the decision maker, through his cognitive system, has limited capacity of representation and computation (functioning on the principle of the economy of resources), he depends on shortcuts in order to process information and he creates a simplified mental representation of the variants among which he has to choose. Although the subject behaves rationally within this simplified mental model, a series of cognitive factors can influence the calculation of possibilities (the cognitive scheme, the degree of proto-normality, accessibility from memory to relevant knowledge, anchoring and rationalization)(M. Miclea, 2004)^[15].

Solving problems is a result of interactive operation of all the components of the cognitive system. According to their vector, the resolute strategies are prospective and retrospective and according to the certitude of obtaining the solution, we use algorithmic and heuristic procedures. These heuristics, either general or specific, allow us to walk through life and they also lead to making consistent and systematic mistakes, being dependent on the domain of knowledge (M. Miclea, 2004)^[16].

The attempt to "adjust" the reality data to certain mental patterns, generates a special category of errors, called cognitive errors, extremely varied as manifestation forms and with major repercussions on the analytical process and obviously on the problem solving and decision making processes. In essence, these are impaired judgment caused by our own strategies of simplifying the processing of information, which can affect, in different degrees, the analysis of information, the evaluation of the arguments, the understanding of the causative relations, the estimates of alternatives, the evaluation of the variants of action and it is difficult to get over them even when we are conscious about them (Heuer, R.J., 1999)^[17].

3.2 The cognitive error, the product of information processing with implications in the decision-making process

The notion of cognitive error was introduced by Amos Tversky and Daniel Kahneman in 1972 (Kahneman, D., Tversky, A., 1972)^[18]. Together with their colleagues, they demonstrated many replicable ways in which judgment and human decision are different from the theory of "the rational choice". Daniel Kahneman, specialist in cognition and a pioneer of behavioural economics, was awarded the Nobel Prize for Economy, in 2002, for his papers which showed that the man is not a "rational actor", as many specialists in economy supported, but he is the subject to numerous pitfalls of intuition. He studied for over four decades the decision mechanisms of the human brain and he identified numerous cognitive errors which influence our decisions without us noticing it. Kahneman (Kahneman, D.,2002)^[19] sustains that human thinking is controlled by two systems: he calls the first system "thinking fast" – it is conscious, intuitive and it does not require volutary effort or control, while the second, "thinking slow", is conscious, uses deductive reasoning and requires a lot of effort. In order to observe that a person is angry,

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there is no need for a conscious effort as this can be noticed instantly and involuntary, exemplifying the fast thinking, typical for the first system. Instead, in order to solve a problem such as a multiplication of two numbers, there is need for a conscious focus of the attention towards a voluntary effort, without which the answer cannot be obtained. This is an example of the second system. However, "thinking fast" presents certain system errors, cognitive errors which, many times, lead to making the wrong decisions (Kahneman, D., Tversky, A., 1979)^[20]. In his most recent book, *Thinking Fast and Slow*, Dr. Daniel Kahneman enumerates a few of these thinking errors, hoping that, by clarifying them, he can help the others identify and understand better their own decisions (Kahneman, D., 2002)^[21]. Some cognitive errors mentioned in studies and research (AL Zacharakis, DA Shepherd, 2001; Jack B. Soll, 1996)^[22] are: "the overconfidence bias" - the tendency to trust yourself excessively, "the planning fallacy" - the error of estimation in planning, "the availability bias" - tendency to judge on the basis of what comes to our mind and "the anchor effect" - the anchoring effect.

3.3 The perspective of social cognition in information processing

From the perspective of the social cognition, the functioning of the cognitive schemes includes picking up pieces of information, comparing and evaluation of their value and credibility, their integration and the formulation (through interferences) of some social judgments. (Ceașu, F., 2010)^[23].

In the process of acquiring knowledge, most of the people follow the law of the minimum effort. They use heuristic strategies in order to obtain information which should be simultaneously: 1) as simple and as easily to acquire as possible; 2) of the greatest possible accuracy and time reliability.

The main types of heuristics used and seen from this perspective would be (Baron, R. et al., 1998)^[24]:

a) the heuristic of representativity or of the judgment by similarity: the reasoning used is that according to which the more an individual resembles a typical member (prototype) of a group, the bigger the probability for him to belong to that certain group.

b) another mechanism is the one of availability or accessibility heuristic, which postulates the following idea: the faster and easier something comes to our mind, the more we have the tendency to consider it as being frequent and important. The recently used schemes influence in a decisive way the new knowledge that we receive (Dube-Rioux, L. and Russo, J. E, 1988)^[25] This knowledge falls to the ground, on a primary layer prepared to absorb the knowledge (priming effect). The phenomenon is dealt with in the so-called "medicine students' syndrome: when they learn the disease symptoms, they get quickly to believe that they suffer from many of them".

c) the effects of the false consensus: the individuals have the tendency to consider themselves (as behaviour) much more alike with their peers than they really are. For example, the students from American universities who smoke believe that there are more smokers than there really are.

d) there is, through simetry, the effect of false uniqueness: some people like to believe that they are unique, especially in what concerns certain desirable qualities (intelligence).

e) the frame or framework effect consists in the fact that our misconceptions and appreciations referring to different objectives, persons and institutions, are greatly affected by the way in which information about them is presented. Moreover, when the positive ones are brought forward, the evaluations will be optimistic.

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f) the anchoring effect (W., Bevan, JF Pritchard, 1963)^[26]: in our appreciative judgment the benchmark from which we start also counts. For example, real estate agents are significantly influenced, in the negotiation of house prices, by the price that is initially required. Once we establish some anchoring points in some issue, people's estimates tend to be connected, although something like this should not happen. "Anchoring" encourages the application of the principle of minimum thinking effort, but this principle generates cognitive costs (errors).

g) the mechanisms of mental simulation, functioning according to the law of minimum effort, are potential sources of error in appreciation. When we are talking about unwanted events, people tend to simulate mental alternatives: "what else could he have done?" or "how could he have avoided that event?" This is counterfactual thinking. We regret not only having done something but also what we have not done. .

h) mental simulation can be a source of error through what can be called false difference of chances and suspicion involvement. When they come across less likely events, the individuals are tempted to consider their chances of appearing in an absolute and not relative manner. If the number of events is smaller, the individuals become suspicious and do not accept that they were produced by chance; on the contrary, if the number of events is bigger, then their occurrence by chance is accepted. New research (Baron et al., 1998)^[27] confirm the older idea that, beyond the particular circumstances, there are two fundamental ways of information processing: the rational way and the intuitive way. The first analyzes deliberately and follows the rules of logic, while the second is spontaneous, automatic, holistic and it is based on simple heuristics, developed through concrete experience.

i) another process through which we form our impressions about the others involves the understanding of their behaviour. The attribution is related to our intuitive attempts to deduct the causes of a person's behaviour, namely the attempt to deduct when someone's action must be attributed to personality or situational causes (for example money, social norms, threats). The fundamental error of attribution appears when we underestimate the situational influences over our behaviour and we believe that a certain personal characteristic of the individual is responsible for this.

4. Conclusion

Some errors are specific to some groups / "herd behaviour" (bandwagon effect – the tendency to do or believe some things just because many other people do or believe the same) and others function at individual level ("confirmation error", where the subject chose only the proofs and arguments that confirmed his belief). Some errors affect the decision-making process, while others, like the illusory correlation, affect judgment. The illusory correlation is an incorrect belief that there is a connection between a cause and a certain effect (Martin Hilbert, 2012)^[28]. Another group of errors affect memory, such as the consistency error. While some errors show the motivation of the subject, for example the desire to have a self-positive image, taking to the egocentric error and avoiding the unpleasant cognitive dissonance, others make people ignore the relevant information, neglect the probability and they can affect the decision or judgment due to the irrelevant information. Subjective validation (an error of probability and belief) is in close relation with the concept of cognitive dissonance – it refers to the tendency of searching and interpreting some information in a way which confirms own misconceptions and stances,

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even if they are not true. The individuals look for new proofs, interpret them wrongly or take information from memory in a selective way.

Many social institutions count on individuals to make rational judgment. For example, the jury in court have to ignore the attractiveness of the one who is accused. Numerous errors proved by different psychological experiments showed that the man can often make such mistakes. Only by understanding our weak points, can we be prepared to identify thinking errors, despite the fact that we cannot avoid them forever. "In order to counteract the errors of the «thinking fast» system, there is, in principle, a simple solution: the recognition of the signs which suggest that we are in a delicate situation, slowing down the decision-making process and appealing to «thinking slow»", suggests Kahneman (Kahneman, D., 2002)^[22].

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