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HEURISTICS, BIASES AND TRAPS IN MANAGERIAL DECISION MAKING

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Abstract

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The aim of the paper is to demonstrate the impact of heuristics, biases and psychological traps on the decision making. Heuristics are unconscious routines people use to cope with the complexity inherent in most decision situations. They serve as mental shortcuts that help people to simplify and structure the information encountered in the world. These heuristics could be quite useful in some situations, while in others they can lead to severe and systematic errors, based on significant deviations from the fundamental principles of statistics, probability and sound judgment. This paper focuses on illustrating the existence of the anchoring, availability, and representativeness heuristics, originally described by Tversky & Kahneman in the early 1970's. The anchoring heuristic is a tendency to focus on the initial information, estimate or perception (even random or irrelevant number) as a starting point. People tend to give disproportionate weight to the initial information they receive. The availability heuristic explains why highly imaginable or vivid information have a disproportionate effect on people's decisions. The representativeness heuristic causes that people rely on highly specific scenarios, ignore base rates, draw conclusions based on small samples and neglect scope. Mentioned phenomena are illustrated and supported by evidence based on the statistical analysis of the results of a questionnaire.

managerial decision making, heuristics, anchoring heuristics, availability heuristics, representativeness heuristics

Heuristics are unconscious routines people use to cope with the complexity inherent in most decision situations. They serve as mental shortcuts that help people to simplify and structure the information encountered in the world. This kind of thinking is useful in conditions, when the approximation of reality is sufficient and the cost of a deeper analysis are too high compared to its benefits (in situations when it is useful to assume that if something looks like a lion, it's a lion). These heuristics could be quite useful in some situations, while in others they can lead to severe and systematic errors, based on significant deviations from the fundamental principles of statistics, probability and sound judgment. In this paper we demonstrate the impact of the anchoring, availability, and representativeness heuristics on the decision making. These types of heuristics were originally defined by Tversky & Kahneman in the early 1970's.

METHODS AND RESOURCES

We conducted a survey within a relatively homogeneous group which consisted of 206 respondents. The survey was conducted in April 2012 using a questionnaire. All respondents were fourth year students of the Faculty of Management, Comenius University in Bratislava. The students were divided into two groups of similar size – A and B – in order to observe the difference in the responses to moderate variations of the questions, i.e. the questions were slightly modified for both groups, but the core of the questions stayed the same. The questionnaire method was used to confirm the influence of heuristics on the decision making. The survey questions were compiled from more sources.

RESULTS

Anchoring heuristics

Human reasoning often begins with rapid estimates, which are based on the initial information. These estimates are further knowingly, slowly and deliberately handled and moved in a certain direction (Gilbert, 2002). The initial information we obtain, respectively are presented to us, have a strong potential to anchor our judgment. Further consideration already depends on them. After obtaining additional information, these initial estimates are usually adapted, but often not enough. The weight we ascribe to the first information tends to be higher than to the information obtained later, regardless of its quality. Further information often serve only for correction (insufficient) of the initial information. Adjustments away from these anchors are usually not sufficient (Tversky & Kahneman, 1974). An example is the first impression, which is difficult to change, once created. Initial information can be obtained even unwittingly, respectively they don't need to relate with the solved problem.

The anchoring heuristics is based on this principle. Chapman & Johnson (2002) define it as the process, in which noticeable, but uninformative number is submitted to participants before they make a numerical estimate. In a broader sense, anchoring applies to all initial information, not only of numeric character.

Participants of the classic demonstration of anchoring were asked to estimate the percentage of African countries in the United Nations. Each participant received a "random" number (obtained by spinning the wheel of fortune in the participant's presence). Experiment was manipulated so that different groups were given different numbers. The needle showed to one group the number 65 and to the other group the number 10. Participants were asked to state whether the actual quantity was higher or lower than this random number and then to make their best estimate. The arbitrary values from the wheel had a substantial impact on participants' estimates. Results show that the median estimate of respondents to whom the value 65 was presented has been 45%, while of the second group only 25%. Thus, even though participants were aware that the anchor was random and unrelated to the judgment task, the anchor had a dramatic effect on their judgment (Tversky & Kahneman, 1974).

They are external, from outside presented anchors. These were described in the previous example. In practice, they may take the form of media information, opinions of coworkers or statistics. Decision making based on anchors persists even in case external anchors are not available. In that case we search in our memory for related information, from which the reflection starts, they represent the inner anchors. In case of our question regarding the area of Prešov county the respondents can come out from more familiar information about the total area of the Slovak Republic. The research results show that utilization of such an inner anchor may lead to proper results. Inside anchors may also cause misunderstandings and communication problems. This happens when we try to understand other peoples' motivation or predict their behaviour based on our own attitudes or behaviour (what we think about or would do). In practice, managers could replace the views and needs of customers by their own preferences.

Question 1 – Anchoring heuristics

Group A: What is the area of Prešov county (in square kilometers)? Make a numerical estimate!

Group B: What is the area of Prešov county (in square kilometers)? Is it more or less than 20 000 square kilometers? Make a numerical estimate!

I: *Question 1 results – excluding outliers (5 max., 5 min.)*

	Group A	Group B
Count	94	86
Mean value	10 088	18 728
Maximal value	65 000	55 000
Minimum value	100	7 000
Standard deviation	7 054	9 464
Median	8 000	15 000
Modus	8 000	10 000

The results in the Tab. I. clearly show the effect of an anchor, which was incorporated in the questions for the group B (Anchor: *It is more or less than 20 000 square kilometres?*). The actual area of the Prešov county is in fact 8 993 square kilometres.

Although both groups responded to questions that investigated the identical nature (area of Prešov county), the results were considerably different. To eliminate the effect of outliers on the results, the outliers were excluded.

Even after this modification, the anchoring effect is evident – in particular the significant increase in the variance and standard deviation, as well as in the mean value. The mean value in the group A (without the anchor) was 10 088 square kilometres, which is relatively close to the correct answer (our respondents had a good estimate). In contrast, in group B there was a significant difference in estimates and the high anchor pulled the mean value almost to the double value – 18 728 square kilometres.

In business praxis, one of the most common types of anchors is a past event or trend. In situations characterized by rapid changes in the marketplace, historical anchors can lead to poor forecasts and, in turn, misguided choices (Hammond & Keeney & Raiffa, 2006).

Availability heuristics

People assess the frequency of a class or the probability of an event by the ease with which instances or occurrences can be brought to their mind (Tversky & Kahneman, 1974). There are situations in which this approach provides a very good basis for decision making, as items or examples that people can arrange to their minds easily, are often the ones that are most commonly encountered in the environment. On the other hand, this tendency leads to biases, because an event that evokes emotions, imagination or is distinct in nature, is more readily available in memory than an event difficult to imagine, vague or unemotional in nature (Bazerman & Moore, 2009). Clarity usually indicates the extent to which something is concrete and imaginable, sometimes also the rate of interest or emotional distance in time and space. Answering the question: *What is more likely to cause death in the U.S. – death due to falling debris of the aircraft or shark attack?*, the second option is usually the intuitive answer. It's due to movies like *Jaws* and media reports that richly cover such attacks with illustrative pictures. Therefore a shark attack is better imaginable. In reality, the probability of a death caused by a falling part of an airplane is 30 times higher than by a shark attack (Plous, 1998).

Emotions are another factor that may affect the availability. When we are in a certain emotional state, we tend to remember the events that correspond to that state. (Hastie & Dawes, 2009). It is also true that an emotionally perceived benefit does not inevitably have to lead to verification of its origin (Okruhlica, 2009).

Except the clarity, which is often subject to external impulses, availability is also affected by the imagination as an internal factor and ability to imagine certain information. The better we can imagine a hypothetical future circumstance, the more likely we would consider it. We presented to respondents of our research a situation in which they were supposed to estimate the probability of being infected by a particular disease. Symptoms of the disease were substantially the same, but they have been described differently for the two groups of study participants. One group had symptoms, which were easier to imagine, such as: fatigue, headache, breathlessness, forgetfulness and distractibility. The second group had the same symptoms, but described in a way more difficult to imagine, like: lack of energy, discomfort in the head, respiratory problems, and deterioration of mental abilities.

Question 2 – Availability heuristics

Group A: Recently, there is a relatively frequent occurrence of a certain disease. This disease is caused by a temporary impairment of liver function, but is easily treatable and often requires no medical intervention. It is estimated that throughout the year the disease affects 10% of the population. Imagine the following symptoms and try to estimate how likely during the following year you would get sick from the disease. Symptoms – fatigue, headache, breathlessness, forgetfulness, and distractibility. Your estimated probability that you would be suffering from this disease (in %):

Group B: Recently, there is a relatively frequent occurrence of a certain disease. This disease is caused by a temporary impairment of liver function, but is easily treatable and often requires no medical intervention. It is estimated that throughout the year the disease affects 10% of population. Imagine the following symptoms and try to estimate how likely during the following year you would get sick from the disease. Symptoms – lack of energy, discomfort in the head, respiratory problems, and deterioration of mental abilities. Your estimated probability that you would be suffering from this disease (in %):

II: *Question 2 results*

	Group A	Group B
Count	103	99
Mean value	20	14
Maximal value	100	99
Minimum value	0	0
Standard deviation	17	11
Median	10	10
Modus	10	10

We can see the results in the Tab. II. The questions for the two groups of respondents are almost identical, they describe the same symptoms, only the symptoms for the group B were formulated in a more tangle way. In the group A we see a higher estimate of the probability (mean value of 20%), compared to group B (mean value of 14%), that the respondents would suffer from the disease. The group A with more easily imaginable symptoms estimated a higher probability of falling ill. We can make a conclusion, that an event or information easier to imagine is more easily accessible in mind, which may increase the specious frequency (even the future estimate) of its occurrence. It is possible that the answers to this question were also influenced by the heuristics of representativeness. The decisions are often influenced by more than one heuristics that can work together; respectively there aren't clear boundaries between them.

Practically we can illustrate the availability heuristics in behavior of a sales representatives. Sales representative is willing to give a higher discount, or offer other special benefits to buyer, if the buyer is willing to act quickly and close the deal fast. The buyer gets better conditions in case of such a quick transaction. The seller is satisfied too – for him it is better to earn less, but certainly and immediately; than earning more, but with uncertainty and risk, that the deal would not be closed at all.

Representativeness heuristics

Tversky & Kahneman (2002) define representativeness as an assessment of the degree of consistency between the sample and the population, between an object and a class, an event and a process or generally between the result and a model. One type of representativeness heuristics is the insensitivity to the sample size.

People tend to make conclusions from small samples of the entire population, although these samples are not representative enough. E.g. for smaller samples, there will be more variations in the average (mean) of the sample from the average (mean) of the whole population. Although the members of these samples bear the characteristic and representative features of the population, to which they belong, it is not possible to generalize the conclusions made from this sample on the entire population, or we must count with significant variations. This applies particularly if it is a statistically insignificant sample. For example, it is much more likely to get 60 percent tails in five flips of a coin rather than getting more than 60 percent tails in 5 000 flips of a coin. With a sufficiently large number of experiments, we would observe a gradual convergence toward one half of the tails, according to the theory of probability. However, people usually judge the probability to be the same, effectively ignoring the sample size. The importance of sample size is a fundamental parameter in statistics; however it is rarely a part of our intuition. According to Grimmett & Stirzaker (2001) law of large numbers in probability theory postulates that by multiple repetition of a certain experiment, the average of results obtained from a large number of trials would with increasing number of trials approximate to the expected value, as it can be expressed mathematically. Tversky & Kahneman (1971) formulated the law of small numbers: Human intuition about random sampling is governed by the law of small numbers, which says, that the law of large numbers applies also to small numbers. There is a tendency to evaluate populations based on small samples, people based on few impressions and to accept hypotheses based on inadequately low number of experiments.

For example, our colleague – teacher complained, that the quality of students significantly decreased over the past few years. He made his conclusion on the basis that he examined the students orally. This colleague used to examine orally all students in the course in the past. However, over time the number of students increased significantly and he changed the examining system. According to new rules, he examined orally only students, who did not have enough points to close up their grade from the projects and written tests. Two things happened simultaneously. During the years the number of students increased, allowing weaker students to study (the acceptance criteria for the study were decreased). In addition the teacher narrowed the sample, he examined orally only the weaker students. Thus, our colleague based his evaluation of students on a reduced and shifted sample of the whole class of students.

Question 3 – Representativeness heuristics (from Tversky & Kahneman, 1974)

There are 2 hospitals in the town – the larger one and the smaller one. In the larger hospital approximately 45 babies are born per day, in the smaller around 15 babies. We know that about half of the babies born are boys, but this ratio may vary in each hospital every day. Both hospitals recorded cases where more than 60% of the children born within one year were boys. Which hospital do you think recorded more of such days?

The question was the same for both groups of respondents. There were three options of the answer – the larger hospital, the smaller hospital, and both hospitals about the same. We can see the results in the Tab. III.

III: *Question 3 results*

Larger hospital	22	10.7%
Smaller hospital	63	30.6%
Both hospitals about the same	121	58.7%
	206	100.0%

We examined in this question whether the respondents are aware of the "law of small numbers". The more babies born per day in the hospital, the more likely is that the ratio between boys and girls would be in balance. This means that the disproportionate distribution of boys and girls is more probable in the smaller hospital. According to the results of our research, only 30% of respondents were aware of this fact. Almost 60% of respondents assumed that the probability is the same for both hospitals irrespective of their size. Our research confirms that people are often subject to self-deception and do not count with the impact of the "law of small numbers" on probability.

DISCUSSION

Our research results confirm the existence of heuristics and their impact on decision making. Its results are in line with the theoretical background on this topic. These theories point on the limited rationality of people and are also a part of behavioural economics. Heuristics influence both the information we use and the way we deal with them in the decision making process. We use them to speed up and simplify our decision process. However, these mental shortcuts could be a source of serious mistakes and errors in making decisions.

The limitations of our research is relatively small (206 respondents) and homogeneous (only students) sample of respondents. We analyzed only

answers on three questions in this article, the whole questionnaire consisted of 20 questions.

Further research could focus on the influence of heuristics on the practice of managerial decision making and possible ways, how to diminish their impact.

SUMMARY

People make estimates by adjusting the initial values they start with. The initial values or starting point (number or other information), that is submitted to us first and has the potential to anchor our judgment, is called anchor. This starting point may be suggested by the formulation of the problem, or it may be the result of a partial calculation. In either case, adjustments are typically insufficient. The different starting points yield different estimates, which are biased toward the initial values. Consequently, such anchors have often the major impact on our decision making.

The human mind operates in a way that vivid, easily imaginable or emotionally loaded events and information are more easily and quickly retrieved in our memory. Therefore we tend to assign to such events higher probability or frequency of occurrence than they actually have. In this way the availability heuristics distorts our judgment and leads to systematic errors.

Although the importance of sample size is crucial in statistics, the sample size is rarely a part of our intuition. In response to the problems dealing with sampling, people often use the representativeness heuristic. The result is that people ignore the issue of sample size, which is critical for an accurate assessment of the problem.

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