HEURISTICS IN THE PROCESS OF DECISION-MAKING

Miloš Mrva - Peter Gál - Matej Meško - Peter Marcin[19]

Abstract

Heuristics are commonly known as routines people unconsciously use to cope with the complexity inherent in most decision-making situations. They can be defined as mental shortcuts that help people to simplify and structure the information encountered in the world.

We conducted survey with several questions on examining heuristics in decision-making process. The basic research of existing theory is also one part of this article. Some of the results how mental shortcuts are involved in process of decision-making and influenced the final decisions are described in our research. We assume that each stage of process of decision-making contains some types of common heuristics and the purpose of this article is to identify those. Presented ideas could be the basis for the future research on this topic.

Introduction

Heuristics, or mental shortcuts, help people make decisions based on limited information, but can result in cognitive biases. Heuristics explain how people make decisions, come to judgments, and solve problems, typically when facing complex problems or incomplete information.

Decision-making can be defined as the process of selecting a logical choice from among the available options. When trying to make a good decision, a person must weigh the positives and negatives of each option, and consider all the alternatives.[20]

[19] Mgr. Miloš Mrva, PhD., Univerzita Komenského v Bratislave, Fakulta managementu, Katedra stratégie a podnikania, Odbojárov 10, 820 05 Bratislava, tel. 00421 2 50 117 642, e-mail: milos.mrva@fm.uniba.sk
Mgr. Peter Gál, PhD., Univerzita Komenského v Bratislave, Fakulta managementu, Katedra stratégie a podnikania, Odbojárov 10, 820 05 Bratislava, tel. 00421 2 50 117 620, e-mail: peter.gal@fm.uniba.sk
Mgr. Matej Meško, Univerzita Komenského v Bratislave, Fakulta managementu, Katedra stratégie a podnikania, Odbojárov 10, 820 05 Bratislava, tel. 00421 2 50 117 612, e-mail: matej.mesko@fm.uniba.sk
Mgr. Peter Marcin, Univerzita Komenského v Bratislave, Fakulta managementu, Katedra stratégie a podnikania, Odbojárov 10, 820 05 Bratislava, tel. 00421 2 50 117 642, e-mail: peter.marcin@fm.uniba.sk

[20] REASON, J. 1990. *Human Error*. Ashgate, 1990. ISBN 184-014-1042

Decision-making implies that a choice will be made, suggesting that alternatives exist or will be identified. On the other side, problem solving is directed at the resolution of a problem, it is a difference between some existing situation and some desired situation.

According to Huber, we can define five stages of problem solving:[21]

1. Understand Problem: include those activities dealing with problem identification, definition and diagnosis
2. Generate Alternative Solutions: include those activities dealing with generation of alternative solutions to the problem
3. Choice of Alternative Solutions: include those activities dealing with evaluation and choice among alternative solutions
4. Implement the Chosen alternative: include those activities dealing with implementation of the chosen solution
5. Monitor and Review the Solution: include those activities dealing with maintaining, monitoring and review the solution

Problem structuring and alternative-generation are recognized as the most important elements of the decision-making process. A problem can usually be solved in any of a number of ways. The choices that the decision maker has to decide on are alternatives.

The only alternative that really counts is the one judged best among those considered. At this point in the decision-making process, however, it is important to consider all feasible ways by which the problem can be solved. Once the problem or opportunity has been recognized and analyzed, decision makers begin to consider taking action. The next stage is to generate possible alternative solutions that will respond to the needs of the situation and correct the underlying causes. One study found that limiting the search for alternatives is a primary cause of decision failure in organizations.[22] Decision alternatives can be thought of as the tools for reducing the difference between the organizations' current and desired performance. Once a problem or opportunity has come to a managers' attention, the understanding of the situation should be refined. Diagnosis is the step in the decision making process in which managers analyzes underlying causal factors associated with the decision situation. Managers make a mistake here if they jump right into generating alternatives without first exploring the cause of the problem more deeply.[23]

A good way that we can follow, when we are faced with a problem, is to examine the problem as a whole, observing and noting the complexities that exist and

[21] HUBER, P. 1980. *Managerial decision making*. Scott: Foresman, 1980. ISBN 978-067-315-1414
[22] NUTT P.C. 1999. *Surprising but true: Half the decisions in organizations fail.* Academy of Management Executive, 1999, p.75-90.
[23] KEPNER H. Ch. - TREGOE B.B. 1965. *The Rational Manager: A systematic approach to problem solving and decision making*. McGraw-Hill, 1965. ISBN 978-007-034-1753

embracing the tension between opposing ideas to create new alternatives that arise from the advantage of having many possible solutions. Our ability to face constructively the tension of opposing models, allows us to generate alternative solutions, that is, rather than choose one model over another can generate a new one containing elements present in the others. A good method for generating alternative solutions is for example brainstorming or simply asking everyone to suggest ideas. All the ideas should be discussed or summarized in a report. Important is to watch out for assumptions; every unnecessary assumption reduces the number of potential solutions.

Heuristics in the initial phase of problem solving

Consideration of the nature of the problem is the initial phase in the process of problem solving. It includes activities concerned with identifying the problem, its definition and diagnosis. The existence of anchoring heuristics plays a significant role in the problem identifying - when identifying and defining a problem, we often tend to fix on a particular detail that may remind us of a similar situation from the past and influences the objective determining of the nature of the problem. In this case the anchor is a dominating factor which is present in the current problem.

Here is an example introduced in the Harvard Business Review on Decision Making[24]. There have been established more production lines in a U.S. automobile factory. One of them has begun to declare a higher percentage of defective products. A worker has worked on this line, about whom some colleagues complained and there were rumors that he has a problem with alcohol. Thus the plant manager thought about this worker as about a cause of higher error rates and wanted to fire him. Finally, however, the issue has been investigated in depth and it has been found that the problem is somewhere else - in the wrong component of the defective line. Also this example shows how dangerous the anchoring to a fact may be as well as the unwillingness to undertake an in-depth analysis of the problem.

Availability heuristics in the phase of problem solving

It is really important to know the connection between heuristics and solutions planning for decision making. One of the common heuristics that could have an influence on decision making and solution planning is availability heuristic. According to Tversky and Kahneman concept of availability heuristics individuals estimate the frequency of an event or the probability of its occurrence by the ease in which instances could be brought to mind.[25] Thus, using the availability heuristic, people

[24] Harvard Business Review on Decision Making. 2001. HBR Press, Boston. 200 p. ISBN: 1-57851-557-2.
[25] SCHWARZ, N. - VAUGHN, L.A. 2002. The Availability Heuristic Revisited: Ease of Recall and Content of Recall as Distinct Sources of Information. In *Heuristics and biases: the psychology of intuitive judgement*. Cambridge: Cambridge University Press, 2002. ISBN 0-521-79260-6, p. 103.

would judge an event to be more likely to occur if they could think of more examples of this event. [26] On the other hand, this tendency leads to biases, because an event that evokes emotion, imagination or is distinct in nature is more readily available in memory than an event difficult to imagine, vague or unemotional in nature.[27]

The process of the availability heuristics can be described as setting up the question and seeking in memory for the recollection of items connected with seeking. The next step is to evaluate the difficulty of recollection (the amount of remembered and flow of recollection). And at the end the frequency or probability is estimated.[28]

Example of the availability heuristic used in problem solving

As an example we can mention the news that can affect our availability heuristic by producing vivid memories that are more readily available. For instance, if the news has recently reported on large forest fires, we are more likely to believe that forest fires are on the rise because the memory appears vivid and is readily available.

Another example, after seeing several news reports about car thefts, you might make a judgment that vehicle theft is much more common than it really is in your area. This type of availability heuristic can be helpful and important in decision-making. When faced with a choice, we often lack the time or resources to investigate in greater depth. Faced with the need to an immediate decision, the availability heuristic allows people to quickly arrive at a conclusion.

After seeing several television programs on shark attacks, you start to think that such incidences are relatively common. When you go on vacation, you refuse to swim in the ocean because you believe the probability of a shark attack is high.

After reading an article about lottery winners, you start to overestimate your own likelihood of winning the jackpot. You start spending more money than you should each week on lottery tickets.

When we are trying to determine how likely something is, we often base such estimates on how easily we can remember similar events happening in the past. For example, if you are trying to determine if you should drive over the speed limit and risk getting a ticket, you might think of how many times you have seen people getting pulled over by a police officer on a particular stretch of highway. If you cannot immediately think of any examples, you might decide to go ahead and take a chance, since the availability heuristic has led to you judge that few people get pulled over for speeding on your particular route. If you can think of numerous examples of people

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[26] TVERSKY, A. – KAHNEMAN, D. 2002. *Extensional versus Intuitive Reasoning. In Heuristics and biases: the psychology of intuitive judgement.* Cambridge: Cambridge University Press, 2002. ISBN 0-521-79260-6, p. 19-48

[27] BAZERMAN, M. H. – MOORE, D. A. 2009. *Judgment in Managerial Decision Making.* Wiley, 2009. 230 p. ISBN 978-0-470-04945-7. p. 7.

[28] HASTIE, R. – DAWES, R. M. 2009. *Rational Choice in an Uncertain World: The Psychology of Judgment and Decision Making*. Thousand Oaks: SAGE Publication, Inc., 2009. 392 stran ISBN 978-1-4129-5903-2. p. 91.

getting pulled over, you might decide to just play it safe and drive the suggested speed limit.

Availability heuristics in the phase of generating alternative solutions

As an example of cooperation between availability heuristic and generating alternative solutions can be description of chain store Lidl and its still stronger power on the market.

Lidl is a German global discount supermarket chain that operates over 10,000 stores across Europe. It belongs to the holding company Schwarz Gruppe, which also owns the store chains Handelshof and hypermarket Kaufland.

Its stores are usually situated near living areas. The basic idea is a small range of products but for low prices. It is easy to see the differences from other rivals - hypermarkets. Lidl has 1,600 products, including 200 branded products, while Billa has a range of 15000 products. People can save their time and have significantly less alternatives to decide for a product they want to buy. What customers really appreciate and Lidl has got a big advantage against its rivals, is the quality, price and freshness of fruits and vegetables. So this fact could be one of the reasons why they decide to come and shop in Lidl. Lidl's inclusion of more branded products meant you could mix between their own products and leading brands. The range is smaller than a traditional supermarket, but customers love they can very easy do a basic shop here.

Own-brands are really important for Lidl, but they believe branded products complement their range. If a customer comes to Lidl for the first time, they will be more comfortable seeing some brands they know. At some point in the Lidl shop, customers will swap to LIDL´s own-brands, but it's important to Lidl that customers have the choice of both.

Customers may not have heard of Lidl washing powder, for example but they will see that there is around a 2€ price difference between that and the well-known brand that sits next to it is and they will try it. When they do, they see that the quality matches that of the brand and do not want to pay more for it anymore. And according to Hermes surveys from September 2013, Lidl is the best communicating company in Slovakia and it also won a category of the best chain store.

Representativeness heuristic in the phase of choice of alternative solutions

When dealing with choice among alternative solutions, representativeness heuristics may occur in the process of evaluating and choice of solutions. These mental decision-making shortcuts were first described by Kahneman and Tversky in 70's and refer to overestimating the likelihood that some event will occur. It is mainly caused by the use of past experiences when confronted with a new experience. People's minds are biased by stereotypes they believe in. There is common error in belief that if the event

or object is more representative it is more likely to occur. "Representativeness is an assessment of the degree of the correspondence between a sample and a population or between an outcome and a model," Gilovich stated.[29]

There are some commonly known types of representativeness heuristics which affects also evaluating and choice among alternative solutions:

- *base rate fallacy* - in this type of heuristic, people do not manage to take correct base rate information into account.
- *regression to the mean* - this type refers to "statistical tendency for extreme scores or extreme behavior return toward the average"[30]
- *gambler's fallacy* - this heuristic occurs when person mispercepts the probability of orderly sequenced numbers to be less possible than random sequence of numbers.
- *conjunction fallacy* - explains the error when people assume that existence of two outcomes is more probable that the occurrence of single outcome.
- *law of small numbers* - indicates situation when people make decision based on small number of nonrandom samples.

Example of the representativeness heuristic in evaluation and choice of alternative solutions

Researchers around the world set up a wide range of problems to test representativeness heuristics. Those studies repeatedly show that people constantly ignore the base rate information. People underestimate the fallacy that comes with small samples of data, which are unreliable .As one of the researches shows, that may lead decision-makers like entrepreneurs to rely on and then generalize small nonrandom samples, which may include insufficient information about customer demand for products and services, production costs. Therefore, they tend to choose the wrong solution from alternatives, based not on reliable information, but on their personal experiences. On the contrary, managers in corporations possess large scale of information, large random samples to reliable estimate demand of customers, so the decisions can be less biased by representativeness heuristics when choosing the right alternative. [31]

One of the representativeness heuristics, the gambler's fallacy, can be also explained by roulette gambling when people evaluate the probability of getting black / red color on misinterpreted predictions based on occurrence of the selected color from

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[29] GILOVICH, T. - GRIFFIN, D. - KAHNEMAN, D. *Heuristics and Biases: The Psychology of Intuitive Judgment*. New York; Cambridge University Press, 2002. 857 p. ISBN 9780521796798

[30] BAUMEISTER, R. - BUSHMAN, B. J. *Social Psychology and Human Nature*. Belmont, CA; Thomson Learning, 2008. 768 p. ISBN 9780495098003

[31] BUSENITZ, L. W. - BARNEY, J. B. Differences between Entrepreneurs and Managers in large Organizations: Biases and Heuristics in Strategic Decision-Making. Journal of Business Venturing. New York; Elsevier Science, Inc., 1997. 9 - 30 p.

the last 10 games. When the last 8 out of 10 colors were black, people predict the next one to be red, because they overlook the fact of the same probability for both colors, even after 8 out of 10 blacks from the last ten games.

Results of the Survey

Question No.1 - Anchoring

Group A: What is the length of the river Danube in km? Try to estimate it numerically!

Group B: What is the length of the river Danube in km? Is it more or less than 500 km? Try to estimate it numerically!

Table 1. Complete Results for the Question No.1.

	Group A	**Group B**
Count	103	98
Mean value	4694	2415
Maximal value	150000	100000
Minimum value	10	200
Standard deviation	17446	9945
Median	2000	1200
Modus	2000	2000

Table 2. Results for the Question No.1. Data Excluding Extreme Values (5 Max. Values, 5 Min. Values)

	Group A	**Group B**
Count	93	88
Mean value	2121	1376
Maximal value	6000	3000
Minimum value	90	430
Standard deviation	1357	716
Median	2000	1200
Modus	2000	2000

Interpretation of the Results for the Question No.1:

The results clearly show the effect of anchoring, which was incorporated in the question for the group B (Is it more or less than 500 km?). Although these homogeneous groups responded to questions, that investigated the identical nature (the length of the river Danube), the results were diametrically different. To eliminate the impact of extreme values on the results, in both cases we excluded 5 minimum and 5 maximum values from the results. Even after this adjustment, it is evident what the anchoring caused - in particular, diffusion and standard deviation were significantly reduced (almost the double value) and the mean value was different (without anchoring it was 2121 km, including anchoring only 1376 km). It was caused by the fact, that the anchor was significantly lower than the actual value, thus it confused even those people, who had a rough idea of the length of the river Danube. Just for clarification, the actual length of Danube is 2860 km.

Group No.2 - Availability

Group A: Imagine, that you can get 50 Eur right now or 60 Eur in a month. What would you choose?

Group B: Imagine, that you can get 50 Eur in 12 months or 60 Eur in 13 months. What would you choose?

Table 3. Results for the Question No.2. - Group A.

	Group A – number of responses	Percentage
50 EUR right now	39	37,5%
60 EUR in a month	65	62,5%

Table 4. Results for the Question No.2. - Group B.

	Group B - number of responses	Percentage
50 EUR in 12 months	15	14,7%
60 EUR in 13 months	87	85,3%

Table 5. Results for the Question No.2. – Calculation of Present Value of Future Income.

	Time value of income for inflation of 3% per annum
50 EUR now	50,00 €
60 EUR in a month	59,85 €
Ratio of both time values of income	119,7%
50 EUR in 12 months	48,52 €
60 EUR in 13 months	58,08 €
Ratio of both time values of income	119,7%

Interpretation of the Results for the Question No.2:

The answer to this question is related to the risk propensity vs. certainty propensity. Although the ratio of the present value of 50 and 60 € is same in both cases – 60 € represents in both cases 119.7% of the value 50 € (see the table no.7), the share of those who would like to get 50 € today vs. 50 € in 12 months is more than 2,5 times higher (37,5% vs. 14,7%).

Answer No.3

Group A: You are responsible for minimizing the loss of the load of three insured cargo ships that sank yesterday near the coast of Alaska. Each ship was carrying a load worth $ 200,000, which will deteriorate if not rescued within 72 hours. The owner of the local emergency services will give you two alternatives (A1, A2), both cost the same. Which one would you choose?

Alternative A1: This plan will save the load of one of the three ships, i.e. $ 200,000.

Alternative A2: There is a one-third probability that this plan saves the load of all three ships, i.e. $ 600,000. However, there is a probability of two-thirds that it will not save anything.

Group B: You are responsible for minimizing the loss of the load of three insured cargo ships that sank yesterday near the coast of Alaska. Each ship was carrying a load worth $ 200,000, which will deteriorate if not rescued within 72 hours. The owner of the local emergency services will give you two alternatives (B1, B2), both cost the same. Which one would you choose?

Alternative B1: This plan will lead to the loss of two ship load out of three, i.e. $400,000.

Alternative B2: There is a probability of two-thirds that this plan will lead to the loss of all three ships and of the whole load, which is worth $600,000. However, there is a one-third probability that no load will be lost.

Table 6. Results for the Question No.3 - Group A.

	FM UK 2012	Hammond, Keeney, Raiffa
Alternative A1	70	
Alternative A2	34	
	67,3%	71%
	32,7%	29%

Table 7. Results for the Question No.3 - Group B.

	FM UK 2012	Hammond, Keeney, Raiffa
Alternative B1	54	
Alternative B2	48	
	52,9%	20%
	47,1%	80%

Interpretation of the Results for the Question No.3:

You must realize there is one key fact: all alternatives (A1, A2, B1, B2) offered **the same** – a one-third probability of rescuing the boats. In addition, the content of the alternatives A1 and B1 represents a completely identical situation, as well as the content of the alternatives A2 and B2. If respondents made perfectly rational decisions, their answers would be indifferent and approximately 50% of the respondents should vote for particular alternatives in all the cases.

We agreed that the resulting value is the same in every case. The distribution of responses matches neither between A1 / A2 and B1 / B2, nor between the identical answers. However, those were formulated once positively and once negatively (a cup is half full versus half empty). This is a Framing trap (Hammond, Keeney, Raiffa). The framing trap occurs when we misstate a problem, undermining the entire decision-making process. [32]

[32] HAMMOND, J.S. – KEENEY, R.L. – RAIFFA, H. 2006. The Hidden Traps In Decision Making. In *Harvard Business Review: Making Smart Decisions.* Boston: Harvard Business Review Press, 2011. ISBN 978-1-4221-7239-1. p. 1.

The pairs of alternatives, are of course, precisely equivalent - Plan A is the same as Plan C, and Plan B is the same as Plan D - they've just been framed in different ways. The strikingly different responses reveal that people are risk averse when a problem is posed in terms of gains (barges saved) but risk seeking when a problem is posed in terms of avoiding losses (barges lost). Furthermore, they tend to adopt the frame as it is presented to them rather than restating the problem in their own way.

The first step of the decision-making process is placing of the situation into a framework. This framework can influence significantly the decision choice. One of the best documented effects of framework creating is the fact that people approach situations perceived as a loss significantly differently, than those they perceive as profitable. If we look at the outcome of the decision as to avoid the loss, we tend to undergo risk. If it is perceived as a gain, we tend to avoid risk. In addition, many tend to adopt a framework the way it was submitted to them; they do not try to reformulate it in their own way.

Answer No.4 - Representativeness

Group A: Imagine there are 10 lottery tickets. Nine tickets have been purchased by nine different people. One ticket costs 1 Euro and the possible prize is 20 Euro. Would you buy the remaining ticket?

Group B: Imagine there are 10 lottery tickets. Nine tickets have been purchased by one person. One ticket costs 1 Euro and the possible prize is 20 Euro. Would you buy the remaining ticket?

Table 8. Results for the Question No.4.

	Group A - number of responses		Group B - number of responses		Together	
Yes	70	67,3%	53	52,0%	123	59,7%
No	34	32,7%	49	48,0%	83	40,3%
	104	100,0%	102	100,0%	206	100,0%

Interpretation of the Results for the Question No.4:

Note the following facts: In terms of probability - this game is definitely worth playing. There are 10 lottery tickets, one costs 1 € and the possible prize for one lottery ticket is 20 €. If we played this game long enough (law of large numbers), so our win should be close to the double amount compared to our contribution. Therefore, it is

surprising that only 60% of the respondents would play the game. The people were psychologically discouraged that there is only one last remaining lottery ticket – however, the likelihood that this is the winning lottery ticket is the same as speaking about any other lottery ticket – and moreover, thanks to the contribution of € 1 you can win € 20 with a probability of 10%! We dare to assume that a sample of less educated respondents would be even less "willing to buy a lottery ticket".

The second important fact concerns the formulation of both issues - the only difference is that in the first case, the tickets have been purchased by *nine different people*, in the latter case; the tickets have been purchased by only *one person*. Regarding the likelihood, the same is still valid what is explained above - regardless of whether the previous tickets have been purchased by 1 person or 9 different people, the likelihood that the last tenth lottery ticket will win is still the same. Nevertheless we can notice a slight difference in the results between the two groups – in the situation when 9 tickets had been purchased by only 1 person the people were less willing to buy the last ticket.

Conclusion

When people make decisions or judgments, they often use mental shortcuts or a rule of thumb, which are also known as heuristics. People usually do not have enough time or sufficient resources to gather and then compare all the information before they make a choice. That applies for almost every decision based on daily bases. Therefore, people use mental shortcuts to help make decisions quickly and efficiently. Many times, these heuristics can be helpful, but in many other cases they may lead to serious errors or cognitive biases.

This article was the initial part of the broader research on heuristics and how they are involved in daily decision-making. We described different types of mental shortcuts and provided some of the examples of their influence when people make decisions. We demonstrated that in every single stage of the initial phases of the decision-making process mental shortcuts play a significant role on which from the alternative solutions people end up with.

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