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APPLICATION OF DIFFERENT HEURISTIC CLASSES IN MEMORY-BASED AND STIMULUS-BASED DECISIONS

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Abstract

This paper studies the drivers of heuristic application in different decision types. The study compares differences in frequencies of heuristic classes' such as recognition, one-reason choice and trade-off applied in, respectively, memory-based and stimulus-based choices as well as in high and low involvement decisions. The study has been conducted online among 205 participants from 28 countries.

Keywords: heuristics, memory-based, stimulus-based, involvement

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Introduction

Back in 4th century BC, Plato stated that "good decision is based on knowledge and not on numbers". Although this approach might seem to deflate the importance of statistics and data, the quotation reveals the phenomenon of heuristics in decision taking processes applied in daily life of each human being. In contrary to common view on heuristics which assumes their negative biasing, the following thesis analyzes them as effective and efficient, albeit irrational decision taking strategy. This paper attempts to understand how specific decisions are taken. What processes does the brain engage to make choices? Are they data-driven or biased by random factors? What are the dominant heuristics and further, is their presence desired for decisional outcome? Finally, do heuristics differ among different types of decision regarding engagement or exposure to stimuli? In view of above-mentioned questions, the following study aims to bring value to consumer and managerial decision taking contributing to more complex comprehension of choice-influencing factors.

Although both heuristics and explicit/implicit memory concepts are subject to many scientific studies, no research attempts to comprehend the relations between them. This paper analyses the link between heuristics and decision types, focusing on three main heuristics (recognition, one-variable and trade-off comparisons), using of which is collated between memory-based and stimulus-based choices. My hypothesis is that the usage frequency of mentioned heuristic types significantly differs between memory-based and stimulus-based decisions as well as low and high involvement decisions. The report presents brief literature review, research methodology, its results as well as conclusions and further research questions. The literature review purpose is to give

overview on relevant managerial and consumer decision-taking literature, concept of bounded rationality as well different approaches to heuristics. The research methodology section explains how the study is linked to summarized literature, how the survey was shaped and what limitation it has. The methodology section is followed by the results' presentation and conclusions for consumer choice and investments decision making and suggestions for future research.

Literature review

This review provides a brief summary of literature related to judgment in decision making and focuses on different approaches to heuristics as well as introduces the concept of memory-based and stimulus-based choices. This part of the paper aims to present relevant scientific frameworks which help readers in understanding the research's emphasis.

Phenomenon of decision making was the subject of philosophers' discussion in Ancient Greece as early as in 5th century B.C. (Socrates – concept of *rationality*, obedience). Nevertheless, one can notice growing interest in this field just in the middle of twentieth century when it became a subject of much scientific research. Simon (1958) noticed that human cognition is limited compared to complexity of the world and coined the term of bounded rationality, which in opposition to rationality describes the attempts of taking rational decision when dealing with time and cost constraints as well as limited (or low quality information) and finally intelligence limitations and perceptual errors (Bazerman, Moore: 2009). This leads to the concept of satisficing (taking choices that achieve acceptable and reasonable level of satisfaction rather than optimal decision based on rationality).

Researchers have discovered that human brain tends to apply simplified strategies when making decision in order to face above-mentioned limitations. These strategies are described as *heuristics* (the term origins in Greek and means *serving to find and discover)*. Heuristics are defined in a numerous way. Shah and Oppenheimer (2008) focus on the effort reduction feature of heuristics which may apply to number of cues, retrieving cue values or their weights, integrating information or number of alternatives. The most adequate definition for this thesis should nevertheless highlight the superiority of heuristics to statistic-based and rational decision making processes which are achieving satisficing outcome more quickly, more frugally and more accurately (Gigerenzer, Gaissmaier: 2011).

The relevance of heuristics for decision taking may be pre-justified by less-can-be-more concept. To illustrate how complexity can hinder decisions, I will introduce the short research example of Wubben and Wangenheim (2008), in which retailer distinguish customer who are likely ti make purchase in the future. In so doing, they simply analyze whether a customer purchased any product within defined time period (one, true-or-false variable), ignoring other cues such frequency of purchases or time spacing in-between them which would demand invoking complex statistical methods. This method is described as a hiatus heuristic and is featured from 3% to 8% more valid customer classifications compared to negative binominal distribution models, although additionally it reduces decision effort. General application of heuristics can be justified by two concepts.

First one, accuracy-effort trade-off (Payne: 1993; Shah and Oppenheimer: 2008) concerns the acceptable loss of accuracy in favor of time and effort. The latter, ecological rationality coined by Gigerenzer (1999) and developed by Smith (2003),

suggests that *heuristic is ecologically rational (ecologically) to the degree that it is adapted to the structure of the environment"*.

The literature concepts concerning heuristics are divided into two dominant approaches. The one adapted for this paper perceives heuristics as skills or abilities (conscious of subconscious) which help efficient (fast and frugal) decisions. This approach is in opposition to heuristics-as-biases concept. Before explaining heuristics analyzed in this paper, I will shortly presented examples of biases.

This part of literature review aims to sensitize the reader to possible negative effects of heurustics. Bazerman and Moore (2009) pointed out three main groups: availability, representativeness and confirmation. Availability heuristics simply focuses on decision biases causes by vividness, recency, or memory structure. I will shortly illustrate two explanatory studies which depicts the phenomenon. For instance, people underestimate the number of death caused by socially acceptable behaviors like tobacco smoking or poor diet and physical activity while overestimate the impact of guns or illicit drug use. (Mokhad, Marks, Stroup & Gerberding: 2004). Influenced by recency bias, insurance customers who experienced natural disaster tend to choose policy protecting from such events more frequently than customers who never experienced them (Kunreuther: 1978).

There many biases emanating from representativeness heuristics. For instance, people tend to ignore sample size. Tversky and Kahneman (1974) asked respondents to judge in which of maternity wards (which differ significantly regarding size), are there recorded more days when 60% percent of boys is born? Respondents were given the information that on average 50% of newborns are boys; however the number varies

from day to day. Most of respondents pointed out that the number of such days should be about the same; ignoring the statistical fact that smaller sample tends to be more distant to population results. Other important representativeness biases regard conjunction fallacy, regression to mean and misconceptions of chance. The last big family of heuristic-based biases concerns confirmation which explains many important phenomena. The most commonly present in literature are confirmation trap (individuals tend to look for data which support their hypothesis while failing to find contractionary arguments), anchoring (making estimates based on given values ignoring their irrelevance). In order to illustrate confirmation trap, I will use example of three-number sequence: 2-4-6 (Wason, 1960). Students were asked to come up with rule that described to sentences usually choose *plus-two* rule based on their first hypothesis whereas in fact they observed *any three ascending numbers*. Bazerman introduces anchoring by presenting the following problem. Responders are requested to estimate the year in which Taj Mahal was built. However, in the first part of the question they are asked is to write down the last three digits of their phone number and add one in front so they received a date of second millennium A.D. After the participants stated whether the actual date of Taj Mahal completion is earlier or later to the one made of phone number digits. The responders (on average) tended to give estimation relatively close to the date constructed of one and their phone number digits which explains the anchoring phenomenon.

The above-mentioned examples of studies show how heuristics invoked by human brain bias decision making processes. In the following paragraph, three main heuristic classes are described more specifically. In contrary to biases emanating from heuristics, groups presented below help deciders to save time and effort but also bring satisficing

outcomes. The following classes are considered: recognition, one-reason decision making and trade-off. Gigerenzer and Gaissmeier (2011) define recognition-based decisions as such based on judgments on recognition information only while ignoring other cues. There are numerous studies showing how recognition heuristic can be superior to more rational methods. It includes *simple recognition*, *fluency* and *take-the-first* strategies. One can easily observe application of this heuristic in daily life, from choosing the meal in the restaurant (sirloin steak against *toad-in-the-hole)*[1] through betting on more popular team or player, answering quiz show questions until investment and consumer choices. When asked to judge, which of two cities is larger, respondents usually point out the one whose name sound more familiar - Heidelberg and Bonn example (Gigerenzer: 1991). Regarding sports, results of Wimbledon tournament in 2004 was predicted more accurate (compared to the Wimbledon experts) by amateur players who knew only 50% of contestants (Serwe & Fargo (2006).

Other studies cover successful German election predictions based exclusively on names' popularity as well as recognition-based stock portfolio building whose returns outpaced portfolios created by experts. Analyzing brand marketing, one can clearly notice that the whole concept of branding and promoting branded products is based on recognition. Fluency and take-the-first heuristics are derivatives of simple recognition and work as follows. Fluency, in this instance, concerns choosing a faster recognized option out of two recognized, while take-the-first strategy, as the name suggests, choosing the alternative that comes to one's mind the fastest. This phenomenon among other explains how team sportsmen take their blink-of-eye successful decisions (Johnson & Raab: 2003; Hepler: 2008).

[1] British dish made of sausage and Yorkshire pudding

The other class of heuristic (one-reason) comprises strategies such as one-clever cue, hiatus heuristic (presented when introducing heuristic – active customer diagnosing) as well as well take-the-best heuristic. This class *bases judgments on one good reason only, ignoring other cues* (Gigerenzer, Gaissmaier: 2011). All strategies belonging to this class might appear similar at first; however they have some fundamental differences. Summarizing them shortly, one-clever heuristic is applied for instance when baseball players or goalkeepers try to hit or catch approaching ball (expected trajectory is based on heuristic rather than on real-time computing). In turn, take-the-best strategy (when comparing two options) includes ordering cues according to their relevance, stopping at first that provides vivid differentiation and taking decision on this basis. I will provide hypothetical example of choosing a restaurant. There are two choices considered. A tourist knows the prices level, quality of meals, quality of service, location, type of cuisine as well as interior design. The decider assumes the following order: location (1), quality of meals (2), price level (3), interior design (4); the rest of criteria is found irrelevant. The location and quality of meals do not differ much, since the restaurant are in the same neighborhood and both are ranked well in term of dishes they serve, the decider focuses on the first differencing cue (price level) and chooses the restaurant with more attractive prices without thinking of interior design.

The third group of heuristic comprises trade-off strategies. As the name suggests, these are multi-variable on-the-spot analyses which lead to criterion trade-offs. Following the example of choosing one of two restaurants, the decider would weight equally all of criteria and then compared available cues to make final decision. There two types of trade-off heuristics distinguished: tallying and 1/N. An interesting example of tallying was provided by McCammon & Haegeli (2007) who explained the phenomenon of this

strategy by analyzing avoiding avalanche accidents. Avalanche experts listed 7 cues appearing on the slope which usually accompany avalanche (e.g. presence of water on the snow surface). When more than 3 cues are present, spending time on the slope is said to pose a huge risk. Although the method seems very straight forward, it predicts up to 92% of avalanches. The other trade-off strategy, 1/N rule assumes *allocation of resources equally to each of N alternatives* (Gigerenzer, Gaissmaier: 2011). Regarding investing, it is worth to mention that 1/N rule (portfolio value distributed equally to each instrument), beat Markowitz mean-variance model in terms of returns (DeMiguel, 2009).

Apart from above-mentioned heuristic classes, social intelligence stimulate efficient decision making. Examples of social intelligence include imitating successful behavior or tit-for-tat strategies. For the purpose of this research, social intelligence is omitted as heuristics type because of lower relevance regarding research methodology.

The second part of literature review introduces concepts of stimulus-based and memory-based choices. As the name suggest stimulus-based decision are impacted by stimuli which are present when decision is being taken while memory-based choice requires deciders to *maintain relevant options in working memory* (Rottensreich, Sood, Brenner: 2007). To better illustrate the differences between Lee (2002) provides the example of travelling couple (John and Betty) who first drives through newly discovered city and a few moments after is about to choose the restaurant for dinner. John tries to remember the signs and hoardings he saw on the way to the hotel, while Betty searches through tourist guides. This simple situation depicts the basic difference between two concepts. John maintains relevant options in his working memory (with no exposure to stimuli at the time decision taking) and Betty chooses between different options when being

exposed to decision impacting stimuli. Another simple example may concern grocery shopping. Some customers prepare the list of products beforehand (memory-based) whereas others are more likely to make choices in-store when exposed to merchandising material and products visual design (stimulus-based). Rottenstreich, Sood, and Brenner (2007) put the concept of system 1 and system 2 though modes into the context of memory-based and stimulus-based choices. System 1 alludes to rapid and automatically taken decisions, in contrary to system 2 which include controlled, slow and deductive mental processing. The authors argue that *memory-based choice tend to reflect relatively more system 1 processing, whereas stimulus-based choices reflect relatively more system 2 processing* which leads to differentiation of choices quality in these two types of decisions. Apart from system 1 and 2 concepts, it is worth to mention explicit and implicit memory theories. These concepts spell new light on the memory-based and stimulus based-choices. Graf and Schacter coined the terms of implicit and explicit memory in 1985. According to them, the following mechanism can attributed to implicit memory: when trying to *remember recently presented information, subjects are simply required to perform a task* (stimulus)*; memory is revealed by a facilitation or change in task performance that is attributable to information acquired during a previous study episode,* while explicit memory refers to revealing facts without external stimulation (*conscious recollection of previously presented information).* Examples that differ the mentioned types of memories is singing a song while not being able to remember specific parts of lyrics without melody (implicit memory), in contrary writing down the complete lyrics or poem alludes to explicit memory.

To sum up the literature review, the paper introduced the concept of heuristics explaining the different between biases emanating from heuristics and heuristics as

efficient decision taking tools. Regarding the positive view on the heuristics, the four main classes of heuristics were introduced: recognition, one-reason, trade-off and social intelligence (which for the purpose of this research will not be analyzed separately). In the next part of literature review, the paper illustrates stimulus-based and memory-based decisions along with concepts of implicit and explicit memory.

Discussion of the topic

The following part of the paper aims to sketch the connection between the literature review and the conducted study as well as to describe methodology along with obtained results and brief comment on them.

Method

The purpose if this study is comparing heuristic application between stimulus-based and memory-based choices. The following diagram depicts the main research questions:

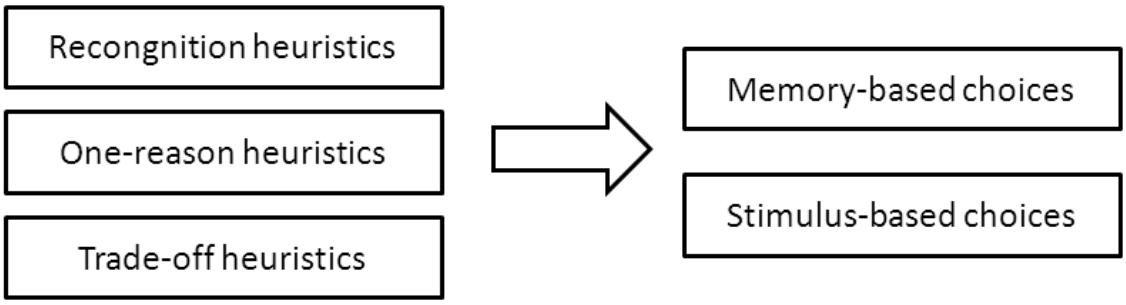

Diagram 1. Depiction of research problem

The sample size amounts to 205 (Appendix 2) and consisted mostly of university students since the survey was distributed online on Facebook groups of Nova SBE, Universidade Nova, Universidade Catolica, Warsaw School of Economics. Regarding demographics data the respondents were asked about their age, gender as well

nationality and informed about the main purpose of the survey (including the fact that they should not check the answers in external sources). The mean age of participant amounted to 23.43 years and it ranged from 18 to 54. Regarding gender, survey was fulfilled by 133 women and 72 men. The respondents represented 28 countries in total, with the biggest fractions from Poland (88 participants) and Portugal (35 participants).

To analyze the problem, an online survey was developed. The dependent variable was defined as the class of heuristic with three different values (recognition, one-reason decision and trade-off) which was analyzed separately in view of two independent variables which are decision type (memory-based and stimulus-based) as well as involvement level (high and low).

After the short-introduction, the respondents were asked to answer 8 questions (Appendix 1). The question comprised two types of decision. First part (questions 1-4) concerns answer to geography-related topic while the second part (questions 5-8) concerns investment decisions. The choice of question areas derives from the need of achieving different involvement of respondents. The study assumption is that respondents are less involved when answering questions on geography (television show type) without personal relations and are more involved when answering questions on their personal investment choices. Further, the respondents are asked interchangeably to provide their choice on actual issue (question 1; 3; 5; 7) and then to justify how the choice was made (questions 2; 4; 6; 8). Inputs from the questions on actual choice in which respondents were asked to give either the largest in a certain continent or decide on the most attractive investment options (text input or were not considered as study data inputs as they role was to make respondents take decision. However, after each of these questions the respondents were asked to choose between heuristics they used – the

multiple choice options associated to each heuristic were adapted to common language. Each stimulus-based choice from the same area was preluded by memory-based choice. The order is conditioned by the fact that the participants were supposed to reach their memory explicitly first and then after made choice to similar question on the implicit basis.

The questionnaire assumes that the respondents are not sure about the right answer and this is why they are unconsciously forced to use heuristics. The questions on investment are the matter of personal choice, while geography questions have *one correct answer* which however is assumed to be unknown by respondents (tested in pre-research questions). The questionnaire was optimized in terms of time needed to fulfill it in order to achieve bigger sample. To avoid suggestive influence of multiple choice questions, each question was displayed separately.

Regarding the questions on geography each of multiple choice answers is mapped to one heuristic while in investment questions several answers are counted as single heuristic application:

Type of question	Questionnaire reference	Represented heuristic type	Involvement
Geography questions	*It simply came to my mind the fastest (I know quite a lot about this city; I traveled there often etc.)*	Recognition	Low
	I thought of one decisive factor (e.g. it has to be a big financial center OR it has to be a famous tourist destination).	One good reason	
	I came up with more than one criterion and compared their	Trade-off	

	importance on the spot (e.g. financial center vs. famous tourist destination vs. capital city etc.).		
	I knew the answer beforehand (I was 100% sure).	N/A	
Investment questions	*It is the most popular way.*	Recognition	High
	I think the mechanisms behind it are the clearest to me.		
	It has been proven by my friends of family.		
	It is the least risky method.	One good reason	
	It is featured by the highest return opportunities.		
	It is featured by "the best return to risk ratio".	Trade-off	
	There are some other features which influenced my decision.		

Table 1. Questionnaire mapping.

Results

The purpose of the research was to compare class of heuristic applied by respondents in memory-based and stimulus-based choices. Additionally, the survey design allows comparing low-involvement and high-involvement choices. To present the results, in view of research hypothesis, the obtained results[2] are synthesized in the matrix below (geography question excludes respondents who claim to know the answer):

[2] Detailed results are presented in Appendix 3

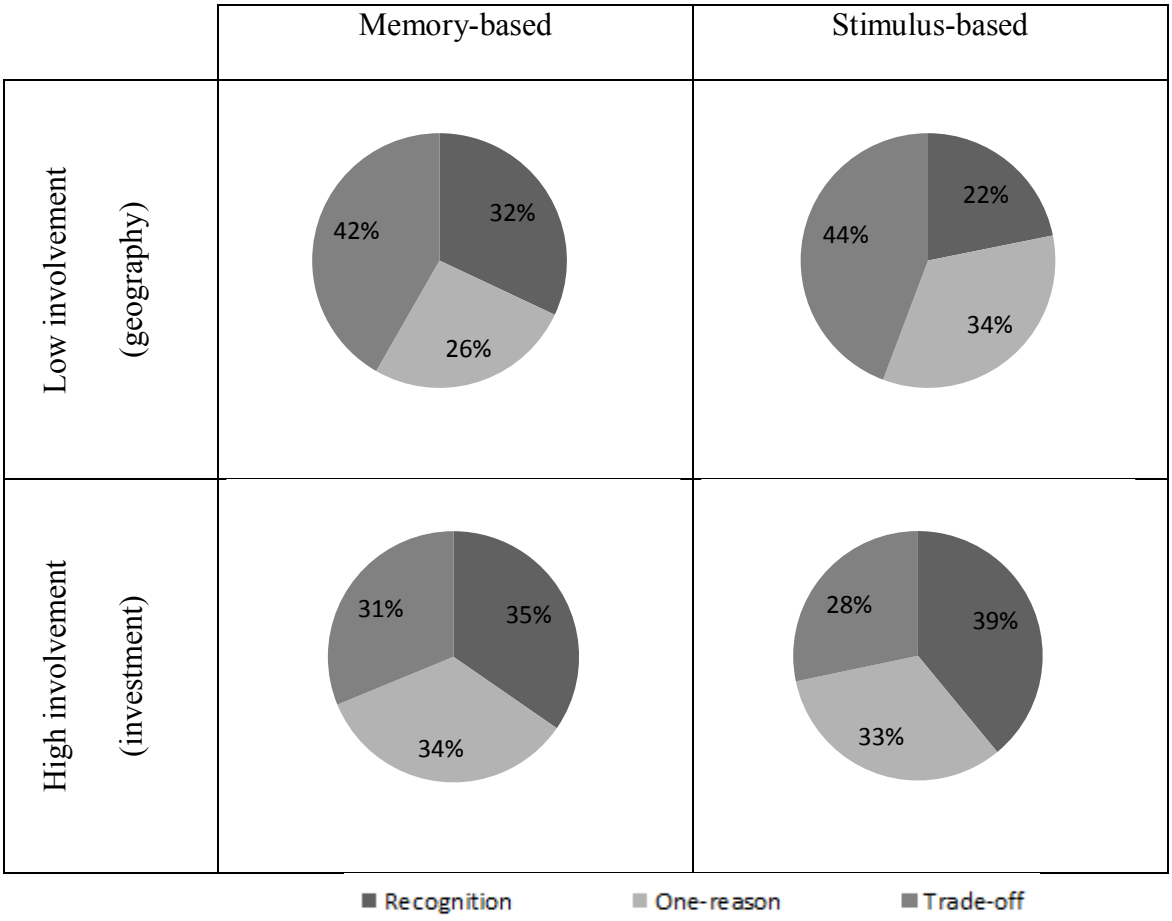

Table 2. Descriptive analysis of results.

Regarding recognition heuristic, its application was the most frequent in stimulus-based high-involvement decision (39.0%) while the least frequent in stimulus-based low-involvement decision (21.8%). One-reason heuristic application ranged from 26.3% (memory-based low-involvement choice) to 34.1% (memory-based high-involvement choice). The declaration of trade-off heuristics was the lowest in stimulus-based high-involvement decision (28.3%) while the highest in stimulus-based low-involvement choice (44.3%).

Comparing heuristics used in memory-based and stimulus-based, one can notice that there are no coherent and significant differences between their applications. Analyzing

the question on geography, one can notice that recognition heuristic was applied 10% less frequently (in favor of one-reason heuristic) when respondents' choice was not supported by listed answers (stimulus-based). However, these findings were not proved by the other types of question (considering investment) hence the study does not confirm that significant differences in application of different heuristic classes exist between memory-based and stimulus-based choices.

However, the differences can be observed in application of trade-off heuristics between low-involvement and high-involvement choices. The absolute average difference[3] in application of recognition heuristic amounts to 9.9%, whereas regarding one-reason and trade-off strategies respectively 4.5% and 13.2%.

To analyze statistical significance of results, a series of chi square test was computed (separately for each independent variable and each heuristic class frequency). The test was chosen in sake of big sample as well as relatively high popularity in other similar researches. Chi square test results are in-line with descriptive analysis, showing very high values of chi square - high dependence for involvement and recognition as well as trade-off heuristics – respectively 8,44 and 14,33 (Appendix 4) - rejecting zero hypothesis on data independence, while maintaining H0 regarding relation between heuristics class and decision type – memory-based and stimulus based. The results are statistically significant for confidence interval of 95%.

The above-shown results suggest that there are no significant differences in application of heuristic between memory-based and stimulus-based choices, however the differences regarding low-involvement and high-involvement choices can be observed.

[3] Average difference between memory-based and stimulus-based questions

Considering all the mentioned limitations as well as sample size and structure, the obtained results provide robust statistic which can be the subject of drawing further conclusion.

Conclusions

The study provides many literature examples that prove relevance of heuristic as efficient decision making tools and further structure main classes of heuristic based on Gigerenzer's classification. When the reader is familiar with the main heuristics groups, the frameworks of memory-based and stimulus-based choices are introduces with extension to implicit and explicit memory concepts. After literature review, the paper introduces study's link to it and main methodological assumptions on how it should be conducted. It is followed by brief results presentations which are put into dimensions of stimulus-based and memory-based choices as well as low-involvement and high-involvement. Obtained results do not confirm the research's main hypothesis that stimulus-based and memory-based choices condition application of different heuristic classes. Nevertheless, the fact that the usage frequency of different heuristic differed between types of decisions (on geography and on investment which represent respectively low-involvement and high-involvement decisions) disposes to further analysis.

Stimulus-based and memory-based choices are not the factors which influence application of specific heuristics. After results' analysis, it may be assumers that it is because the choice applied heuristic is involvement-based, decider-based or simply situational problem-based rather than depending on usage of explicit and implicit memory. At this point, the study can draw attention to the fact that in decisions

demanding higher involvement (in the study – personal investment preferences), deciders prefer to reach simple heuristic (recognition or social intelligence) rather than depend on personal judgment (on average 10% higher usage rate) including analysis of cues which differentiate particular criteria. This can lead to drawing important conclusion for managerial and investment decision making.

The study put the following questions. What are the factors which differentiate the applications of a certain heuristic class? And again, is the dimension of stimulus-based and memory-based (along with explicit and implicit memory usage) neutral towards heuristic class? The latter question leads to critical perspective on the research. The biggest diagnosed weakness concerns unawareness of applying heuristics. Can it be assumed that respondents are aware of how they actually answered given questions? Are they able to analyze given set alternatives of different strategies without being biased? How to design the research to exclude suggestive factor and reveal unconscious decision making processes?

First of all, it is assumes that respondents are aware of how they made decision and are able to consciously answer the question on how their choice was made. To some extent usage of heuristics is unconscious. The necessity to choose one's decision strategy can also implied the fact that respondents would also be more likely to choose the method which appear more complex and advanced to them (cognitive bias emanating from overestimating own decision complexity). Secondly, the paper assumes that sample (composed of students) will represent the population well which indicated that decision processes of this group are reflected by the whole population. Another limitation is caused by the fact that after answering the first multiple question in which different decision strategies are presented, the respondents will try to adjust next decisions to one

of given strategies. Further, respondents might know the answer to the geography related questions which can exclude significant part of the sample. Further, the survey does not analyze social intelligence as the separate decision strategy (social intelligence is included in recognition heuristics). This limitation was introduced in order to compare different types of choices (on geography – television show type of questions and on investment – questions with higher involvement). Regarding the questions on geography, social intelligence heuristics are not applicable. The survey was conducted with awareness of the above limitations.

Although hypothesis was not confirmed by the study, it also provides an interesting insight which can be a subject of further studies in specific areas.

Consumer choice

Insight 1: Grocery shopping based on the list compared in-store decision taking does not affect application of heuristics.

Knowing that stimulus-based and memory-based choices are based on the similar heuristic frequency indicates that in-store shopping decision and decision taken out of store are based on similar heuristics. This insight is especially valuable for FMCG and other consumer goods companies which aim to influence shoppers' choices. It does not condition that in-store decisions are taken without impact of stimuli (e.g. impulsive products), however based on available cues consumers' decision processing is conducted similarity to situation when stimuli are not present.

Investment

Insight 2: Decisions concerning investment tend to be more dependent on recognition and social intelligence rather than simple, low-involvement choices.

Insight 3: Investment decisions based on direct stimuli are ruled by the same heuristics as decision based on memory.

Similarly to consumer choices, investment decisions based on stimuli are subordinated to the same heuristic as memory-based choices. It can bring the interesting contribution for trading securities as well as financial product marketing. Another insight suggests that high-involvement choices, in this case – specifically investment decision – are highly affected by social intelligence which also brings value for banking and trading.

Further Research

This study analyzed impact of decision conditions (memory-based versus stimulus-based) as well as involvement level on the heuristics applied to take a decision. The question concerning other factors influencing chosen heuristics remains open. The following issues could be subject of future research. How are heuristics applied to programmed and non-programmed decisions? How human personality influences application of different heuristic classes? And regarding management specifically - how corporate level of decision (operation, tactical, strategic) and decision style of managers (guardian, motivator, flexible, catalyst, visionary) impacts classes of used heuristics?

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APPENDICES

Appendix 1 – Survey Published Online

Each of cells represents separate screen

Demographics.

Please note that all your inputs remain anonymous.

How old are you? *
Please insert the number (e.g. 25).

What is your gender? *
Please choose.

- Female
- Male

What is your nationality? *
Please insert text (e.g. Portuguese, Polish).

Question 1

1/8

What is the largest city in Europe (in terms of population)? *
Please give your best guess. Do not check the answer.

Question 2

2/8

How have you decided? *
(regarding the last question on the largest city in Europe)

- I thought of one decisive factor (e.g. it has to be a big financial center OR it has to be a famous tourist destination).
- It simply came to my mind the fastest (I know quite a lot about this city; I traveled there often etc.)
- I came up with more than one criterion and compared their importance on the spot (e.g. financial center vs. famous tourist destination vs. capital city etc.).
- I knew the answer beforehand (I was 100% sure).

Question 3

3/8

Which of the following cities do you consider to be the largest city in Asia (in terms of population)? *
Please give your best guest. Do not check the answer.

- Seul
- Karachi
- Tokyo
- Jakarta
- Beijing
- Mumbai
- Shanghai

Question 4

4/8

How have you decided? *
(regarding the last question on the largest city in Asia)

- I thought of one decisive factor (e.g. it has to be a big financial center OR it has to be a famous tourist destination).
- It simply came to my mind the fastest (I know quite a lot about this city; I traveled there often etc.)
- I came up with more than one criterion and compared their importance on the spot (e.g. financial center vs. famous tourist destination vs. capital city etc.).
- I knew the answer beforehand (I was 100% sure).

Question 5

5/8

5. Imagine that you possess significant savings. You do not want to consume it. How would you invest it? *
Please give the short one-line desciption or simply the name of financial instrument.

Question 6

6/8

How have you decided? *
Please choose the most appropriate answers (decision concerned investing your savings).

- It is the most popular way.
- I think the mechanisms behind it are the clearest to me.
- It has been proven by my friends or family.
- It is the least risky method.
- It is featured by the highest return opportunities.
- It is featuted by "the best return to risk ratio"
- There are some other features which influenced my decision.

Appendix 2 – Sample structure

n = 205

Age

Age	n	Percentage
18	1	0,5%
19	5	2,4%
20	16	7,8%
21	26	12,7%
22	34	16,6%
23	41	20,0%
24	33	16,1%
25	27	13,2%
26	8	3,9%
27	7	3,4%
28	2	1,0%
30	1	0,5%
36	1	0,5%
38	1	0,5%

40	1	0,5%
51	1	0,5%
Mean: 23.34 **Mode: 23** **Median: 23**		

Gender

Gender	n	Percentage
Female	133	64,9%
Male	72	35,1%

Nationality

Nationality	n	Percentage
Polish	88	42,9%
Portuguese	35	17,1%
German	17	8,3%
Italian	13	5,9%
French	12	5,9%
Spanish	7	3,4%
Dutch	3	1,5%
Norwegian	3	1,5%
Belgian	3	1,5%
Austrian	2	1%
Chinese	2	1%
American	2	1%
Danish	2	1%
Lithuanian	2	1%
Singaporean	1	0,5%
Korean	1	0,5%
Colombian	1	0,5%
Bulgarian	1	0,5%
Swiss	1	0,5%
Moldavian	1	0,5%
Mexican	1	0,5%
Slovak	1	0,5%
Swedish	1	0,5%
Czech	1	0,5%
Estonian	1	0,5%
Ukrainian	1	0,5%
Brazilian	1	0,5%
Armenian	1	0,5%
Number of countries represented: 28		

Appendix 3 – Detailed data

Answers	Question 2		Question 4	
	n	Percentage	n	Percentage
It simply came to my mind the fastest (I know quite a lot about this city; I traveled there often etc.)	56	27%	38	19%
I thought of one decisive factor (e.g. it has to be a big financial center OR it has to be a famous tourist destination).	46	22%	59	29%
I came up with more than one criterion and compared their importance on the spot (e.g. financial center vs. famous tourist destination vs. capital city etc.).	73	36%	77	38%
I knew the answer beforehand (I was 100% sure).	30	15%	31	15%

Answers	Question 6		Question 8	
	n	Percentage	n	Percentage
It is the most popular way.	21	10%	28	14%
I think the mechanisms behind it are the clearest to me.	32	16%	30	15%
It has been proven by my friends or family.	18	9%	22	11%
It is the least risky method.	43	21%	41	20%
It is featured by the highest return opportunities.	27	13%	26	13%
It is featured by "the best return to risk ratio"	30	15%	27	13%
There are some other features which influenced my decision.	34	17%	31	15%

Appendix 4 – SPSS Reports

Recognition heuristics – Low/High Involvement Chi Square Test

Involvement * Heuristic Crosstabulation

			Heuristic		
			,0	1,0	Total
Involvement	High	Count	259	151	410
		% within Involvement	63,2%	36,8%	100,0%
	Low	Count	255	94	349
		% within Involvement	73,1%	26,9%	100,0%
Total		Count	514	245	759
		% within Involvement	67,7%	32,3%	100,0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8,444[a]	1	,004		
Continuity Correction[b]	7,998	1	,005		
Likelihood Ratio	8,507	1	,004		
Fisher's Exact Test				,004	,002
N of Valid Cases	759				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 112,65.

b. Computed only for a 2x2 table

Recognition heuristics – Memory or Stimulus-Based Chi Square Test

Basis * Heuristic Crosstabulation

			Heuristic		
			,0	1,0	Total
Basis	Memory	Count	253	127	380
		% within Basis	66,6%	33,4%	100,0%
	Stimulus	Count	261	118	379
		% within Basis	68,9%	31,1%	100,0%
Total		Count	514	245	759

	% within Basis	67,7%	32,3%	100,0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,454[a]	1	,501		
Continuity Correction[b]	,355	1	,551		
Likelihood Ratio	,454	1	,500		
Fisher's Exact Test				,535	,276
N of Valid Cases	759				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 122,34.

b. Computed only for a 2x2 table

One-reason heuristics – Low/High Involvement Chi Square Test

Involvement * Heuristic Crosstabulation

			Heuristic		
			,0	1,0	Total
Involvement	High	Count	273	137	410
		% within Involvement	66,6%	33,4%	100,0%
	Low	Count	244	105	349
		% within Involvement	69,9%	30,1%	100,0%
Total		Count	517	242	759
		% within Involvement	68,1%	31,9%	100,0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,962[a]	1	,327		
Continuity Correction[b]	,815	1	,367		
Likelihood Ratio	,964	1	,326		
Fisher's Exact Test				,349	,183
N of Valid Cases	759				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 111,28.

b. Computed only for a 2x2 table

One-reason heuristics – Memory or Stimulus-Based Chi Square Test

Basis * Heuristic Crosstabulation

			Heuristic		
			,0	1,0	Total
Basis	Memory	Count	264	116	380
		% within Basis	69,5%	30,5%	100,0%
	Stimulus	Count	253	126	379
		% within Basis	66,8%	33,2%	100,0%
Total		Count	517	242	759
		% within Basis	68,1%	31,9%	100,0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,646[a]	1	,422		
Continuity Correction[b]	,527	1	,468		
Likelihood Ratio	,646	1	,422		
Fisher's Exact Test				,437	,234
N of Valid Cases	759				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 120,84.

b. Computed only for a 2x2 table

Trade-off heuristics – Low/High Involvement Chi Square Test

Involvement * Heuristic Crosstabulation

			Heuristic		
			,0	1,0	Total
Involvement	High	Count	288	122	410
		% within Involvement	70,2%	29,8%	100,0%
	Low	Count	199	150	349
		% within Involvement	57,0%	43,0%	100,0%
Total		Count	487	272	759
		% within Involvement	64,2%	35,8%	100,0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	14,337[a]	1	,000		
Continuity Correction[b]	13,768	1	,000		
Likelihood Ratio	14,336	1	,000		
Fisher's Exact Test				,000	,000
N of Valid Cases	759				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 125,07.

b. Computed only for a 2x2 table

Trade-off heuristics – Memory or Stimulus-Based Chi Square Test

Basis * Heuristic Crosstabulation

			Heuristic		
			,0	1,0	Total
Basis	Memory	Count	243	137	380
		% within Basis	63,9%	36,1%	100,0%
	Stimulus	Count	244	135	379
		% within Basis	64,4%	35,6%	100,0%
Total		Count	487	272	759
		% within Basis	64,2%	35,8%	100,0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,015[a]	1	,901		
Continuity Correction[b]	,002	1	,961		
Likelihood Ratio	,015	1	,901		
Fisher's Exact Test				,940	,481
N of Valid Cases	759				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 135,82.

b. Computed only for a 2x2 table