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HEURISTICS IN THE UNTAMED INFORMATION WORLD

The aim of the article is to present and emphasize the role of heuristics with respect to diversified and untamed information environment. It has been assumed that intuitively used information heuristics are helpful to the contemporary users of e-information when it comes to the extraction of information that is essential, most credible and sufficient for the fulfillment of the assigned tasks. The interesting research question to answer is how heuristics help users to make fast assessment of information quality and credibility and how the Internet social mechanisms are used to support this process. In order to verify it the author focuses on the recent research which shows how the web users make use of information and deal with the problems they encounter, what are their aims and the heuristics they use. The analyzed material will be used to indicate new trends to follow in the area of information science.

1.   HEURISTICS - DIFFERENT SCHOOLS OF THOUGHT

"Logic, probability and heuristics are three central ideas in the intellectual history of the mind" (Gigerenzer, 2008, p. 20). Decision making, which is a basic component of human life, is modeled by these three major tools. This article is focused on heuristics only, discussing their several selected contexts present within a broad framework of information science.

In the literature heuristics are listed as general rules of thought or action, mental operations, tactics, behaviors or attitudes that tend to produce useful results in certain problem-solving situations (in reality they often fail to do that). They are also known as rules of thumb (in biology), educated guesses, intuitive judgments or simply *common sense*. Proverbs such as "a bird in the hand is worth two in the bush" are heuristics guiding the conduct of everyday life. Heuristics are often used in the philosophical, psychological, and cognitive science literature to describe or explain methodological techniques or "shortcut" mental operations that help in inferring, decision-making, and problem-solving. Heuristics can be used to solve a variety of decision problems involving choice, categorization, estimation, elimination and other tasks faced by the decision makers. They bring the results that may not

be optimal but are, in some sense, "good enough". People employ heuristics to reduce the effort they spend on the decision-making processes and recognize them as methods employing the principles of effort-reduction and simplification.

Most researchers indicate that heuristics are two-edged - they can reduce mental efforts in decision-making but their use can also lead to systematic biases or errors in judgment. There are two different schools of thought dealing with the heuristic approach; 1) one that believes that heuristics should be avoided, 2) and the other that assumes that heuristics should be used extensively. The first school is dominated by social and cognitive psychologists who conducted extensive studies on heuristics, rules of logic and statistics.

In psychology heuristics became associated with errors and contrasted with logical and statistical rules that were believed to define rational thinking in all situations. Psychologists identified biases or cognitive errors (shortcuts) that block decisions and lead to fallacious conclusions and judgment errors. In traditional understanding the use of heuristics is still considered valuable if there is no rule or alternative available (Gigerenzer & Gaissmaier, 2011; Khan & Rehman, 2013) but relying on heuristics based on intuitive judgment in uncertain circumstances may lead to severe errors.

In the past decade some areas in psychology have undergone dramatic conceptual changes due to the emerging science of heuristics. Many decisions are made with no proof they were based on any rational models, and it is an empirical issue how well cognitive heuristics function in an uncertain world (Gigerenzer & Gaissmaier, 2011).

In the following section the attempt is made to analyze the arguments and examples provided by those who believe that heuristics should be used, and show possible situations in the information world.

2. HEURISTICS – SIMPLIFYING AND SATISFICING PROCEDURES

Heuristics are usually useful in simplifying the information processes. They have specific qualities that are often absent from other solutions. First, they are fast, which means that they can be used in the cases when time constraints would considerably restrict the use of other methods. Second, they are frugal, in the sense that they make use of selected pieces of information; rather than taking all available information into account, they simply ignore some information.

Humans rely on heuristics because information retrieval and computation require time and effort. People reduce their effort with heuristics, but at the cost of accuracy. Gigerenzer & Gaissmaier (2011) indicate two explanations of this tradeoff: 1) Not every decision is important enough to justify spending much time to find the best course of action; here, relying on heuristics can be rational in the sense that the cost of the effort is higher than the gain in accuracy; (2) Cognitive (capacity) limitations prevent us from acting rationally and force us to rely on heuristics, which are considered a source of judgmental errors.

Unlike statistical optimization procedures, heuristics do not attempt to optimize (i.e. try to find the best solutions) but rather satisfice (i.e. find a 'good enough' solution). Calculating the maximum of a function is a form of optimizing; choosing the first option that exceeds an aspiration level is a form of satisficing (Gigerenzer, 2008; Gigerenzer & Gaissmaier, 2011).

3. COGNITIVE HEURISTICS, HEURISTICS IN THE ADAPTIVE TOOLBOX OF HUMANS

Heuristics are efficient cognitive processes, conscious or unconscious, that ignore part of the information (Gigerenzer & Gaismeier, 2011). The systematic study of cognitive heuristics finds its beginnings in the XX century, promoted by biologists - Niko Tinbergen described the rules of thumb animals used for choosing mates, food and nest sites; Gestalt psychologist Karl Dunker described heuristic methods for restructuring and insight. In early psychological contexts, heuristics referred to useful mental shortcuts, approximations, or rules of thumb used for guiding search and making decisions (Gigerenzer, 2008).

There are many types of heuristics, including computational, perceptual, and cognitive ones. Cognitive heuristics are processes that utilize conceptual information and can be further subdivided into methodological and inferential heuristics (Chow, 2011, pp. 53-57). Methodological heuristics occupy philosophers of science who are interested in creative thinking, the logic of discovery, and the construction and improvement of theories in science. Perceived as tools or devices for discovery and problem-solving, methodological heuristics are aids to learning and understanding. In contrast, inferential heuristics do not concern learning or understanding per se, but serve to facilitate judgments, inferences, and decision-making. We "can distinguish inferential heuristics from methodological heuristics by making some generalizations. Inferential heuristics are often epistemically opaque - people often employ these heuristics without knowing that they do so, and without knowing the nature of

these heuristics (that is, absent of a psychologist informing one of such things). Methodological heuristics, on the other hand, are generally epistemically transparent—these methods are more or less easily identified; we often consciously and deliberately employ them; their usefulness is usually known; and, because of this, an individual is able to compare and manipulate them (and all this without a psychologist informing one of such things). Moreover, methodological heuristics are typically cultivated from experience and therefore vary between individuals, whereas inferential heuristics can be to some extent immune to experience and very common among everyone, and some may even be innate" (Chow, 2011, pp. 55).

G. Gigerenzer, H. Brighton (2009) in their concept of "homo heuristicus" suggest the human mind resembles an adaptive toolbox with various heuristics tailored for specific classes of problems. They present ten well-studied heuristics for which there is evidence that they are present in the adaptive toolbox of humans.

Table 1

10 Heuristics That Are Likely to Be Present in the Adaptive Toolbox

Recognition heuristic	If one of two alternatives is recognized, infer that it has the higher value on the criterion.
Fluency heuristic	If both alternatives are recognized but one is recognized faster, infer that it has the higher value on the criterion.
Take the best	To infer which of two alternatives has the higher value: (a) search through cues in order of validity, (b) stop search as soon as a cue discriminates, and (c) choose the alternative this cue favors.
Tallying (unit-weight linear model)	To estimate a criterion, do not estimate weights but simply count the number of positive cues.
Satisficing	Search through alternatives and choose the first one that exceeds your aspiration level.
1∕N; equality heuristic	Allocate resources equally to each of N alternatives.
Default heuristic	If there is a default, do nothing.

Tit-for-tat	Cooperate first and then imitate your partner's last behavior .
Imitate the majority	Consider the majority of people in your peer group and imitate their behavior.
Imitate the successful	Consider the most successful person and imitate his or her behavior.

Based on*: Gigerenzer G. (2008), p.24; G. Gigerenzer, H. Brighton (2009), pp.130-131.

The explanation to the question" How does the mind select heuristics that are reasonable for the task?" is directed by Gigerenzer & Brighton towards three selection principles: memory, feedback and the structure of the environment (social and nonsocial one).

4. "LESS-IS-MORE" EFFECT

The goal of making judgments more accurately by ignoring information is new ("a less-is-more" effect). Its discovery contradicts the most popular model of human cognition in terms of accuracy-effort trade-offs.

The term "less-is-more" does not mean that the less information one uses, the better the performance is. Rather, it refers to the existence of a point at which more information or computation becomes detrimental, irrespective of the costs. Referring to 'less information' Gigerenzer & H. Brighton (2009, p. 111) refer to ignoring cues, weights, and dependencies between cues. The fact that simple heuristic can be more accurate than complex procedures is one of the major discoveries of the last decades (Gigerenzer, 2008). Heuristics achieve this accuracy by successfully exploiting advanced mental abilities and environmental structures. The classical critique of the model "More information is always better" is that in the real world the information retrieval requires time or money, so at some point the costs of further search are no longer justified. This has led to the development of optimization-under-constraints theories in which the search is terminated when the expected costs exceed the benefits (Gigerenzer & Brighton, 2009, p. 110).

Gigerenzer & Gaissmaier (2011) reviewed studies on decisions made by individuals and institutions, including business, medical (health care), and legal decision making, that show that heuristics can often be more accurate than complex "rational" strategies. Their research indicates that (*a*) individuals and organizations often rely on simple heuristics in an adaptive way, and (*b*) ignoring part of the information can lead to more accurate judgments than

weighing and adding all information in some situations. This puts heuristics on a par with statistical methods and emphasizes a new ecological question: in what environment does a given strategy (heuristic or otherwise) succeed?

Although the study of heuristics has been typically considered as purely descriptive, 'less-is-more' effect opens a prescriptive role for heuristics, resulting in two research questions: 1) Description: which heuristics are used in which situations? 2) Prescription: when should people rely on a given heuristic rather than a complex strategy to make more accurate judgments? (Gigerenzer & Gaismeiser, 2011, p. 453).

5. HEURISTICS AS INFORMATION SEARCH TACTICS

In 1979 M. Bates published comprehensive analyses of general information search and idea tactics (heuristics) applicable to a variety of search situations, including online information retrieval. She underlined that tactics (heuristics) may help, but not necessarily; they may be good in one situation and not in another. The aim of her work was to determine the circumstances under which certain tactics are most likely to be useful.

Following her work S. Harter & A. R. Peters (1985) distinguished between strategies and tactics for online information retrieval. Their typology of search heuristics consisted of six main classes: 1. Philosophical attitudes and overall approach; 2. Language of problem description; 3. Record and file structure; 4. Concept formulation and reformulation; 5. Recall and precision; 6. Cost/efficiency. Some of them are very well known and even seem too obvious to be included. Let us consider some examples: stay loose, be flexible, look at a search in more than one way, serendipity is important for effective retrieval, browse, be skeptical of system responses, always question null sets (1); don't assume perfect indexing, use online and printed thesauri to find synonyms and related terms, use both acronym and full terms to obtain maximum retrieval, particularly in databases with no controlled vocabulary (2); keep the number of terms and facets proportional to the amount of texts in the searchable part of the records of the database, know your database – its structure, fields of information, limitations, parsing rules (3); use the smallest number of facets to satisfy the search problem (4); the fewer the concepts, the better, do not overspecify, use Venn diagrams to help conceptualize the facets and search logic, do not become overly committed to the search terms and concepts you think are the best, use methods to generate new ideas (5); truncate, check and evaluate search results, print records in inexpensive formats (6).

This organization of heuristics is useful as a preliminary approach and perhaps not as helpful as it might be to a searcher looking for the correct approach at a given point in an ongoing

search. In 1987 S. Harter published his new proposition of heuristics based on search states (Harter, 1987). Many heuristics were firmly based upon the database systems in use at that moment, and as such are of less use when it comes to the study of full-text searching.

6. HEURISTICS IN THE EVALUATION OF CREDIBILITY

Networked digital media make people face new challenges in finding information that they can trust. In the evaluation of credibility Metzger, Flanagin & Medders (2010) identify five cognitive heuristics employed by the information users: reputation, endorsement, consistency, expectancy violation and persuasive intent. These heuristics are employed by information consumers when they attempt to determine what online sources and information to trust.

The reputation heuristic signals a reliance on the reputation or name recognition of websites or sources of web-based information as a credibility cue, rather than a close inspection of site content or source credentials. Many people trust, for instance, big companies, such as Amazon.com, CNN, because they are well-known to everyone. They often project the company brand name or reputation onto the credibility assessment of that organization website content. "The reputation heuristic is likely psychologically rooted in part on a simpler heuristic principle of favoring recognized alternatives over less familiar options as a strategy for making judgments with minimal cognitive effort" (Metzger & al, 2010, p. 426). In the context of online credibility judgments, when choosing between sources, people are likely to believe that the source the name of which they recognize is more credible compared to unfamiliar sources. The reputation heuristic may also be a subset of the ''authority'' heuristic in the credibility assessment. The reputation of the website or other online source serves as a heuristic credibility cue allowing users to avoid more effortful and systematic processing of the content as they evaluate online information.

"*The endorsement heuristic* suggests that people are inclined to perceive information and sources as credible if others do so also, without much scrutiny of the site content or source itself" Metzger, Flanagin & Medders, 2010, 427) . People automatically tend to trust sites and sources that were either recommended by their friends or come from aggregated testimonials, reviews, or ratings. Trust derived from the friends' recommendation is an endorsement heuristic that is perhaps best underpinned by a common form of heuristic reasoning known as the ''liking/agreement heuristic''. Trust derived from aggregated information sources stems from a presumption that the website is credible if it (or its source) receives a lot of positive feedback (for example ''star ratings'').

The consistency heuristic - Another common strategy for validating information is checking various websites to make sure that the information is consistent. This consistency heuristic can be accomplished by cross-validation – as a strategy for information evaluation. In most information-seeking situations, although requiring more cognitive effort than other heuristic strategies, consistency heuristics function as a relatively quick means of arriving at a credibility judgment in comparison to more laborious methods of determining the identity and credentials of each source, considering issues of its potential bias or agenda, and discovering when the information was updated for the last time. Information found online can be validated both with additional online and offline sources. In situations where information is highly consequential (e.g., a large financial transaction or health situation), individuals state they more often cross-validate for consistency offline. The sources of those offline verifications typically are reported as trusted persons such as family and friends.

The expectancy violation heuristic - Several types of expectancy violations that have implications for credibility were observed in the research of Metzger, Flanagin & Medders (2010). People often rely on the surface characteristics of websites and sources when evaluating their credibility. Sites presentation features, their appearance, layout, and functionality are particularly prevalent form of expectancy violation. Bad grammar and typographical errors ("amateurish" sites) are a quick and easy way to determine the site credibility without a great deal of cognitive effort and scrutiny of message arguments, source qualifications, and other more advanced methods of information evaluation. Information users usually dislike the websites asking for more information than necessary or providing more information than requested. They do not trust sites that give them something they did not ask for or expect to receive, for example, when the website redirects them to another site. Many participants of Metzger, Flanagin & Medders (2010) research showed a tendency to view information as credible if it confirmed their pre-existing beliefs and not credible if it did not. The extent to which people feel the information confirms their own opinions or biases determines their perception of that information credibility. The overarching logic is that people expect credible sources to present information clearly and professionally as a reflection of their creators' expertise and attention to detail.

Persuasive intent heuristic - Internet users in general are negative about the credibility of the websites which present unexpected commercial content and intrusive advertising such as pop-ups or page-redirects, identifying them as a kind of red flag. They perceive it as some type of manipulation, which elicits an immediate defense mechanism that leads people to mistrust information without further scrutiny. This phenomenon is discussed in terms of an

intrusiveness heuristic, whereby unsolicited and unwelcome information negatively affects users' perception of the website content because the annoyance generated by the information is projected to the site or source itself. In extreme examples, the suspicion of commercial intent leads some users to stop using the entire top-level domain of .com websites as a source of credible information.

Numerous findings show that the common strategy employed by Internet information seekers is to minimize cognitive effort and mitigate time pressure through the use of heuristics. It is possible to categorize these five heuristics into two general classes of credibility heuristics: one based on social confirmation and the other rooted in expectancies within context. The idea of social confirmation seems to underpin the reputation, endorsement, and consistency heuristics, which are all focused on the notion that credibility can be established on the basis of others' actions and beliefs. If a certain number of people use some websites or information, recommend it, and agree with it, then the information users assume it is credible. Although this heuristic helps users find valid information in many cases, it is not perfect because it is subject to crowd behavior and may erroneously equate credibility with popularity (Metzger, Flanagin & Medders, 2010, p. 435). The article is concluded with an agenda for future research necassary for better understanding of the role and influence of cognitive heuristics in the credibility evaluation in computer-mediated communication contexts.

7. CONCLUSIONS

In the information science scene heuristics should be considered in a number of contexts, for instance: human cognition, information behaviors - information searching, usability assessment, credibility assessment. It should be kept in mind that, for the majority of Internet users, very important limitation to the information operations (including searching and reading activities) is time. Heuristic methods incorporate the use of already accumulated knowledge (one's own as well as the external one) and known procedural patterns in the formulation and verification of one's own 'intelligent', creative and novel solutions (searching strategies and tactics).

In view of the recent research we can define the information user as a person who typically does not employ optimizing strategies in his/her judgments and decisions. The information user is also a satisficer by nature. He/she uses different methods to reduce the effort associated with his/her tasks. One of these methods are heuristics, ubiquitous in human cognition. Heuristics ignore part of the information, with the goal of helping to take decisions

more quickly, frugally, and/or accurately than more complex methods (Gigerenzer, Gaissmaier, 2011, p. 454).

The creation of the catalog (or set) of information heuristics, that are most useful in still untamed and fast developing information world, is rather difficult. As Gigerenzer &Todd (1999) explain, it is often complicated to sort heuristics into mutually exclusive categories. Many situations elicit multiple heuristics. As heuristic principles can be combined in multiple ways, several varieties of basic heuristics can be identified.

This article is an attempt to show heuristics as a very important factor influencing human activity in the information environment. The discussed research problem topic generates new interesting research areas for information science – not only in the field of information retrieval theory. In particular it changes the approach towards the assessment of the behavior of the information user, whose individual research effort may be redefined and evaluated anew. It also can influence the design of new generation of information retrieval tools optimizing search results with respect to the time, effort and users' environment.

REFERENCES

Bates M. (1979). Information Search Tactics. *Journal of the American Society for Information Science*. 30 (July), pp. 205-214.

Choo S. (2011) *Heuristics, concepts, and cognitive architecture: towards understanding how the mind works*. [online] http://ir.lib.uwo.ca/cgi/viewcontent.cgi?article=1230&context=etd

Gigerenzer G. (2008). Why heuristics work. *Perspectives on Psychological Science* 3(1), pp. 20-29.

Gigerenzer G, Brighton H. (2009). Homo heuristicus: why biased minds make better inferences. *Topics in Cognitive Science*. 1, pp. 107–143.

Gigerenzer G., Gaissmaier W. (2011). Heuristic Decision Making. *The Annual Review of Psychology*. 62, pp. 451–82

Gigerenzer, G., Todd, P.M. (1999). *Simple heuristics that make us smart*. Oxford University Press, New York.

Harter S. P. (1987). Online searching as a problem-solving process.[online]

Harter S.P., Peters A.R. (1985). Heuristics for online information retrieval: a typology and preliminary listing. *Online Review*. 9(5), pp. 407-424.

Khan A., Rehman H. (2013) Heuristics Adoption in Decision Making and Its Implications in Information Profession: An Epistemological Exposition. *Pakistan Library & Information Science Journal*. 44 (3), pp. 21-26.

Metzger, M.J., Flanagin, A.J., Medders, R. (2010). Social and heuristic approaches to credibility evaluation online. *Journal of Communication*. 60 (3), pp. 413--439.

Metzger, M.J., Flanagin, A.J. (2013). Credibility and trust of information in online environments: The use of cognitive heuristics. *Journal of Pragmatics*. 59, pp. 210-220.