

ON REDUCING THE DETRIMENTAL INFORMATION FLOOD IN THE USE OF INTERNET

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Abstract

Among many positive aspects of the development of the Internet in the last decades, one may also find some damaging ones. This paper centers on the information flood, which any user must face whenever she/he approaches the Internet.

The amount of information in the network is hastily increasing and it does not seem to have limits. New studies show that the amount of information in the Internet reaches a value near one zettabyte. Zettabyte is a unit of information equal to 10^{21} bytes. Any searching in Internet is, ever increasing, an immersion in a sea of information that may bring high discomfort to the users, caused, especially, by the inability to process all the data read.

This research analyses the issue of information flood and proposes a solution to be implemented as an interface between users and the Internet. The creation of this new tool takes into account the requirements from the psychological standpoint and the implementation issues from the telecommunication point of view.

The cooperation between psychology and ICT (Information and Computer Technologies) seems crucial to improve the well-being of people in a as technical a society as the current one.

Key words: *information overload, use of Internet, information selection.*

Introduction

The consequences of technological development are rather within the scope of interest of arts than sciences. Some researchers use the term technological determinism, as they aim at emphasizing the power of the influence of modern technique on its users (Bobyryk, 2001). This attitude assumes that determinism has a bilateral character. Technique influences social relations which in turn have, or do not have, an effect on the development of technique. This attitude, when limited to media, is called media determinism. Then there are two opposite attitudes depending on the specific type of interaction between technique and its users, which were labelled techno-optimism and techno-pessimism.

The bilateral, that is positive and negative effects of the media presence in life, found its fullest representation in the famous 'laws of the media' (McLuhan and McLuhan, 1992). The fact that the term is written in inverted commas means that it does not deal with strictly obliging rules but rather with a set of acknowledged and ordered problems, conveyed in a comprehensive way. The positive effects of technological development on man are emphasized by the law of enhancement and retrieval:

-every product created by man amplifies his abilities or speeds up some processes (enhancement);

-thanks to new products a phenomenon considered obsolete becomes essential again

(retrieval)

The negative effects, on the other hand, embrace the law of closure and reversal:

-technological development causes some solutions to become obsolete or even eliminated (obsolescence)

-when a phenomenon reaches its developmental peak, it gets transformed into its opposite, hence commencing the degradation process (reversal).

The list of negative effects accompanying the use of modern technology is long and contains examples of different phenomena. As many researches deal mostly with the presence of Internet in everyday life, most often they write about direct and deferred results of the irrational behaviour of its users. Among them one may find physical effects (lack of sleep, lack of outdoor activities), social effects (limited number of direct contacts), and finally psychological effects, which embrace both pathological phenomena, e.g. Internet addiction, and less serious, but more popular ones, such as complaints concerning difficulties with selecting information.

Let us remark that in order to account for the effects technique has in our everyday life both deep thinking and systematic research, and above all a good theory are required, although naturally that does not imply resignation from works popularizing rational use of the achievements of technology.

The plan of further analysis is based on the acknowledgement of enormous disproportions between the content of Internet sources and the possibility of processing them by the human brain. This Lack of proportion is a source of psychological discomfort and the reason of the diminution of performance efficiency. These damaging results can be controlled and reduced by applying psychological and/or technical solutions. Psychological solutions base on the better access to the information and the improvement of the selection of the information. On the other hand, technical solutions center on the implementation in the network of different tools directed to make easier the searching requests of the end users.

Information Overload as an Example of the Reversal Effect

The information overload problem is easy to pinpoint. Among the authors focusing on definition problems one can find, inter alia, Charles Jonscher. The researcher wrote many years ago: „the term information is used very freely and in numerous contexts: information processing, information overload, confidential information. What do we mean, however, when we mention this being, possessing neither dimensions, nor shape, nor weight, but nevertheless having worth and price?” (1999, p. 57).

According to the most popular definition, information is the basic characteristics of physical, biological and social states and processes carrying meaning, limiting the indefiniteness of the system, influencing its behaviour (Kozielecki, 2009). Arguilla and Ronfeld (2001) present a similar opinion, treating information as the basic characteristics of the physical world. Defining information, it is indispensable to refer to Wiener's attitude, who wrote many years ago that „information is a content taken from the outside world within our process of adjusting to it and adapting our senses to it” (1961, p. 18). In coherence with these assumptions, getting and using information constitutes an example of our adapting to different circumstances of the external environment and active life in that environment.

In every historical epoch information was characterized according to quality and quantity. The combination of content and size is complicated, but today the fact that overload of information deters the evaluation of its content comes to the first plan. In other words, easier access to information is accompanied by more difficult choice, which was called the data availability paradox (Woods, Patterson and Roth, 2002). The constantly growing amount of information can be looked upon from different points of view, historical perspective included. It is estimated that the volume of information produced by human race from the Stone Age until

1999 amounts to approximately 12 exabytes. One exabyte equals 10^{18} bytes. Within the next three years, that is in the period between 2000 and 2002, this number was doubled (Morbitzer, 2007). In 2006 the Internet contained already 200 exabytes, and in 2009 - 500 exabytes. In the period 2010-2013 the figure can be approached of 1 zettabyte (10^{21} bytes) (guard09), (Gantz07). A new information unit for the future is a yottbyte; $yb = 10^{24}$ bytes. Robertson (1998) states, that the introduction of the computer – called sometimes the fourth information revolution – resulted in an increase of data availability of the range of 1025 bytes. It is caused by the easy way of inserting and distributing data into a global network. In modern times every Internet user can be an information provider, and even teenagers are authors of professionally made websites.

In technologically developed countries access to information is common and easy. Information is omnipresent, and above all- excessive, compared to the possibility of processing it. Hence, it is by all means justified to write about overflow or, to avoid this metaphor, overproduction of data (Goban-Klas, 2005). This avalanche of knowledge concerns areas essentials for everybody – health, child development, nutrition. (Cialdini, 1996, p. 246).

While elaborating on the thesis concerning the consequences of discrepancies between the amount of information received and the possibility to process it, it is necessary to emphasize that the problem is universal and characteristic of every epoch. It is a general rule that stimulation exceeds perceptive possibilities. In the 21st century, however, the problem has increased to enormous dimensions- many people, especially those who study or work, are flooded with information. The overwhelming amount of information available makes it difficult to receive, select and elaborate on it. It is also hard to connect it to the resources of knowledge already in one's possession. The characteristics of attention and memory cause that man cannot process the information load. This type of difficulty, however, does not concern all people. It is mainly encountered by people searching for information and interested in it, that is by individuals with cognitive curiosity. The research activity they perform is highly esteemed, it is said that „they [i.e. exploration behaviours] perform a key role in the process of the organism's adaptation to environment changes. Their importance can be only compared to nutrition, with the only difference – that information becomes food” (Pisula, 2003, p. 7). Confrontation with information overload has influence in the sphere of both intellectual and emotional functioning. Its intensity differs depending on man psychological characteristics.

The question about sources of tension in human psyche remains still a crucial one. The answer requires to make reference to the basic mechanisms of behaviour regulation. They include, with no doubt, human needs, treated by many scientists as one of the most powerful drives to take action (Obuchowski, 1995). Among others, example of these needs are need for orientation, a variety of cognitive need, classified as one of the basic needs. The term need for cognition was made popular by R. Petty and J. Cacioppo, while they referred to the terminology suggestion of A. Cohen and his co-workers (Petty, See, 2007). Those scientists define the need for cognition as a permanent feature of personality, which is characterized by inclination to get engaged in cognitive tasks from different spheres requiring much effort. Thus people with a high intensity of cognitive need crave for information; they like analyzing complex situations and enjoy solving problems. They spontaneously get engaged in tasks requiring mental effort and like searching for new information. In a word, they perceive cognitive tasks as a source of positive emotions. On the other hand, people with a low intensity of that feature, rarely think about the environment and the wisdom of their thoughts and opinions, as they need outside encouragement or additional stimuli for that. It can be assumed that people curious of the world can be exposed to deprivation of the need for orientation to a larger degree, as a result of weakening or loss of exploration control. The fact that information exchange is connected to emotions remains not without meaning. Negative entropy, that is ordering information, is accompanied by positive emotions. Whereas disorder, chaos, impossibility to put together too

numerous data causes a state of irritation, anxiety. The syndrome of individual convictions about the inability to cope with overload of information and negative emotions accompanying it are sometimes called information stress and is subject to empirical studies (Ledzińska, 2009).

The Selective Function of the Mind to Minimize Unfavourable Phenomena

Basic research, directed to knowing subjective measures of experience intensity of this contemporary variation of stress, is accompanied by the question whether it is possible to prevent it. Psychologists form several answers, emphasizing the role of shaping opinions and skills. The idea of forming opinions refers to the concept of man as a rational being, who subordinates action- also search for information- to a determined goal. „One of the basic questions of the internet user should be: what am I searching for now and why? „I search therefore I am”, says one of the contemporary telecomputer scientist, making a paraphrase of Rene Descartes’s philosophical statement “Cogito ergo sum” (Leszczuk, 2008). Formulating the aim of action and monitoring the activity directed to its realization proves that behaviour is under control and is classified among the highest competences of man called meta-cognitive. The space of meta-cognition is created, besides the skills already mentioned, by meta-cognitive knowledge, in it the awareness of the brain’s cognitive limitations, the peculiarity of its functioning, and infinite information resources of the Internet. Concrete ways of effective use of the web, meaning fast search for necessary information, can be worked out on the foundations of the above mentioned assumptions and competences. In fact those are effective perceptive and memory strategies, especially selection, basing on the brain’s selectiveness.

Making a choice assumes the existence of selection criteria, meaning rules for rejecting redundant data, not connected with the task performed. They are supplied by knowledge and the system of values, which constitute the basic filter instruments. The mechanism of selection remains the basic, however unsettled issue: where is the selection done, which piece of information is registered and where? There are many interesting hypotheses on that subject, which emphasize the essential role of attention. Attention belongs to the oldest psychological terms, and from the middle of the 20th century, it became a basic category in cognitive psychology. At first it was associated with the field of consciousness, at present it is treated as „the basic mechanism to reduce an excess of information” (Nęcka, 2003, p. 77). It is not the only definition of attention, and the quantity of definitions available, the variety of conceits and research paradigms are a good example illustrating the phenomenon of information flood. Most often five aspects of attention are mentioned: a) field scanning, b) prolonged concentration, c) divisiveness, d) alternation, e) selectiveness (Nęcka, 2007). It is worth devoting some time to selectiveness, which is different ways of understanding the attention filter.

A deeper explanation of selective processes is proposed, inter alia, by Logan (1992), where two types of processing are emphasized: connected to conscious attention and automatic processes. Automatic processes are limited by the capacity of short term memory (abbr. STM), they proceed quickly and parallel to each other, without conscious attention (Caplan, 1991). They are however, stiff to a certain extent, susceptible to modification only to a small degree. On the other hand, conscious processes are flexible, but processing with their participation is much slower. Their most essential limitation implies a narrow range of consciousness of facts registered in a particular moment. Man can register all the stimuli which reach him, which happens in low stimulation conditions, or only some of them. Division of attention – without deteriorating the level of actions performed simultaneously – happens only when automatic processes are concerned (Kolańczyk, 1992; Engle, 2002). Psychologists of cognitive orientation are interested mainly in conscious attention processes.

Selection of information engages not only attention, that is why psychologists describe a wider phenomenon, which is selectiveness of the mind (Hankała, 2001).

It embraces, apart from data coming from the outside world, also that processed during mind activity (imagining, thinking) and stored in our memory. Thus it goes beyond the phase of receiving contents emitted from the outside and it refers to all the stages of processing. There are two ways of putting it, the first, narrow, concerns only perception and is connected with the functioning of attention. It explores the outside world but it happens also to be directed towards the content of the mind, as “the inner eye”. Instead, widely understood selectiveness embraces the remaining psychological processes, such as memory, thinking, deciding, acting. Some scientists underline the particular meaning of memory in processes of selectiveness of the mind (Hankała, 2009). The main role of using individual and social experience is attributed to it. Memory is unique in processes of understanding, initiating and planning actions. It remains indispensable in thinking, supplying the material in the form of data and creating space for performing operations. Researchers concerning its selective function make reference to the concept of constructive memory. Not only does it store information, but also elaborates on it, and finally deforms it.

The selectiveness of memory is the ability to single out a determined subset of information from the whole lot, a process of selective search for data important in a given situation (Hankała, 2001). The attempts to answer the question about the nature and place of this distinctiveness sound interesting. Its substance remains creating differences in context of similarity (Hunt, 2006). In the first place man groups information into units on the principle of similarity, and in the next stage elements standing out of the existing set are chosen. So, as it is, distinctiveness engages two processes: search for similarities and finding distinct features. Many authors, having noticed the spontaneous character of that singling out, say that most probably it begins already in the stage of content reception. Limited cognitive resources cause that the cognitive system must be able to distinguish essential and unimportant contents already „at the entrance” (Eysenck & Keane, 2005). The resignation to code all information one pay attention to is a strong evidence of the adaptive function of memory. Others point to the phase of extracting information as the place of its selection. They make reference to the so called “rule of the specific function of coding”. It informs us that contents stored in memory are reproduced as a result of putting together information included in a memory trace and in a context direction (Tulving, 2007). In this light selectiveness means readiness of the memory system to “react” in a selective way to such a piece of information from the environment which carries a direction to reproduce.

The selective function of the mind is an essential phenomenon, but still not very well known (Rumelhart & McClelland, 1986). Both the contents chosen, as well as the strategies of choice can be analyzed. One of the main problems of the net user is: what should I chose and how can I do it? Distinguishing- being the essence of selectiveness – is a complicated human competence. As most competences it is acquired gradually, according to a determined order. The essence of development change is expressed in the passage from: a) inability to distinguish information, through b) selectiveness done under control (controlled from the outside), to c) selective activity initiated and supervised by the subject. This final one –voluntary and conscious – constitutes one of the indexes of man’s cognitive maturity, a representation of subjective behaviour (Jarymowicz, 2008).

Requirements for Information Selection in the Process of Internet Search

Selection of information from Internet resources has been facilitated for many years by special tools, among them the web search engine by Google Inc., which occupies an outstanding, although not unique place. The concern to make data search more effective means nowadays concentrating around the possibilities of making a more perfect interface, a liaison connecting man and the machine. Man possesses knowledge, individual experience and intelligence. The

Internet has an infinite amount of information, inserted mostly in an anarchic way.

The use of a web search engine has nowadays the form of easy communication; by typing a query you get access to different data. Compatibility of search results with our expectations can be increased by many methods. Here are some chosen examples.

-the simplest method is to specify the area, that is setting the information within a context.

-pointing to the logical category is also possible, a higher level label narrowing the field of further exploration.

-finally, there is the possibility of „man- machine communication”. A user searching for information using a given method (e.g. deduction strategy, that is from general to particular) sends information about the perceptive strategy he prefers. This information can be – by means of feedback – further used by the machine, able to remember the specific work of an individual. One of the possibilities to improve the interface is to personalize the ways of using the Internet. It would require an installation of an additional device for “diagnosing” the dominant way of behaviour of the man sitting at the computer.

This idea relates to one of the most fundamental postulates of contemporary cognitive psychology; in order to establish the properties of human mind not only the peak of human possibilities needs to be determined (that is abilities), but also the preferred way of functioning (that is cognitive styles). The latter refers to our likings, predilections to a definite way of discovering the world, also in the area of data reception. They are mentioned as one of the main dimensions of individual differences. Style is „the dominant way, and at the same time a considerably permanent variation of organizing the course of a cognitive activity or action” (Nosal, 2000, p.471). In other words, style is the characteristic way of processing information on every stage of its processing, from its reception to recalling it and using in practice. The results of the research show that experiencing info-stress is stronger for some cognitive styles whereas weaker for the other ones. It turns out that cognitive control, managed by man, makes stress weaker. It can adopt different shapes, among others: a) a reflexive caution while searching for information, b) structuring it by oneself, c) organizing data according to criteria limiting the volume of the contents, d) perpetuated convictions concerning personal influence on events (Ledzińska, 2009).

Many open problems appear within the described area of analysis, that is: why and to what extent cognitive styles, manifested in contact with printed texts, are reflected in contact with the computer? Actually, this question concerns the universality of styles, or the peculiarity of exploring network resources. It seems that the computer is able to read individual methods of receiving information. It can also modify those methods, thus decreasing the psychological discomfort caused by moving within the information tangle. It cannot however do it with the precision of an expert equipped with a psychometric tool such as a questionnaire or psychological test. The technical solution to this problem is an issue of the future.

If it is not possible at the moment to put into life the postulate of recognizing cognitive styles, the question arises, what kind of useful user data can be acquired and used in the process of streamlining the interface? The following can be considered the basic ones: the peculiarity of the query entered into the web search engine in the period under analysis (this variable can be manipulated by modifying intervals) and frequency of occurrence. It is not a problem to record frequency, as well as to characterize the queries entered. The latter can be classified taking into consideration different criteria:

- substantial: setting into an area (physics, psychology, medicine, etc.),
- logical belonging: specific or abstract idea,
- chronological: most recent data or from the past,
- language: mother tongue or foreign language; colloquial or scientific language,
- formal: the degree of particularization of the query entered.

Custom Search Engines

The so-called Web search engines have been gaining in popularity in the Internet until they are one of the most important services in the global network. There are three most important Web search engines known, which are bing® (bing), yahoo!® (yahoo) and, especially, Google® (google). They are intended to search information in the net composed by servers containing interlinked hypertext documents (text and multimedia) known as World Wide Web as well as servers containing any kind of file that could be transferred by the network by using the File Transfer Protocol. Roughly speaking, World Wide Web and File Transfer Protocol network is the public part of the Internet, where millions of persons daily fulfil milliards of info researches.

The search engines' implementers improved the search technique from the first one based on file title search (Daswani, 2009). Currently, Google bases the searches in the PageRank algorithm, which assigns weights to the pages within the World Wide Web. In order to calculate the weight of given page, the PageRank algorithm considers the graph created by all the pages connected by the hyperlinks (links between pages). Moreover, the algorithm considers votes for some pages; in this way, some pages are considered more important than others and Google may control the Web spam pages that try to achieve higher than deserved weights for their own pages.

On the other hand, other Web search engines use other search algorithms as e.g., TrustRank (Gyongyi, 2004) **algorithm (used in yahoo!), which by analysing a seed of Web pages**, is able to distinguish the reliable and unreliable pages.

The search algorithm results crucial for the good work of the search engine as it is the responsible of giving the results of the search and the order of these results being the key tool in the information selection process in the Web search.

The most important not-solved issue in Web search engines is the process of integration of the users' likings into the search process, i.e., the users define how the information is looked for into the network. The novel tool here presented is a forward step in this direction.

Google Inc. has developed a whole of complex tools to offer to the users the possibility of refine the Google searches. These tools are called Custom Search Engines. By using these tools, the users may limit the number of websites where searching the info, or exclude not desired websites, or include categorization of topics, or aggregate synonyms, etc. To sum up, a custom search engine is a program created by the users that gives some guidelines to google to move closer the search process to the user's likings. After the custom search engine is implemented and saved, any user (the creator or any other authorized by the creator) can make use of this search engine in place of the google classical search engine. The new custom search engine initiates searches within the Internet on the basis of the parameters inserted during the creation of the new engine.

Google facilitates three different methods to implement a custom search engine (Goo_CS). The first one is by using the control panel implemented by google. The control panel is a graphic friendly environment where the customer may quickly and easily create a custom search engine by filling out text boxes (instead of creating files). This method permits few modifications in the search engine. The second method is the implementation of context files and annotations files. The context file specifies how the custom search engine works, whereas the annotations file indicates the range of webpages where the search engine must search. The difficulty lies in the programming of the files but, on the other hand, context and annotations files offer outstretched control on the future searches. The third and last method is the so-called site search, which basically is the same tool as the context and annotations files but, in this case, the tool is not free and a quote of \$100 is required. In return no advertising will appear during the use of the custom search engine. Moreover, some little technical improvements are added to the

site search. Let us remark that, for all the methods, custom search engine may be implemented only by google users, so it is mandatory a login in the google system (free of charge).

The strong limitation of the custom search engine is that the process of refining the engine is not easy. Once the tool has been created, it is tedious and not easy to change it after each search, so, in practice, the feedback is not feasible.

Because of this an interface was implemented, which may be started after each search to provide modifications to the custom search engine in an easy, friendly and technical-unaware way. The interface is the responsible of (1) collecting the information from the user's side after each search, (2) translating this information into the settings to be modified into the custom search engine, (3) opening the context and annotations files of the custom search engine and (4) providing modifications.

Concretely the process of searching and providing feedback to the search engine proceeds as follows:

- the user opens the custom search engine and provides the data for the required search
- Google responses with a list of sites where the information could be placed (as normal Google search)
- the user opens one of the sites and read it
- the user closes the site
- at this point the interface starts and presents in the monitor a very simple questionnaire about the satisfaction of the user, i.e., whether she/he is interested in this information and why
- the user saves the data
- the tool opens the context and annotations files and provides the necessary modifications.

This step is transparent to the user

Figure 1 shows the Graphical User Interface of the tool, which is a simple questionnaire with some entry fields that make its use very easy.

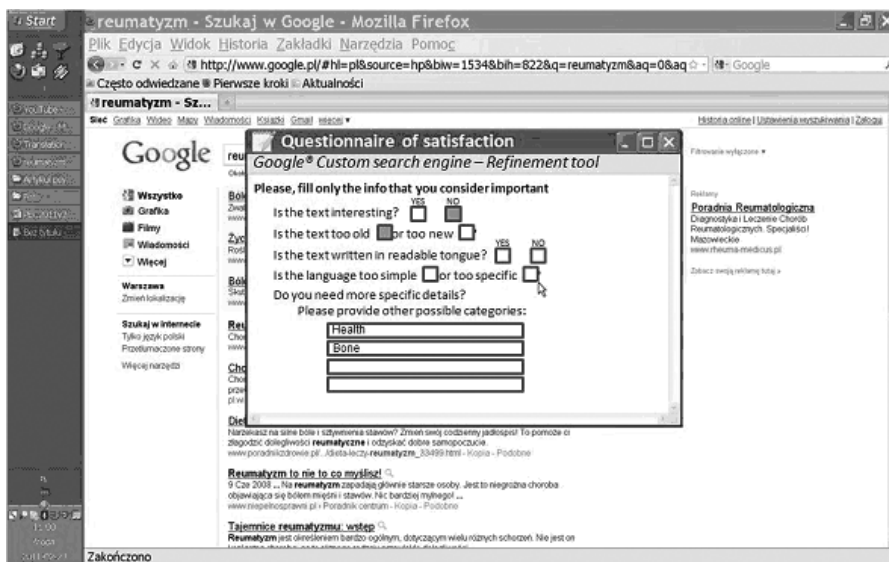


Figure 1: Graphical User Interface of the interface tool.

As explained above, it is mandatory to be logged in Google to modify the custom search engine, so the interface tool immediately provides modifications only when the user previously logged in. In other case, the tool keeps the list of modifications to be provided until

the user will be logged in Google system.

It is not the scope of this paper to show all the boring implementation details of the novel interface tool and these details are reserved for publishing in an specialized ICT journal. However, are presented some details about the mapping between the information provided by the user about satisfaction and the setting parameters to be modified into the context and annotations files.

The table 1 presents the psychological requirements drawn from the precedent chapter, the related question in the questionnaire presented to the user and the modifications that should be provided into the context and annotations files according to the response to the related question. The last column presents the file that must be modified in the custom search engine.

Table 1. Mapping between psychological requirements and technical setting parameters.

Psychological requirements	Questionnaire	Modifications	Modified file
Substantial	Is the text interesting?	No modifications (a new search is required)	---
Logical belonging	Is the language too simple or too specific?	To exclude the site and homepage from the list of searched websites	Annotations file
Chronological	Is the text too old or too new?	To update from oldest to newest (or opposite)	Context file
Language	Is the text written in readable tongue?	To exclude this language from the preferred languages	Context file
Formal	Do you need more specific details?	To aggregate refinements (copy the categories provided by the user)	Context file

As the reader may suppose, the use of this novel interface tool for a single search or for few searches has not much sense, but when the number of searches increases, the tool becomes more useful, especially due to the fact that the most of the searches in the Internet of one person are related with not so many different fields (profession, interests, hobbies). Therefore, after several searches and fulfilled questionnaires, the user may expect to receive from Google search engine more accurate responses shortening the process of information selection and reducing the quantity of text sources that man must read until arriving to the satisfying information.

Conclusions

Along the last years, the search techniques in the Internet did not consider individual necessities of the users and only the global requirements of search process were considered. This way, some important psychological aspects as cognitive styles do not appear in the current Internet search engines. Some technical aspects stood in the way: the search engine is located at the network devices and a solution that considers each user does not scale (scalability is one of the most important characteristics of the current Internet). Moreover, unfortunately, current economic burdens do not follow the track of psychological comfort. But also it should be considered that engineers are not aware about the importance of psychological issues when they develop new tools for the Internet.

Conclusions of the proposed analysis show the high risk of information overload, when any user gains access to the network. Therefore, a new interface tool is proposed and implemented. This tool may decrease the information overload during the process of searching information within the Internet. The new interface tool is located between the custom search engine and the end user and assists on refining the next searches by introducing feedback of user's satisfaction about the current search. The presented interface tool speeds up the process of searching in the Internet by ordering the information on the basis of user's likings.

The constant feedback of user's likings to the custom search engine makes feasible the consideration of cognitive styles in the search process.

In future works, the authors want to improve the interface tool by considering other aspects of cognitive search styles and to study the effects of the use of this interface in a number of network users.

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