W. Karwowski, J. Kantola (eds.)
Science, Technology, Higher Education and Society in the Conceptual Age, Taylor & Francis, London-New York, 2013

48 Information Overload and Human Information Needs

Marek Hetmański

CONTENTS

INTRODUCTION

Finding proper and valuable information and knowledge capable of controlling and managing our activities in everyday life, science, education, entertainment, or the public domain has become the focal point for practitioners (computer and information technology engineers, politicians, publishers, and educators) as well as theorists (cognitive and artificial intelligence scientists, psychologists, anthropologists, and philosophers). In the age of "the information turn," the problem of how to search, retrieve, process, and convey information in order to realize one's own practical interests and cognitive needs and, subsequently, satisfy institutional, sociocultural demands and standards is of particular importance. Immanuel Kant's three questions—"What can I know," "What must I do," and "What may I hope," stated in the century of complete, certain, and true knowledge ideally formulated by Newtonian physics—remain a challenge and demand new answers. Living in the decades of rapid scientific and technological progress—when ideas of complexity, nonlinear and dynamic chaos, as well as epistemological concepts of bounded rationality, unpredictability, and uncertainty, disclaim, or at least weaken, the previously accepted viewpoint—we have to focus our attention on the phenomena through which these questions are manifested.

Kant's last question—considered in the context of unpredictability and limited hopes to gain complete knowledge—does not seem to have an easy answer. Cognitive needs and wants like curiosity, searching for news, or more detailed research including searching for the truth are unquestionable. They are natural for all human beings. Owing to information–communications technologies, which amplify them instrumentally, these needs and wants are increasingly intense. The Internet, World Wide Web, net communicators, information forums, and e-mail discussion groups as well as educational institutions like long-distance education, permanent education, e-learning, or organizations like open universities—they all rely on and, consequently, radically modify human cognitive needs. Having such needs bodily and mentally rooted as well as possessing culturally inherited standards (norms) of such needs (a truth, trustworthiness, reliability, etc.), we find ourselves in a very specific and challenging, though epistemologically obscure, situation. Our cognitive needs are not ours; we tend to know, in fact, what is not needed; we take virtual pictures or simulations as real; being so deeply involved in technology, we seem to have lost our natural way of looking for

really important information (Hetmański 2010). But, first of all, we are constantly forced into coping with *an increase in the volume of information*, and *a decrease in its meaning*, which is actually in line with the prophets of "the digital revolution," found neither among precipitous databases nor in global networked communication. Even in education, which is now almost completely shaped by technology, we feel lost and helpless. Pupils and students follow rules and instructions rather than their natural and spontaneous cognitive needs. Teachers, on the other hand, treat them as "natural born cyborgs" whose main task is just to process information given at the input. Even higher education has undergone similar changes.

EPISTEMOLOGY OF INFORMATION

Information gives humans an opportunity to acquire knowledge. However, this happens neither automatically nor always in the same way. It is only deliberately and selectively recognized signals that are absorbed and subsequently processed in the existing agent's cognitive structures (perceptual schemas, memory structures, intellectual frames as reasoning, conceptual thinking, or imagining) that actually constitute meaningful human knowledge. There are many bodily processes and mental operations on the one hand as well as different sociocultural circumstances on the other hand that determine when and why information becomes knowledge. Technological support, especially sophisticated computerized information technologies, is one of such factors. Nevertheless, they are not so crucial as it has been recently and repeatedly claimed in the theories of artificial intelligence and robotics (Hetmański 2005). Except instrumental information processing that takes place in the technologically advanced environments, real informational phenomena occur in human beings—their bodies, minds, and especially, the ways they interact with the environment being equipped with the instruments and tools. Information as such is a function of all these things and processes.

INFORMATION SEEKING AND INFORMATION NEEDS

The need for information is neither special nor the most important need of human beings. If "need" is an inner motivational state that brings about human thoughts and behaviors, the need for information (information need) is very closely connected with other cognitive mental states like believing, remembering, imagining, doubting, fearing, or expecting. It is an element in the structure of practical–cognitive attitudes that people assume in real-life situations. However, information need is a more complex psychosocial phenomenon than one could expect. As cognitive scientists have demonstrated, cognitive needs have to be separated from merely desires and wants, which, in fact, have no real impact on an agent's informational needs. Suggestive or intensive desire is not the same as a cognitive need; even an intentionally formulated plan or a strategy does not equal a cognitive need. One could want to, for instance, search all library catalogues looking for special data, whereas one's real information need would be just to browse or scan a concrete bulletin or journal. It implies that information needs depend on many objective as well as subjective circumstances. Generally speaking, information needs of an agent must be: (1) *instrumental* in reaching desired goals by using different means, tools, and instruments to accomplish these goals; (2) *necessary* in the sense of being important for the agent's vital (primary or secondary) life's needs, which may actually change one's course of conduct; and (3) *true* (not in the epistemological sense) with respect to the real (objective, not imagined) situations or positions of a person who seeks knowledge. Finally, another important criterion of a need, not a mere desire to be acquainted with more or less imagined or simply wanted things, is the agent's *behavior* in which the information needs are met. "Information seeking is the behavior that is the directly observable evidence of information needs and the only basis upon which to judge both the nature of the need and its satisfaction" (Allen 1996). Behavior such as acts, individual conduct, cooperation schemes, social attitudes, utterances, and so forth in which human needs are expressed as well as the instruments that effectively realize them are proper criteria that

tell us when and why people have cognitive needs. A behavioral approach toward information needs offers an objective way of studying, measuring, and evaluating them. It also offers an opportunity, which is worth mentioning, to avoid false distinctions and misleading conceptions and theories.

There is another important distinction of needs versus *demands* that helps assess properly and justifiably real cognitive needs and avoids telling (suggesting to) people, which is not infrequent, what their "real" or "true" information desires or obligations are. To be more objective and critical, one should talk about the demands that people actually have, demands of which they are not fully aware, rather than rely on their declarations or apparently pseudo-cognitive attitudes. There are three strategies (approaches) one can find in the recent cognitive science literature that supply objective and verifiable methods on how to recognize cognitive needs and demands. The first strategy depends on distinguishing such features (states) of a particular realization of a need as unconscious, conscious, expressed in utterances, and finally, communicated. If the inquirer, after mental deliberations, puts in words or questions a cognitive need after receiving the answers from an information source/system, then he/she declares an actual informational demand; central to the entire process is the ability to communicate one's desires by negotiating questions and answers. The amount as well as the nature (the level of generality or incorrigibility) of the conveyed questions give information about the inquirer's information needs and real-life cognitive demands.

The second method, appealing to Shannon's concept of uncertainty (convergent with the thermodynamic definition of entropy), consists in juxtaposing the levels or states of information and knowledge in order to reach the final satisfactory state. People constantly compare current levels of knowledge against the goals they want to achieve and look for information that could reduce uncertainty involved in such situations. They are confronted with many states of anomalous, incomplete, or ambiguous knowledge and are forced or obliged to cope with them. Uncertainty is very closely connected with the feeling of anxiety, which is a strong and powerful cognitive motive. Conceived objectively (as a statistical measure of the states of information) as well as subjectively (as a experienced mental state), uncertainty in both cases is an originating state of any type of search manifesting in everyday life, mass communication, and entertainment, as well as more formalized research in science and domains of public affairs (systems of law).

If uncertain or incomplete data or the news brings about in the agent's mind a gap in previous or current knowledge, then a need to "make sense" occurs. Making sense, the third approach to information demands, is a type of compulsion experienced by the agent while confronting with the lack (gap) of sufficient information; unanswered, open questions; unsolved problems; and so forth. The search for sense (the search for meaning) constitutes what can be called precisely an information need. This need, however, arises in an individual's mind being at the same time strongly connected with or triggered by real-life situations. The emotional as well as cognitive side of "making sense" eventually shows that human information needs are complex and multilayered cognitive–practical undertakings.

The aforementioned approaches to the information needs and information demands bring to light a variety of strategies in which people reveal their real cognitive demands or wants and, by extension, a variety of research methods found in cognitive psychology. In the spectrum of these methods—from objective to subjective ones—one can recognize and analyze all human cognitive endeavors. As Donald Case (2007) holds:

> "The prototypical search for the Objective point of view is one in which there is a well-defined need to retrieve a specific fact to make a decision or solve a problem. From this perspective, information needs are thought to be relatively fixed. (...) In contrast, the Subjective pole represents the idealized view that many (an perhaps even the majority of) searches for information are prompted by a vague feeling of unease, a sense of having a gap in knowledge, or simply by *anxiety* about a current situation. This view does not deny that purposeful thought leads to information seeking, but rather emphasizes that humans are often driven to 'make sense' of an entire situation, not merely its component 'data', and that rational goals are often overstated. Under such a view, information needs are highly dynamic."

The results of research programs show additionally that people, no matter what the areas of their cognitive interests are or what the nature of processed information is, undertake specific, distinguishable activities that can be called information behavior. "I make a case for use of the term 'information behavior' as better suited to characterizing a broad range of relevant human behaviors dealing with information" (Case 2007). Information behavior is characterized thus by an agent's intentional, conscious, and effective interest in recognizing, processing, and conveying information gathered from the environment that helps to coordinate his/her activity in it.

INCOMPLETE INFORMATION AND UNCERTAIN KNOWLEDGE

Information conceived mainly as an objective, quantitative, and measured characteristic of events also has another, equally important aspect—subjective and qualitative, correlated directly with particular human agent needs and intentional demands, which decide what is information: information for an agent, information in respect to an agent's needs. The scientific perspective as well as the ordinary way of thinking both assume that information is a physical state or a natural commodity that is found in the real world, ready to be taken and easy to use. In short, they remain at the agent's disposal. However, this overall viewpoint obscures to some degree the real nature of information, especially its entanglement in human affairs. Information processing and managing imply vital questions, problems, and dilemmas worth discussing.

The most interesting and, therefore, practically important are the situations where information entails specific limitations and involvement with the particular agent's reactions toward the signals that carry (reveal) information. These reciprocal, objective–subjective interrelationships occurring in human experience are generally called but at the same time equivocally "incomplete" or "improper," "misleading" or "misinterpreted," as well as "overload" or "lacking" information. In fact, all these modifiers mean different things. According to the syntactic and semantic or pragmatic and communicational contexts of information, one can, in fact, distinguish between different meanings of information due to the nature of things (affairs) that generate it. All that happens, as Shannon and Weaver's mathematical theory of communication assumes, at the "source of information"—in the physical places and/or social situations where information is given, dispensed, and conveyed. These states of affairs take on, simply speaking, one of the two alternative statuses—they are or they are not, they occur or do not occur, they are conveyed or not, and so forth. In this sense, information as such exists or does not exist at all. Consequently, it is true or it is not true. The criterion of its existence is the agent's reaction toward it including selective recognition, measurement, processing, utilizing, and evaluating. Most of these processes and activities happen in communication undertakings. This ontological situation involves epistemological consequences in all areas of human knowledge and communication. As Fred Dretske (2008) asserts:

> "As the name suggests, information booths are supposed to dispense information. The ones in airports and train stations are supposed to provide answers to questions about when planes and trains arrive and depart. But not just *any* answers. *True* answers. They are not there to entertain patrons with meaningful sentences on the general topic of trains, planes, and time. Meaning is fine. You can't have truth without it. False statements, though, are as meaningful as true statements. They are not, however, what information booths have the function of providing. Their purpose is to dispense truths, and that is because information, unlike meaning, has to be true. If nothing you are told about the trains is true, you haven't been given information about the trains. At best, you have been given misinformation, and misinformation is not a kind of information anymore than decoy ducks are a kind of duck. If noting you are told is true, you may leave an information booth with a lot of false beliefs, but you won't leave with knowledge. You won't leave with knowledge because you haven't been given what you need to know: information."

In other words, humans cannot posses knowledge without previously acquiring proper, nonmisleading information. The mental content of current beliefs or other mental states that the agent would have has nothing in common with the information occurring at "the source" and, finally,

at "the destination." In other words, only information that is actually demanded with respect to a real agent's cognitive needs constitutes human knowledge and not merely elusive impressions or transient news. Human knowledge emerges in the process of transmitting the signals constituting the messages conveyed in the channels of communication being not at the same time not reduced to that process. In fact, it appears in the receiver's reciprocal relations and responses to the sender's intentions. It is, generally speaking, an emergent product of complex, manifold, and multilayered information processing taking place between people and the world at large. This, however, does not appear automatically while conveying the signals, because information encoded digitally or in an analogue manner is merely a necessary, and not sufficient, element of human knowledge. Informational value of the external signals and signs that humans detect, process, and manage is deeply connected with the informational needs they have.

Really important cognitive situations are those in which human beings recognize, in a way that is not fully proper, albeit satisfactory, specific information that has meaning but is not epistemologically true. Such situations happen to people when they make decisions in a state of uncertainty on the basis of insufficient and incomplete knowledge. It takes place almost in all areas of human endeavors—not only in common everyday activity but also in business, management, and even, paradoxically, in scientific reasoning, estimating, or judging. Learning and education are not—which is worth mentioning and actually has far-reaching consequences—free of such ambiguous situations. Judging, evaluating, and behaving in a state of uncertainty are the subject of multidisciplinary research (psychological, anthropological, social, and political), which renders important and interesting results. This research analyzes different ways and methods people cope with not only the lack of proper and sufficient information but also redundancy and surplus of information as well. The methods used in such situations are strikingly rich and lead to more or less satisfactory results. This all proves that people do not need to posses full and complete knowledge in order to behave effectively and even rationally. Satisfactorily made decisions can be, at the same time, as valid as improper, accordingly to the rules of logical (rational) thinking.

Classic and standard psychosocial experiments done by Daniel Kahneman and Amos Tversky in the 1970s showed that people (laymen as well as scientists!) always rely on heuristics, which are not fully rational (algorithmic) inferences. Heuristics reduce complex cognitive tasks (of assessing possibilities and predicted values of perceived events) to simpler and useful strategies. They do not imply complete knowledge, relaying on opinions, incomplete information, and common sense or even intuition. Heuristics are a type of a biased cognition. Some examples include (1) insensitivity to prior probability of outcomes (due to additional, new information) that are not recognized in the stereotypes obscuring them; (2) insensitivity to predictability when people prefer forecasting in terms of favorableness of the description, ignoring prior, valuable, and sufficient information; and (3) illusion of the validity of the increasing redundancy among the correlated statistical data (which are the example of information overload), which, in fact, decreases accuracy of description and prediction. These heuristics are, as Kahneman and Tversky argue, unavoidable systematic errors that happen to people, especially when they are confronted with complex cognitive situations, mainly with information lack or overload. The researches summarize their Cognitive Illusions Program with the conclusion that people rely on heuristics only because of their inevitable cognitive biases and illusions, which do not allow them to have full access to proper information. That is why more information and computation (if available) is always better for adequate and optimal estimations or predictions of complex situations. One should thus rely on heuristics only in routine decisions of little importance.

Gerd Gigerenzer is one of the cognitive scientists who conduct empirical research programs on how people cope with complex cognitive situations in the absence or overloading of information. However, he summaries his results in a different way than Kahneman and Tversky. People, he asserts, rely on heuristics due to the structure of the problem, not to their cognitive inclinations. In concrete situations, people choose, more or less reasonably, mostly intuitively, appropriable heuristic methods and strategies—"fast and frugal heuristics" that exist in the human mind as an "adaptive toolbox." Besides, relying on heuristics is not an error. It happens even in serious and important

cognitive situations such as scientific research or medical statistical diagnoses. Good decision making or problem solving requires ignoring part of the available information and performing less complex estimations. Human beings have evolved, Gigerenzer (2008) admits, as "natural statisticians" who are rather good at simple, noncomplex tasks. Violations of logical rules are not cognitive illusions, but they are a manifestation of practical, bounded rationality.

> "The adaptive toolbox contains the *building blocks* for *fast and frugal heuristics*. A heuristic is fast if it can solve a problem in little time and frugal if it can solve it with little information. Unlike as-if optimization models, heuristics can find good solutions independent of whether an optimal solution exists. (...) Heuristics work in real-world environments of natural complexity, when an optimal strategy is often unknown or *computationally intractable*" (Gigerenzer 2008).

The main feature of such heuristics is looking for simple and discrete data and information because human beings have been biologically designed to cope with obvious, transparent, nonapparent situations. Even in complex, instrumentally mediated environments (not to mention the very recent networked, computerized systems functioning in the information society), people are still furnished with very simple conceptual tools useful in acquiring and producing even the most complex and sophisticated systems of knowledge. "Good decision making in a partly uncertain world requires ignoring part of the available information and, as a consequence, performing less complex estimations because of the robustness problem" (Gigerenzer 2008). In other words, even if confronted with the complex, obscure practical–cognitive situations, humans act surprisingly effectively relying on their natural faculties coping with uncertainty found in their environments. Neither lack nor surplus of information prevents them from fulfilling their real information needs. It appears, from the evolutionary perspective at least, that people are relatively well equipped with natural tools to manage such situations. However, they are frequently confronted with new intellectual situations. Looking at this from the civilization perspective, one can admit, nevertheless, that functioning in the technological environments, especially when people are confronted with the overload of signals, signs, the news, pictures, as well as models or simulations (simulacra), brings about new practical problems and epistemic dilemmas.

INFORMATION OVERLOAD

What, in fact, is "overload of information," as it is commonly and misleadingly used (and misused)? It is not a single phenomenon that could happen everywhere and anytime in the same way. Nevertheless, components of information technology, that is, hardware, software, networked systems, and so forth, are standardized and work (until they fail, which happens quite frequently) following an algorithm pattern. People use them differently for different purposes and in accordance with their computer literacy skills. As these skills differ significantly depending on age, training, gender, cultural standards, and so forth, computerized tools and systems do not guarantee the one and only effective means of access to information. It is one of the reasons for the occurrence of excess of information, and this is why people feel overwhelmed, if not threatened, with it. Interestingly enough, information overload not only is brought about through automatically incoming information, which is not welcome by users, but also, is caused by a lack of proper skills to manage the information systems. In short, this type of overload is due, not by accident, to the agents' inability to utilize the possibilities that modern technology offers and not to information technologies as such. As a matter of fact, this subjective factor is connected with the objective one—the automatic, exponential growth of digitally coded bytes; both are responsible for problems and dilemmas resulting from the phenomenon under analysis.

Information overload should be analyzed in three aspects: (1) its *reasons*, subjective as well as objective causes; (2) *mechanisms* that generate and govern it; and (3) immediate and direct *results* as well as secondary and indirect *consequences* caused by it. They, all together, enable us to explain the essence of the phenomenon in question.

Different factors cause certain agents (or systems) to struggle with the surplus of information. When signals and signs coming from many sources are not properly processed and managed (e.g., lack of ineffectiveness, inherent difficulty, low speed, high costs, etc.) by an agent and where information is redundant, the effect of overload appears. Overload is then a quantitative phenomenon. A similar situation occurs where signals do not match the information acquired or where prior expectations of the agent are not met. Consequently, problems with absorbing information come to the surface. However, results of information overload may *differ very much* because information absorbing, processing, or managing does not lead to the same consequences. There may be results of such information conceived as negative or positive, which is due to the role it plays in the structure of knowledge. If the general structure of knowledge—the sensual and conceptual schemas and frames, memory, imagination, and linguistic skills, which the agent is supplied with—is rich and functionally effective, then it is unlikely for information overload, considered at least from the subjective perspective, to happen. Nevertheless, any dysfunctional disturbance of this structure could disrupt smooth and easy absorption of information. Besides, the phenomenon in question largely depends on the place (library, school, company, service agency, communications operator, etc.) where transformation of information into valuable knowledge takes place.

It follows that one can distinguish a few different possible reactions and responses to overload, as defined above, namely, *omission*, *error*, and *escape*, which are, in fact, dysfunctional (they consist in failing to process some of the incoming and input information, including giving it up entirely). Others include *queuing*, *filtering*, and *approximating*, which are, this time, maladaptive. They consist in delaying (suspending) the inputs with the intention of catching incoming information later, processing information selectively, or lowering the criteria and standards of absorbed and processed signals and the news. The latter responses and attitudes are the errors that people make not as deliberately as they do in the former cases, where they less consciously but, nevertheless, still dysfunctionally (without any chance to succeed) try to cope with this difficulty.

Generally speaking, information overload does not always evoke the same subjective feelings in the agent. It may happen that he/she experiences, in such cases, not only anxiety (according to Abraham Maslow's statement that "we can seek knowledge in order to reduce anxiety and we can also *avoid* knowing in order to reduce anxiety") but also other, more positive and constructive mental states and feelings. As Case (2007) aptly puts it: "We often think of information as *reducing* anxiety, but such is not always the case." People do not always experience the mentioned effects negatively because they very often adapt in a smart way to having too much information and then take a more positive stance toward it. Living among a myriad of signals, images, the news, and other information that bombards people for a long time and with the same intensity makes them (especially the young) immune to them, changing the way they experience the world.

As psychological experiments, comparative cross-cultural studies, and theoretical analyses show, adequate and reasonable qualitative estimation of the situations in which people feel cognitive and intellectual discomfort, called "information overload," is relatively difficult. Apart from the technological circumstances, at the core of things lie an agent's attitudes and skills as well as his/her networks of connection with many types of informational environments (conceived as a cybernetic model of interrelations between inputs and outputs). In substance, only then can external circumstances codetermined with subjective factors constitute human cognition, learning, knowing, and communicating overload.

CONVERGENCE BETWEEN INFORMATION AND MINDS: TWO STUDIES—MANUEL CASTELLS AND JEROME BRUNER

Education is the place where the above-mentioned processes occur and undergo different and not-always-welcome changes. Considered functionally and not structurally (as a process and not a state), education is a distinctive phenomenon in which emergence of acquired knowledge accomplished

throughout different types of information processing (perceiving, understanding, memorizing, imagining, speaking, etc.) includes all the human cognitive abilities and activities (training, learning, educating, specializing, etc.) and their objectified and externalized results (knowledge-how, knowledge-that, inference, language, formal knowledge, science, etc.). During the course of long-term education, humans are still confronted with many obstacles and challenges worth considering, apart from other interpretations, epistemologically. In order to be precise and concise, one can say that the education taking place on the all levels (elementary, secondary, higher, etc.) entangles its subjects and agents into long-lasting, multiple, repeated, and never-ending informational processes. Educational institutions like schools and universities provide a proper environment and material equipment, especially and lately, technological peripherals—ubiquitous computers that have dramatically changed our lives.

There is a widespread viewpoint, established by multimedia companies as well as psychologists, educators, and futurologists, that for the last two or three decades, we have been living in the age of *hypertext*. This effective and pervasive techno-cultural phenomenon—the complex text consisting of a combination of such elements like pictures, words, pictographs, sounds, and so forth—gives us unimaginable possibilities of experience, cognition, and knowledge. Hypertext and hypermedia are more and more perceived as an ideal model (symbol) of the essence of our civilization.

> "[T]he post-war challenge of managing information overload, a model of a mind as a web of trails and associations, and a concept of non-linear writing then extended to a freely accessible 'grand library' all of kinds of media, finally led us to the concept of hypermedia. This vision of the potential of the hypertext opens out to encompass an emancipatory configuration of human knowledge based in accessibility and manipulation through associative links" (Lister et al. 2003).

Not all practitioners and theorists of education concur with general image of modern civilization. Manuel Castells, a distinguished Internet researcher, doubts such an idea. It is too primitive a vision of culture and technology telling that the latter simply determines the former. A mutual convergence between human cognitive processes or ideas and information/communication technologies occurs in a much more complex and, thus, ambiguous way than the oversimplified viewpoint suggests.

> "Our minds—not our machines—process culture, on the basis of our existence. (...) Therefore, if our minds have the material capability to access the whole realm of cultural expressions—select them, recombine them—we do have a hypertext; the hypertext is inside us. Or, rather, it is our inner ability to recombine and make sense inside our minds of all the components of the hypertext that are distributed in many different realms of cultural expression" (Castells 2001).

Technology has consequences not only in the communication infrastructure but, more fundamentally, in the way people perceive, memorize, conceive, and imagine the world. This is why the main effects of information technologies happen in human minds, especially when people interchange the meanings of their experience in their social environments.

As Castells (2001) writes:

> "Our minds are not single, isolated worlds; they are wired to their social environment, so we process signals, and we look for meaning, according to what we perceive through the experience of everyday life. But in a social structure—the network society that induces structural individualism, and increasingly distinct social experiences, some of this shared meaning through practice is lost, so that areas of cognitive dissonance may grow proportionally to the extent of self-construction of meaning. The more we select our personal hypertext, under the conditions of the networked social structure and individualized cultural expressions, the greater the obstacles to finding a common language, thus common meaning."

In other words, relying only on subjective and individual impressions, no one could effectively process information even if technology would seem to supply him/her with unlimited possibilities.

Pure technological processing and managing of data, taking place without understanding, will confront people sooner or later with information overload.

To participate in the cultural hypertexts, as the author of *The Internet Galaxy* suggests, people must go up over individual experiences and images to the level of commonly shared and interchangeable universal meanings. It happens thanks to the mass communication based on, Castells (2001) says, the "existence of protocols of meaning." Culture and science very much help to achieve such goals, but learning and education contribute the most. But it is a pure possibility of the ideal—fruitful and effective communication based on the perfect commitment. There is also an alternative negative scenario—increasing misunderstanding and disagreement leading finally to the total social dispersion. "Lack of common meaning could open the way for widespread alienation among humans—everybody speaking a different language, built around his/her personalized hypertexts" (Castells 2001). But he does not believe such a course of happenings and makes a critical warning as regards the convergence between technology of information and human knowledge.

The same school of thought is presented by Jerome Bruner in his remarks on the "culture of education," which is determined, as he admits, more and more by the information technologies. His viewpoint reveals similarities with Castells' opinions about the consequences of improper use of technology in education. Relying too much on the technology may fail if we will not use previous, traditional "instruments" of education and learning like oral speech and writing, both going on in direct personal connections. Bruner confronts two models of education and, therefore, theories of the human mind—culturalism and computationalism. Both of them tend to explain how technology helps as well as disturbs us in acquiring information and building new knowledge. Bruner's sympathy is for culturalism because he doubts how people could develop properly their intellectual faculties relying only on the computerized technologies that supply them with enormously extended amounts of information but do not give the tools to recognize where the meaning is (if any) among the information.

> "Like its computational cousin, culturalism seeks to bring together insights from psychology, anthropology, linguistics, and human sciences generally, in order to reformulate a model of mind. But the two do so for radically different purposes. Computationalism, to its great credit, is interested in any and all ways in which information is organized and used information in a well-formed and finite sense mentioned earlier, regardless of the guise in which information processing is realized. (...) Culturalism, on the other hand, concentrates exclusively on how human beings in cultural communities create and transform meanings" (Bruner 1996).

Education is a matter of long-term mutual interchanges of meaningful information taking place in institutions and between agents who have proper methods and procedures and, subsequently, agents who are open to be shaped and changed. The vital role in this process is played by the instruments, including technological ones. "How well the student does in mastering and using skills, knowledge, and ways of thinking will depend on how favoring or enabling a cultural 'toolkit' the teacher provides for the learner. Indeed, the culture's symbolic toolkit actualizes the learner's very capacities" (Bruner 1996).

REFERENCES

Allen, Bryce 1996. *Information Tasks: Toward a User-Centered Approach to Information Systems*. New York: Academic Press.

Bruner, Jerome 1996. *The Culture of Education*. Cambridge, Mass: Harvard University Press.

Case, Donald 2007. *Looking for Information. A Survey of Research on Information Seeking, Needs, and Behavior*. Amsterdam: Academic Publications.

Castells, Manuel 2001. *The Internet Galaxy. Reflections on the Internet, Business, and Society*. Oxford: Oxford University Press.

Dretske, Fred 2008. Epistemology and information. In: P. Adriaans, J. van Benthem (eds.), *Philosophy of Information*. Amsterdam: Elsevier, pp. 29–47.

Gigerenzer, Gerd 2008. *Rationality for Mortals. How People Cope with Uncertainty*. Oxford: Oxford University Press.

Hetmański, Marek 2005. Artificial intelligence: The myth of the information science. In: M. Żydowo (ed.), *Ethical Problems in the Rapid Advancement of Science*. Warsaw: Polish Academy of Sciences, pp. 46–58.

Hetmański, Marek 2010. Technologized epistemology. In: M. Miłkowski, K. Talmont-Kamiński (eds.), *Beyond Description: Normativity in Naturalized Philosophy*. London: College Publications, pp. 112–132.

Lister, Martin et al. 2003. *New Media: A Critical Introduction*. London: Routledge.