

COMPUTATION: DETERMINANTS AND NATURE OF THE SECOND STAGE OF HUMAN COGNITIVE PROCESSES

DURKO, Martin, SR

Abstract: The article provides a detailed description of the second stage of cognitive processes “Computation” which is an integral part of the Theory of social communication (TSC) published earlier by the author. It is the stage which limits our ability to collect, decode, and compute data from environments (natural, social and virtual reality), and incorporate them into their existing individual or combined representations. The majority of these processes are automatic and involuntary but they are complemented by the uniquely developed function of the human brain “cognitive decoupling” which allows us to think in an abstract manner and execute operations of so called reflective thinking as understood and applied in the dual system theories of human mind. The TSC aims to explain (1) the nature and causal relationships between three basic stages of human cognitive processes, (2) personal identity with its individual and collectively shared elements, and (3) people’s communication behaviour influenced mainly by two key variables – empathy and the change in personal or group utility.

Key words: computation, cognitive decoupling, cognitive skills, intuition, judgement, education

1 Introduction

This paper provides further theoretical analysis of determinants and nature of three human cognitive processes and their relation to people’s communication behaviour. Specifically, I will describe and analyse the second stage of these cognitive processes – Computation – which limits our ability to collect, decode, and compute data from environments (natural, social, and virtual reality), and incorporate them into their existing individual or combined representations. The proposed theory of social communication aims to explain researched phenomena in the domain of media manipulation which is the key topic of my PhD research. It is important to state here that the broad and ambiguous term “media” does not apply only to so called “mass, social or digital media” whose definition might be derived from the definition of “mass communication”. D. McQuail describes it as “*all types and processes of communication that are extensive, public and technically mediated*” [1], but the meaning is rather understood in its traditional sense as “*means by which something is communicated or expressed*” [2]. In the context of my work it is equivalent to the meaning of “sign” in Semiotics. In the following pages, I will try to outline the determinants and nature, and existing limitations of human computational abilities of any data available to us through senses or recorded, coded, stored, computed, transferred, or decoded by technologies and displayed through an optimal interface.

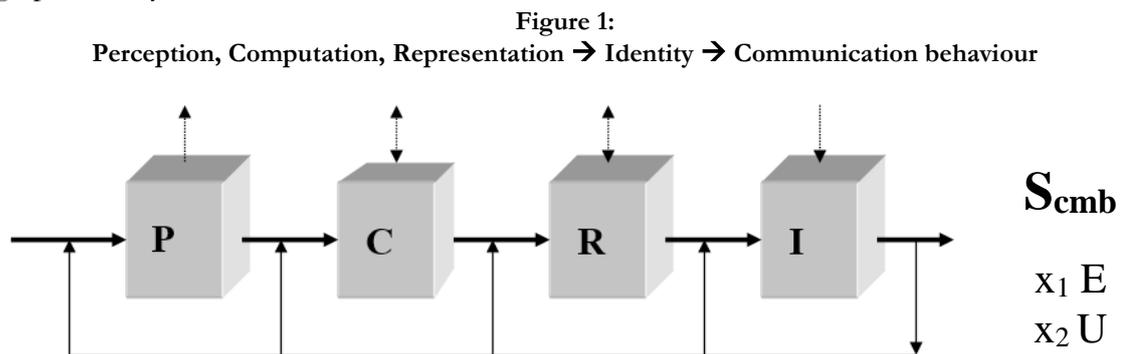
2 The natural limits of the second stage of cognitive processes - Computation

Before I can continue with further analysis of the computational stage, I should explain the basic assumptions and relationships in the proposed theory. The first stage of cognitive

¹McQUAIL, D. *Mass media communication theory*. 6th edition. London: SAGE Publications, Inc., 2010, p. 5. ISBN 978-1-84920-292-3

²OXFORD Dictionary. *Medium*. (online). Available: <http://www.oxforddictionaries.com/definition/english/medium>. [Accessed on: June, 28, 2016].

processes “pS – perception of a subject” includes our direct and indirect experience and I have described it in other conference contributions in greater detail. The second stage “cS – computation” represents processes which record, store, compare/combine, analyse, modify, and adjust all our sensory inputs from these experiences. The key relationships are expressed in the following formula: $pS + cS = \Delta rS \rightarrow Si \rightarrow \Delta S_{cmb}$. The “S” stands for a subject and the first two stages of cognitive processes (perception and computation) determine the dependent variable: representational stage of the world (Reality: natural, social and virtual) which further serves as a basis for creating a permanently modified and updated concept of the subject’s individual identity. This identity guides his/her communication behaviour [3]. The following scheme shows these relationships also in a graphical way.



Source: Ďurko, M. Stoffová, V. – Perception: determinants and nature of direct and indirect experience [4]

Socialization and educational processes aim to develop computational abilities, desired skills, and competencies, all of which provide an individual with the appropriate toolkit for the experiences she/he encounters in the combination of natural, social, and virtual reality. No one has the option of choosing the crucial variables affecting our identity which stem from the experience (direct/ indirect “pS”) and body’s ability to process it (“cS”). There are obvious limitations placed on us by the genetic code and its actual material expression as well as the environments in which the central and peripheral nervous system are developed, but many people do not question this artificial concept of one’s conscious self revolving around cultural artefacts, ideas, colours, symbols, etc. All of these are a few out of many variables forming the illusory self of any individual. Research in neuroscience and cognitive psychology confirms that the majority of human cognitive processes are executed below the threshold of our conscious experience which lags behind the reality; ‘reality’ cannot be considered as an accurate interpretation due to the many natural constraints of the sensory data input and the brain [5]. Most of the data entering the human cognitive system cannot be realized at the level of our consciousness which, through the dynamic and permanently updated image of self, can be seen as “a user interface layer” over the reality of electromagnetic waves. Some computational processes, e.g. additional calculations of visual fields and overlearned rules/algorithms in our neuronal network predetermined by previous experiences, can be pre-computed by the brain without our ability to interfere

³ ĎURKO, M. *Theory of social communication*, Proc. of MMK 2014 (International Masaryk Conference for PhD students and young researchers), Magnanimitas, Hradec Králové: 2014, p. 2109-2111. ISBN 978-80-87952-07-8

⁴ ĎURKO, M., STOFFOVÁ, V. *Perception: determinants and nature of direct and indirect experience*. International Scientific Conference: Megatrends and Media, SVK. presented on 19th of April, 2016.

⁵ DEHAENE, S. *Consciousness and the brain*. New York: VIKING Penguin Group. p. 115-128. 2014. ISBN 978-0-698-15140-6

with them, modify them or even realize them. In general, the older the brain, the less flexible and changeable it becomes which is often reflected in a more conservative approach to life and a greater resistance to change. These processes vary with every individual and they are experienced in ordinary human interactions as more or less selective features of our perception - inability to see, hear or reflect on the actual state of reality expressed in codes (concepts, theories captured in languages and symbols) by other people.

It is also important to state that the cognitive processes mentioned above include all the processes which are involved in the complex relationship of a living organism and the specific environment affecting its well-being. In my work and understanding, they do not represent only rational, conscious or so called higher-order cognitive skills of the reflective mind which has the capability of generating cognitively decoupled versions of reality in which one's self originates and operates. The computational operations of the reflective mind are serial, energy and time intensive and the automatic and pre-conditioned reactions (from the level of the intuitive mind) are set as default. Due to a conflict between cognitive ease and strain experienced in the mental state described as cognitive dissonance, these automatic reactions are naturally preferred by most people [6]. The familiar becomes true and the least conflicting mental state becomes the most desirable. It is no surprise that these evolutionarily pre-conditioned mechanisms and nature of the human mind are actively exploited by communication behaviour of other individuals or groups in areas such as advertising, social design, politics, etc. In the former one, it has become a norm that sex, violence and taboos are actively exploited so the consumer society can flourish [7]. The argument about the value of our intuition, many times ascribed to a supernatural anthropomorphized source, was settled three decades ago by H. Simon who said that "*Intuition is nothing more and nothing less than recognition*" [8]. Mutual research of G. Klein and D. Kahneman provides us with two simple conditions which are necessary for development of a valid intuitive judgement although the latter author conducted his own extensive research on quite a frequent phenomenon called "illusion of validity". They concluded their research of intuitive judgements with "*two basic conditions for acquiring a skill: 1) an environment that is sufficiently regular to be predictable 2) an opportunity to learn these regularities through prolonged practice*" [9].

We can clearly see that these two conditions are at the centre of epistemology and scientific progress. The key feature of human cognition is the observation of the world, giving names to objects and their categories, creating new abstract concepts, organizing them into theories and finally testing them against the observed reality. All these procedures are in place also in the lives of ordinary people although they might be less rigorous and realized. If the role of an educational system is to extend individual knowledge then, first of all, we need to create an environment which provides the access to appropriate sources of direct and indirect empirical knowledge. Secondly, we need to develop computational skills which allow an individual to process collected data, decode the data, and represent the data at the conscious level in a valid and coherent

⁶ KAHNEMAN, D. *Thinking, Fast and Slow*. New York: Farrar, Straus and Giroux. Kindle location 950 – 1127. eISBN 9781429969352

⁷ KOSZEMBAR-WIKLIK, M. *Controversial themes in advertisement: On manipulating the emotions of audiences and extending the boundaries of the social 'taboo'*. In *Communication Today*, 2016, Vol. 7, No. 1, s. 18-30.

⁸ SIMON, H. *What is an "Explanation of Behavior"?* In: *Psychological Science*, VOL. 3, NO. 3, MAY 1992. p. 155. (online). Available: http://groenland.medien.uni-weimar.de/cognitive_systems/readings/files/simon_1992.pdf. [Accessed on: June, 28, 2016].

⁹ KAHNEMAN, D. *Thinking, Fast and Slow*. New York: Farrar, Straus and Giroux. Kindle location 4003. 2011. eISBN 9781429969352

representation of the reality. His/ her identity will be derived from this representation and consequent communication behaviour needs to be constrained by at least the minimum of human empathy which helps us to create a just society.

3 Computation/ Cognitive skills and development of cognitive decoupling

I think that besides the variables we cannot change or modify, such as the limits of key environments (family, society, culture), the nature of our cognitive system determined by genes and the biochemistry of the body-brain relationship, there are certain still underdeveloped areas in education which demand our attention. I addressed these issues earlier in my analysis of the key concepts of future education where I concluded that instead of the recent focus on the development of critical thinking or media literacy as the new reincarnation of these old and confusing concepts, we need to teach and develop students' cognitive skills of which thinking at the abstract level (cognitively decoupled reality) is the most important one [10]. I provided examples from around the world which show that the implementation of critical thinking concepts, not to mention the actual critical thinking abilities of graduates, are confusing and insufficient. A good example is the product of TwentyEighty (formerly IPS learning and ESI International) which offers a course on Critical Thinking and Problem Solving. This course "*addresses the five types of critical thinking needed in business environments: strategic thinking, tactical thinking, analytical thinking, innovative thinking and implicative thinking.*" [11]. It is my contention, however, that all these forms of thinking are not types of critical thinking but that critical thinking itself is just a single and equal member of the broader category called "thinking". This category is simply a subcategory of human cognition, although, as I said earlier, the most important one.

It is undeniable that we all use the same biological structures, cognitive skills, and reasoning procedures in every domain of our lives and therefore I would suggest that the education of the 21st century should include an independently designed and taught subject developing these skills and procedures. I argue that a specialized class can provide us with better desired outcomes than the actual state of affairs in which all these skills are developed more or less haphazardly in other classes. Moreover, the ability to think independently and without a strong need to follow the authority is suppressed by the quantity of materials students must memorize for passing exams - still the most common method for manifesting acquired knowledge. I do not think that we should eliminate testing completely, but what I will say is that we need to create a curriculum which will be focused on development of cognitive decoupling abilities and crucial experience with dealing and avoiding known irrational heuristic thinking procedures as well as the natural biases of the human mind. Many of them have been studied, analysed and addressed by scholars around the world for over 50 years. The first work of D. Kahneman, Slovic, and A. Tversky titled "Judgment under Uncertainty: Heuristics and Biases" was updated into a comprehensive book "Heuristics and Biases: The Psychology of Intuitive Judgment". The book was edited by T. Gilovich, D. Griffin., and D. Kahneman who received and coedited contributions from scholars from more than 70 universities. These findings and knowledge could serve, together with very well-known forms of false reasoning (logical fallacies), concepts of cognitive dissonance, fundamental attribution error, etc., as a foundation for new teaching materials. I realize that it would have to be adjusted to younger age categories

¹⁰ ĀURKO, M. *Key concepts in future education*. In: EDUCATION YESTERDAY - TODAY – TOMORROW, Education in a dialogue of generations and in building better future. Radom: Radomskie Towaryzstwo Naukowe. 2015. p. 182-191. ISBN 978-83-88100-38-3

¹¹ TwentyEighty. *Critical Thinking and Problem Solving*. (online). Available: <http://www.strategyex.com/learning-programs/business-skills/critical-thinking-and-problem-solving>. [Accessed on: June, 28, 2016].

at lower levels of education because implementing these concepts only at the university level will not target the majority of the population which determines the state of affairs in every modern democratic system. I would hope that these changes might bring a new status quo in which the majority do not organize their lives around and build their understanding of the world on the naïve stories from the Iron age. In addition to that, there might even be a day when an educated person will understand what the crucial stages of his/ her epistemological process are and will actively avoid all known pitfalls along the way to knowledge. Consequently, his or her communication behaviour will disclose the true utility behind it and will include the minimum level of sociopathic tendencies.

4 Conclusion

To conclude my analysis, I should summarize the key features and characteristics of the second stage of human cognitive processes - computation. Perception and computation of data from environments and their representation into a coherent, meaningful story like narrative belongs to the category of automatic and involuntary processes. They can be interfered with, from the level of the reflective mind, through a function of the human brain called cognitive decoupling which has, in certain cases, the ability to take the automatic system offline and thus modify the default pre-conditioned automatic response. Unfortunately, this ability is far from perfect and there are many instances in which the initiation of cognitive decoupling fails, or cannot be maintained for the necessary period of time, or due to the missing mindware the subject cannot reach a more appropriate interpretation of the specific environment and therefore his response will fall back to the category of pre-conditioned automatic responses [12]. They are not, of course, false by default, but they carry a high risk of being inappropriate and outdated which is especially true in rapidly changing environments such as our modern technological society. There are variables which we still cannot control or reasonably influence such as genetic predisposition of individuals, family environment, social status or culture; however there are variables in the educational process which are accessible to us and we should definitely try to make the most of it. Implementation of an independent subject with an appropriate allocation of time and special curriculum focused on the development of cognitive skills might help to provide us with desired outcomes.

Bibliography

- [1] McQUAIL, D. *Mass media communication theory*. 6th edition. London: SAGE Publications, Inc., 2010. ISBN 978-1-84920-292-3.
- [2] OXFORD Dictionary. Medium. (online). Available: <http://www.oxforddictionaries.com/definition/english/medium>. [Accessed on: June, 28, 2016].
- [3] ĎURKO, M. *Theory of social communication*, Proc. of MMK 2014 (International Masaryk Conference for PhD students and young researchers), Magnanimitas, Hradec Králové: 2014. ISBN 978-80-87952-07-8.
- [4] ĎURKO, M., STOFFOVÁ, V. *Perception: determinants and nature of direct and indirect experience*. International Scientific Conference: Megatrends and Media, SVK. presented on 19th of April, 2016.
- [5] DEHAENE, S. *Consciousness and the brain*. New York: VIKING Penguin Group. 2014. ISBN 978-0-698-15140-6

¹² STANOVICH, K. *Rationality and the reflective mind*. New York. Oxford University Press Inc. 2011. p. 98 – 104. ISBN 978-0-19-534-114-0

- [6] KAHNEMAN, D. *Thinking, Fast and Slow*. New York: Farrar, Straus and Giroux. 2011. eISBN 9781429969352
- [7] KOSZEMBAR-WIKLIK, M. *Controversial themes in advertisement: On manipulating the emotions of audiences and extending the boundaries of the social 'taboo'*. In *Communication Today*, 2016, Vol. 7, No. 1, s. 18-30. ISSN 1338-130X, EV 3972/10
- [8] SIMON, H. *What is an "Explanation of Behavior"?* In: *Psychological Science*, VOL. 3, NO. 3, MAY 1992. (online). Available: http://groenland.medien.uni-weimar.de/cognitive_systems/readings/files/simon_1992.pdf. [Accessed on: June, 28, 2016].
- [9] KAHNEMAN, D. *Thinking, Fast and Slow*. New York: Farrar, Straus and Giroux. 2011. eISBN 9781429969352
- [10] ĎURKO, M. *Key concepts in future education*. In: *EDUCATION YESTERDAY - TODAY – TOMORROW*, Education in a dialogue of generations and in building better future. Radom: Radomskie Towarzystwo Naukowe. 2015. ISBN 978-83-88100-38-3
- [11] TwentyEighty. *Critical Thinking and Problem Solving*. (online). Available: <http://www.strategyex.com/learning-programs/business-skills/critical-thinking-and-problem-solving>. [Accessed on: June, 28, 2016].
- [12] STANOVICH, K. *Rationality and the reflective mind*. New York. Oxford University Press Inc., 2011. ISBN 978-0-19-534-114-0

Contact address:

Martin Ďurko, MBA,
Faculty of Mass Media Communication
The University of Ss. Cyril and Methodius, Slovakia
Nám J. Herdu 2, TRNAVA 917 01
email: martin.durko@fmk.sk