REVIEW

of a dissertation for the acquisition of the educational and scientific degree "Doctor of Philosophy"

Author of the dissertation: Andreas Chetkowski, Philosophy Department of Sofia University "St. Kliment Ohridski".

Thesis topic: 'Information and Entropy. Knowledge Structures in the Age of Artificial Intelligence"

Reviewer. Marina Bakalova

Andreas Chetkowski has submitted a dissertation entitled "Information and Entropy: Knowledge Structures in the Age of Artificial Intelligence", consisting of 176 standard pages.

Let me briefly introduce the professional CV of the candidate first. Andreas Chetkowski studied German philology and economics at the Technical University of Berlin, where he received his MA degree. Between 2014 and 2019, during his PhD study at Sofia University, in addition to his academic work, he taught German language and organized events related to the German culture. Chetkowski speaks English, German and Polish fluently. The candidate has three publications dedicated to Wilhelm Dilthey's hermeneutics and the autobiographical memory in contemporary social media.

Andreas Chetkowski's dissertation is centered on the concept of information - the fundamental ingredient of all forms of communication. He offers a detailed historical overview of the concept and its uses by theoreticians in different fields. At the heart of the discussion is Claude Shannon's theory of information, according to which information is a mathematical code for the same message conveyed through different modes or channels of communication. The code preserving the sameness of a message is called "entropy". One bit is the smallest amount of information which boils down to an answer of a "yes" or "no" question. If there are more than two alternatives which might happen, there is more entropy in the system and therefore - more information. No matter how complex a communication system is, the information that it contains is always encoded as a choice between "yes" and "no" or 0 and 1, along with certain probability values ascribed to the components. The information itself, according to Shannon, consists in the surprise or novelty of the particular answer.

Information is ubiquitous, it underlies each and every micro or macro action: from DNA and neural electrical signaling to oral and virtual communication in our daily lives. By finding a way to compress gigantic amounts of information, to a great extent thanks to Shanon, modern

science provides us with unprecedented informational efficiency. In a single day, we are able to learn as many facts as a medieval man was able to learn during his entire life. Of course, reducing information to a choice between 0s and 1s lies at the heart of the computer metaphor and the idea of creating artificial intelligence (AI).

In his thesis, Chetkowski has tried to question the possibility of a strong AI by going beyond the mathematical analysis of the concept of information and comparing it to what happens in the subjective human mind when deciphering information. The author sees the two as incompatible.

Andreas Chetkowski's linguistic and economic background is visible in his dissertation, especially through the extensive etymologies of various concepts and in collecting a plethora of data that do not always follow smoothly a logical thread. The author has studied a great amount of relevant literature in English and German.

The dissertation is divided into three separate chapters.

The first chapter is devoted to the concept of information and different approaches to it. The chapter is extremely long and compiles a lot of information not clearly constituting any sort of argument. The main dichotomy in this chapter is between two general notions of information: information as a message of an idea exchanged between a sender and a receiver, and information as a statistically new message that emerges from certain chaotic processes such as the realization of a particular probability. The author's preferred use of "information" is in terms of self-organization, the internal process in a system by which it makes choices to turn a particular possibility into reality. In Chapter 3, the author will consider that notion in a humanitarian context and will find the main difference between human and artificial intelligence precisely in the way humans and computers make these choices.

An interesting aspect of chapter one is the author's attempt to make sense of cultural history through the technical formats of information transmission, characteristic of different époques of human history (chapter 1, 16).

My favourite part of this chapter is the drawn distinction between the Enlightenment and the Information Age and the noticed dependency between information and misinformation. On page 18, the author raises the rhetorical question whether the Information Age is indeed an improvement in comparison to the age when books were the main bearers of information? Chetkowsky raises an indeed non-trivial ethical issue regarding our interactions with computers - namely, does the ability to compress and exchange such large amounts of information take something away from us? Very aptly, the author refers to Socrates' thought that if one could record his or her thoughts, this would reduce one's capacity to remember. If Socrates was right

about that we can only imagine to what extent does modern information technology alienates us from relying on our own cognitive capacities. I think that this particular aspect of human interaction with the computer is not often noted, and deserves more attention.

The second chapter is devoted to entropy as information clutter or noise. Entropy is potential information whose probability can be quantified. In Shannon's theory, a high level of chaos potentially leads to the generation of more information. In this chapter, the author attempts to show that the mechanisms by which information emerges from chaos, according to information theory, are not the same mechanisms as those used by human subjective mind. Humans use heuristics to make sense of order in situations of uncertinty. Accordingly, information depends on the observer - one person may see clear order, while another may see complete disorder in a particular situation. According to the author's example, a cleaning lady entering a office may see a desk as being in complete disarray, while the employee working on that desk probably sees a specific order in the apparent disarray. In this sense, as Fred Dretske (1983 p. 55) also notices: "Information, like beauty, is in the eye of the beholder."

The third chapter is devoted to the difference between the way the human mind processes and stores information and the way a computer does so. The basic idea here is that humans alter and enrich their memories through their imaginations, while computers retrieve what is stored in their memory without changing it. Chetkowski argues that human subjective perspective determining a personal choice cannot be repreoduced in a computer. However, there is no discussion in the chapter explaining why this is fundamentally impossible.

Assessment of the dissertation:

The candidate has studied quite an extensive literature related to the topic of his dissertation. As a result, the text contains a number of interesting ideas which are not trivial and which one cannot arrive at unless one has read the literature in question.

My main criticism is that the dissertation is vastly unfocused and the main idea is structurally underdeveloped. There are no clear arguments that support it either. Often there is no logical thread between the different paragraphs. Many components in the dissertation are connected by free associations and the reader has to guess why they are there which makes the text extremely difficult to read. For example, it is not clear why in chapter three the author goes through a detailed exposition of Leibniz and Heidegger on reason and its relation to truth when the subject is simply information processing? Furthermore, one would expect that there would be a clear exposition of Shannon's information theory at the very beginning of the dissertation, showing that the author really understands the theory.

My second critical note is this. Since the candidate links different traditions in which the same term has incompatible usages – he must have shown that he is aware of the difference and yet his arguments are valid. In the introduction, these differences should have been clarified. The most striking example is the phrase 'subjective knowledge'. What does it mean? If something is knowledge, it must be true, and truth is objective. What is subjective truth, what makes it true? Knowledge cannot be subjective. It can be about inner subjective states, but in order to be knowledge - it must be true. I get the feeling that the author does not really distinguish between "knowledge" and "information". It remains vastly unclear to me why the title contains "knowledge structures". I suggest that a better option would be "cognitive structures". In my opinion, the author should substitute "knowledge" with "cognition" throughout his dissertation. Knowledge and information are two different things and the dissertation is only about information. Information processing is also something different from knowledge-producing mechanisms.

During the defense, I expect the author to answer the following questions:

1.   Why is it *in principle* impossible to recreate the subjective human consciousness in a computer, e.g. by optimal programs for meta-cognitive monitoring and emotional intelligence? Likewise for subjective choice? I want to hear one simple argument.

2.   The author talks about "subjective states", but in the AI there is also a "state" that changes depending on commands. What is the difference between the two?

3.   How does entropy determine that there is no clear predictability of the laws of nature and yet it is based on a probability theory? (end of p. 10)

In conclusion, I would like to say that I admire the enormous efforts and motivation of the candidate in conducting this massive research. I have serious problems with how the text is written though. However, given that the candidate has worked so hard and has arrived at some interesting, original and potentially significant ideas, I will vote in favour of awarding the degree of Doctor of Philosophy to Andreas Chetkowski.

Sofia, 2.10. 2024   Marina Bakalova