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Nr albumu: 86352

The idea of downward causation in the emergentism philosophy

A study based on the example of computer systems

The aim of this work is to analyze and continue the research of downward causation in computer systems, which was initiated and studied by George F. R. Ellis. His original idea has been modified through a change in accepted philosophical statements to theses accepted within the emergentism viewpoint. This modification allows for a different look at emergence and downward causation in the example used by Ellis. The following steps were taken to research this topic.

Chapter one deals with the notion of downward causation within the context of the emergentism theory. In view of the fact that emergentism and emergence are often mistakenly considered as equivalents in scientific literature, the first and second paragraphs attempt to bring order in this matter. The first paragraph deals with emergentism. It describes the origins of this philosophy which are connected with british emergentism, and it describes the influences of its representatives: John S. Mill, George H. Lewes, Samuel Alexander, Conwy L.Morgan and Charlie D. Broad. Next, the paragraph describes different versions of modern emergentism. Because the theory is described by a rich variety of features, this work emphasises the characteristics of the idealized version of british emergentism as presented by Brian P. McLaughlin. Because these characteristics are very general, they encompass different versions of modern emergentism. Paragraph two deals with the phenomenon of emergence, which has been given a lot of attention in the history of philosophical studies. Despite that, there is still a lack of one uniform version of this philosophy. From among many versions of emergence, this
thesis discusses the classifications made by Philip Clayton (weak, strong) and Mark A. Bedau (nominal, weak, strong). Paragraph three is devoted to the notion of downward causation as one of the characteristics of the idealized version of emergentism. It provides a historical background, particularly focusing on periods of greater interest in the notion of downward causation in the philosophy of the mind, from which it spread to other areas of study. Next, the paragraph discusses different versions of downward causation and presents their general interpretations. Paragraph four lists the problems which often appear in discussing the phenomenon of emergence and downward causation.

Chapter two is devoted to the study of downward causation in the classic computer system considering emergentist interpretation of the world. The first paragraph presents Ellis's accomplishments made so far. It also presents his understanding of emergence and downward

causation, and the presence of downward causation in a classic computer system. Paragraph two concerns two aspects which are significant for the research in this work: the definition of computer and its hierchical structure. Ellis does not devote too much attention to the definition of the computer; on the other hand, the hierarchic structure of the computer he presents has a pragmatic character. This discussion proposes considering the ontology of the computer in search of downward causation in classic computer systems. The third paragraph is devoted to the process of compilation which consists of translating a code from higher level computer language to an equivalent code of the lower level language, which is an example of downward causation which considers the ontology of the computer.

The aim of chapter three is an application of the results of the previous chapter to quantum computers. The first paragraph strives to enhance the understanding of quantum computers through a presentation of a historical background of research done in this field. It also discusses the rules which must be kept and it lists some attempts of physical implementation, at the same time providing the description of how a quantum computer based on magnetic resonance works. These analyses allow for the comparison between a quantum computer and a classical computer, as well as providing the definition of a computer as such. Paragraph two discusses the occurence of downward causation in quantum computers at the level of equipment and software. The discussion of equipment is based on quantum phenomena used in quantum computers, in which downward causation has been noticed. After doing the analysis, the ontology learned from classic computer studies was applied to quantum computer software.

The conducted analyses of the research material served as a basis for a series of research problems.