Mark Burgin

Computing devices as information operators

Operators have become one of the most important tools in theoretical physics and are also becoming an important tool in information theory. Computing devices are information transformers and generators. That is why in this work, we develop operator models of computing devices and study their properties based on the ontological operator theory. An operator is an object (system) that operates, i.e., performs operations on, some objects, systems or processes which are called operands of this operator. In other words, an operand is an object, system or process operated by an operator. Thus, being an operator or an operand is a role and a characteristic of a system. One and the same system/object can be an operator in some situations and an operand in other situations, as well as an operator with respect to some systems and not an operator with respect to other systems. All operators are systems, but not all systems are operators as they can exist and function in sizeable isolation from their environment. To construct a mathematical operator theory, it is necessary to organize or represent operands in the form of an operating space, i.e., the space which is transformed by an operator. Different types of operators function in distinct operating spaces. For instance, operators of quantum mechanics use Hilbert spaces as their operating space. Information operators function in information spaces. As there are diverse types of information, representation of them by operators demands different types of information spaces. According to the general theory of information, we differentiate syntactic, semantic, pragmatic, algorithmic, cognitive, emotional and effective information. Consequently, modeling computing devices by information operators, we can treat them as tools for transformation and generation of distinct kinds of information. Here we consider syntactic, semantic, and pragmatic information. This brings us to syntactic, semantic, and pragmatic information spaces.