Knowledge as a Complex Phenomenon

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Abstract: The paper presents the construction of the discursive space, which is a representation of knowledge. It is a multidimensional dynamic space crossed by discourses running along their specific trajectories. These discourses remain in the relationship of supervenience with reality, which is interpreted as a world of facts (state of affairs). Discourses inherit the complexity of the world, and because they are the articulation/retention of knowledge, this knowledge also inherits this property. Discursive space is, therefore, a model of knowledge of a complex nature.

1 INTRODUCTION

This paper addresses the subject of knowledge in the context of complexity. In particular, it presents a knowledge representation model based on two main ideas: discourse and dynamic space. The first idea comes from the area of social sciences and philosophy and uses the classical concept of discourse presented by Michel Foucault (Foucault, 1966, 1969, 1971). The second idea comes from the area of physics, where it is also a classic tool for representing and describing various types of phenomena (Nolte, 2010, 2015). Thanks to this combination, it is possible to find a junction between the existing formal construction and the phenomenon which is very hard to formalize, although such solutions have been proposed.

Dynamic space is a tool that can be used to describe complex systems. However, the key place to justify the use of the concept of complexity in the proposed knowledge model is the mutual relation of discourses and the world, which is based on the relationship of supervenience (Armstrong, 1997), which exists between discourses and the world interpreted as a set of facts (world of affairs). Armstrong, who develops the ideas of Wittgenstein and Russell, is based on this interpretation (Russell, 1923; Wittgenstein, 1922). In this situation, discourses must inherit the uncontroversial immanent property of the world, which is its complexity.

Complexity, therefore, appears not as an assumption but as a necessarily arising problem to be solved.

The immediate reason for taking up the described problems is the phenomenon of knowledge and the state of interpretation of this phenomenon, in particular in the context of IT development. Knowledge is treated in the IT field as an autonomous resource that must be reconstructed in a computable way. The effort involved has been going on since at least the 1960s and is mainly associated with the so-called artificial intelligence.

However, knowledge is a phenomenon whose perception has undergone a broader, fundamental revision in the 20th century. The classical definition of knowledge puts at the center a man who is its only subject (Pritchard, 2016, p. 3). It was given in Plato's dialogue Theaetetus and functions as the basis for understanding knowledge to the present. Its short definition is *Dóksa alethés metá lógu* (Appiah, 2003), in English translation by Waterfield: "true belief accompanied by a rational account" (Plato, 1987, p. 115), usually shortened to *justified true belief* (Dancy et al., 2010). It is a combination of three elements: belief, true and justification (the so-called *tripartite*) which "is a central philosophical claim [of knowledge] of the Western tradition since Plato" (Appiah, 2003, p. 43).

The revision was based on the deprivation of knowledge of its transcendental nature, in particular, the abandonment of the condition of truth and a pragmatic approach in its understanding. This kind of

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change was due to some fundamental changes in the understanding of physics and mathematics in the nineteenth century e.g. (Husserl, 2008; Russell, 1923). This leads to a functional and teleological understanding of knowledge e.g. "as a generalized capacity to act and as a model for reality" (Adolf & Stehr, 2014, p. 22) and also to perceive it as the separate and autonomous issue i.e. human-independent phenomenon e.g. (Adolf & Stehr, 2014; Burgin, 2015; Ibekwe-SanJuan & Dousa, 2014; Pritchard, 2006; Tolksdorf, 2011).

The implementation of this pragmatic approach had many variants. These include the emergence of a modern philosophy of science that is based on reflection as old as philosophy itself (Losee, 2001; Machamer & Silberstein, 2002). The philosophy of science in the twentieth century has become, however, "the distinct yet central part of philosophy" (Psillos & Curd, 2008, p. xxi) formulating fundamental questions about the justification of the scientific reasoning e.g. (Popper, 1935). One of the branches of this philosophy even led to the phenomenon of the so-called "historical turn" in the understanding of science interpreted by researchers like Kuhn, Lakatos, and Feyerabend as a product of current historical and social circumstances (Bird, 2008, p. 21).

In the 20th century, this social context becomes the most important circumstance of knowledge and shows the way to its interpretation (Bloor, 1976; Fleck, 1935; Knorr-Cetina, 1981; Latour & Woolgar, 1979; Mannheim, 1929). This interpretation may have a more philosophical and speculative character, as exemplified by the reflection of Foucault and Lyotard (Foucault, 1966, 1969, 1971; Lyotard, 1979) or based on a social, economic and political approach. In the latter area, knowledge can be interpreted in at least three ways: first, as the basis of management, the main premise of political organization and a direct resource, e.g. for business (Bell, 1973; Drucker, 1961; Machlup, 1962; Simon, 1971). Secondly, it can be subject to instrumental economic management (Nonaka & Takeuchi, 1991; Wiig, 1993) or thirdly, to function as a resource that is subject to practical human activities such as searching, acquiring and organizing (Hjørland, 2016).

However, probably the most important way of understanding knowledge in a pragmatic way is associated with its use in the area of IT. Knowledge perceived from this perspective is computable, i.e. it is treated either as purposeful, intentional, explicit knowledge bases or on the contrary as hidden, spontaneous and random resources. Especially the latter have gained in importance recently, leading to

generalized ways of interpreting knowledge e.g. (Burgin, 2015; Moldoveanu & Baum, 2014; Weller, 2010; Zhuge, 2012).

Computing solutions aimed at formalizing knowledge for broadly understood IT purposes have their beginnings in the 1960s and 1970s e.g. (Collins & Quillian, 1969; Minsky, 1974; Schank & Abelson, 1975; Sowa, 2000) and have developed many practical solutions e.g. (Brachman & Levesque, 2004; Van Harmelen et al., 2008). Recent rapid progress in the field of neural networks has raised the importance of solutions based on the non-symbolic, distributed way of knowledge understanding e.g. (Bengio et al., 2003; Goodfellow et al., 2014; LeCun et al., 1990; Mikolov et al., 2013; Vaswani et al., 2017). Another rapidly growing area of knowledge acquisition is massive data repositories created spontaneously, whose prototype is the WWW, explored through several techniques known as mining: data mining or particularly text mining (Bramer, 2016; Jo, 2019; Kitchin, 2014).

2 METHODOLOGY

The reasoning presented in this paper has a conceptual character (Gilson & Goldberg 2015) since it presents the metalevel type of reflection due to the general problem of knowledge. Although it refers to the numerous empirical reflections on particular issues and solutions. Such reasoning maintains coherence both on the level of deduction and coherence of the adopted assumptions, fulfilling, on the one hand, Popper's postulate (Popper, 1935) and on the other assumption of the axiomatic approach (Hilbert, 1899; Peano, 1889).

3 RESULTS

This paper proposes the discursive space construction as a model of knowledge. The definition of the discursive space is as follows: "the discursive space (DS) […] is the method of the description of the massive and ubiquitous phenomena like the internet chosen as an example. This method could be also treated as the model of knowledge about the chosen phenomenon. This knowledge is understood from the point of view brought by sociology and philosophy which present the so-called constructivist attitude which means that the knowledge is treated by them as a social, temporary and spatially local creation. […] Two essential ingredients appears as the base of DS:

complexity as a generic model and discourse as its direct substance" (Maciag, 2018). The more formal definition of it is as follows: discursive space is an n-dimensional dynamical space in which discourses, which are autonomous instances of knowledge, run in time trajectories describing the real state of knowledge in the subject they concern.

Such a definition brings instantly at least the following two questions: first, about the nature of discourses, second, about the conditions of the building of the dynamical space i.e. its dimensions. For the complexity the first is crucial. To establish such a space the idea of discourse was based on the theory by Michel Foucault (Foucault, 1971). Foucault describes discourse as a retention/articulation of knowledge, what is classical approach now, widely presented in the current literature e.g. (Angermüller et al., 2014, p. 6; Dijk, 2013, p. 592; Hyland & Paltridge, 2011, p. 39; Jørgensen & Phillips, 2002, p. 2).

Foucault characterizes discourse indirectly, by formulating the rules of its analysis, which are the only ways due to its character. This character is fundamentally linguistic but discourse goes beyond this level. Foucault proposes four rules that explain this character. He names the reversal as the first rule and opts for the rejection of such classical subjects as the author, the discipline, the will to truth. They are recognized as "the negative action of a cutting-up and a rarefaction of discourse" (Foucault, 1981, p. 67). The second is the discontinuity which qualifies discourse as "discontinuous practices, which cross each other" (*ibidem*). The third rule: specifity, maybe the most difficult, which underlines the influence of discourse on things, discourse through the violence becomes operational. The fourth rule is the exteriority, which refers to the conditions of the existence of discourse which are always external.

Discourse presents then the autonomous entity of the uncertain identity. This uncertainty defines it. The only way to recognize discourse is to observe its impact on things what means that this identity is invisible by itself by the usual modes of cognition. Foucault calls it "practices" (*pratiques*) what heading towards certain human actions and also towards their dynamic form of existence. The rule of exteriority excludes the existence of kernel, the overriding principle of the discourses which "cross each other, are sometimes juxtaposed with one another, but can just as well exclude or be unaware of each other" (Foucault, 1981, p. 67). Such a set of properties lets understand discourse as potentially complex.

However, the main premise for the claim of the complex nature of discourse comes from the assumption about the ontological establishment of the discourse. This establishment assumes the relation of supervenience between the space of discourses and the world. Armstrong defines the supervenience which is as follows: "We shall say that entity Q supervenes upon entity P if and only if it is impossible that P should exist and Q not exist, where P is possible" (Armstrong, 1997, p. 11). The general character of this definition neither doesn't exclude the particular kinds of relations nor determines the direction of them what allows the presence of circular relations instead of the simple casual ones. At the same time, Armstrong doesn't exclude the factor of time which means that supervenience relation can develop over time i.e. is a dynamic process.

The second side of the relation (besides the discourses): the reality is interpreted by Armstrong who names it in terms of a state of affairs. He defines it as follows: "The general structure of states of affairs will be argued to be this. A state of affairs exists if and only if a particular (at a later point to be dubbed a *thin* particular) has a property or, instead, a relation holds between two or more particulars. Each state of affairs, and each constituent of each state of affairs, meaning by their constituents the particulars, properties, relations and, in the case of higher-order states of affairs, lower-order states of affairs, is a contingent existent. The properties and the relations are universals, not particulars. The relations are all external relations" (Armstrong, 1997, p. 1). Armstrong relies on the idea proposed earlier by Wittgenstein and Russell (Russell, 1923; Wittgenstein, 1922).

Russell describes the idea of the structure of the world in a text from 1911: „I believe there are simple beings in the universe, and that these beings have relations in virtue of which complex beings are composed." (Russell, 2003, p. 94). For this text is the indication of the relational character of the world is most important. Russell composed his structure of the world of the two elements representing on one side the simplest parts of it and the relations between them on the other (Russell, 2003, p. 95). He calls them "the stuff" and "the structure" (Russell, 2003, p. 276) and names them "particulars" and "universals".

Wittgenstein published Tractatus in 1921, but the first draft entitled Notes on Logic he presented to Russell in 1913 whose student he became in 1912. Wittgenstein created the visionary idea of the world structure based on the idea of the facts: "1.1 The world is the totality of facts, not of things. […] 2. What is the case—a fact—is the existence of states of affairs. 2.1 A state of affairs (a state of things) is a combination of objects (things)" (Wittgenstein, 2002,

p. 5). Such a world is the base of the language. There is a clear connection between them that uses well-defined intermediaries: facts, a logical picture, thoughts, and propositions. There is no place here to develop a detailed justification, so let us remain with the statement that this is the clear manifestation of the complex nature of the world understood in terms of the network (Wittgenstein, 2002, p. 59).

The last component of reasoning is the mode of the representation of the whole concept which is based on the idea of the dynamical space. Nolte refers the fundamental nature of this construction as follows: "A unifying viewpoint of physics has emerged, over the past century, that studying the geometric properties of special points and curves within dynamical spaces makes it possible to gain a global view of the dynamical behavior, rather than focusing on individual trajectories. Dynamical spaces can have many different dimensions and many different symmetries" (Nolte, 2015, p. 2).

Discursive space is built of the unlimited set of dimensions which have primordially the qualitative character. They are the result of the qualitative (semantical) analysis of the discourses regarding the issue under consideration. Infinitely many discourses can run usually trajectories in such a space since there are many interpretations i.e. the manifestations of knowledge concerning every subject. Due to the constructivist nature of such knowledge the category of truth is irrelevant. In the example of the discursive space, the subject of the study was the Internet, which was presented as the value of 19 variables of various types observed in time (Maciag, 2017, 2018). The status of these values has been visualized as a chart on the coordinate system parallel (Inselberg & Shneiderman, 2009). The idea of space can be extended by the introduction of the idea of manifold invented by Riemann, who didn't understand manifold as formally as modern topology (Torretti, 1978). Manifold has been understood in a more general way also by the Husserl (Smith, 2002).

4 DISCUSSION

The application of the idea of complexity to the social and humanistic field which is the case of the idea of the discursive space is not new. Preiser and Cilliers writes that attempts to combine social sciences and humanities with complexity science emerged in the 1990s and point to publications by Byrne and by Luhman as examples (Preiser & Cilliers, 2010, p. 95). In 2005, John Urry called the application of this idea in social research "the complexity turn" and

compared it to other, similar alterations of the paradigmatic research approaches and mentions „Marxism in the 1970s, the linguistic turn and postmodernism in the 1980s, the body, performative and global culture turns in the 1990s" (Urry, 2005, p. 1).

Castellani and Hafferty very widely justify the need to apply the idea of complexity in sociology (Castellani & Hafferty, 2010). Social, humanistic and philosophical aspects of complexity are also the subject of numerous literature e.g. (D. Byrne, 1998, 1998; D. S. Byrne & Callaghan, 2014; Cilliers & Bruce, 1998; Jörg, 2011; Preiser & Cilliers, 2010; Youngman & Hadzikadic, 2014). Complexity was also applied extensively in the field of science of organizations e.g. (Anderson, 1999; Burnes, 2005; Griffin & Stacey, 2005). Routledge even devoted two publishing series to this issue: Complexity and Emergence in Organizations in 2002 and Complexity as the Experience of Organizing in 2005. There are also many textbooks introducing the problematics of the complexity e.g. (Beautement & Broenner, 2011; Downey, 2012; Holland, 2014; Johnson, 2007; Mitchell, 2011).

The way in which complexity appears here is the closest to Byrne and Callaghan's conception (D. S. Byrne & Callaghan, 2014). They perceive the theory of complexity as „an ontologically founded framework of understanding" (D. S. Byrne & Callaghan, 2014, p. 8). They devote a special analysis to the phase space and the state space which are the realizations of the dynamical space construction in the context of the complex adaptive systems they choose as a model (D. S. Byrne & Callaghan, 2014, p. 27). They write that the dimensions of this space are not necessarily mathematical. In the justification, they refer to the difference that separates the so-called metric space and topological space, described by DeLanda (Delanda, 2002, p. 23). In that way, they dismiss the methodological problem of research in social sciences that results from the conflict between the qualitative and quantitative approaches (D. S. Byrne & Callaghan, 2014, p. 38).

The idea of the multidimensional space despite its quantitative nature was also used by Gärdenfors in his idea of the conceptual spaces (Gärdenfors, 2000, 2004; Zenker & Gärdenfors, 2015). The notion of the dynamical system has its strict physical interpretation proposed by Poincaré and developed in a classical work by Birkhoff, who is considered an inventor of this notion (Abraham et al., 1980; Birkhoff, 1966 (1927); Nolte, 2015). Nevertheless, a concept of that system was proposed by Poincaré as a combination of

the qualitative and quantitative approaches in a geometric concept (Abraham et al., 1980, p. xviii).

5 CONCLUSIONS

An approach based on the construction of dynamic space allows the creation of a knowledge model that is represented by discourse trajectories. Discourses are considered articulations/retention of knowledge as interpreted by Michel Foucault, which is one of the foundations of reasoning. These discourses remain in the relationship of supervenience with reality, which is interpreted as a world of facts (state of affairs). The key property of such a world is its relational character, which is an analog of a dynamic network structure.

This structure reflects the complex nature of the world, which is otherwise its non-controversial property. This structure plays the role of a conceptual interpretation of this complexity. Thanks to the relationship of supervenience, discourses as articulations/retention of knowledge about this world inherit its complexity. Dynamic space allows modeling the state of discourses over time and thus modeling the dynamic state of knowledge. Knowledge presented in this way also acquires the character of a complex phenomenon.

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