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Predicative Competence in a Digitalised Society †

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Abstract: In the current digitalised society, communication level requires high predicative competence and concept clarity to avoid predicative fallacies and to manage the contemporary information overload successfully. In this paper we review the fundamental conceptual and operative requirements to achieve this goal. The Evolutive Elementary Pragmatic Model (E^2PM) operative tool can be quite helpful. This paper presents a relevant contribute to model and simulation, offering an example of new forms of evolutive inter- and trans-disciplinary post-Bertalanffy modeling.

Keywords: predicative competence; universe of discourse; narrative; conceptual clarity; squares of oppositions; human predicative rationality; EPM; digitalised society; CICT

1. Introduction

According to traditional theories, brain researchers estimate that the human mind takes in 11 million pieces (tokens) of information per second through our five senses but is able to be consciously aware of only 40 of them [1–3]. So our neurointerfaces and our brain have to filter to the extreme. To better clarify the computational paradigm, we can refer the following principle: "Animals and humans use their finite brains to comprehend and adapt to an infinitely complex environment" [4]. We are constantly reconstructing the world's essential and superficial characteristics. This is the outcome of the on-going evolution of our relationships in a world full of surprises and challenges [5] related to deeper characteristics. In today world, information plays a much broader role, in which what matter is meaning rather than quantity. The classical emphasis posed by natural language processing (NLP) technologies on linguistic representation plays a crucial role in big data scenarios. They try to account for different semantic dimensions (e.g., lexical, grammatical or encyclopedic) during the training for an individual task. Certainly, attempts to introduce semantics into information theory have made some progress, but still fall short of being able to deal with problems in which information is described in full natural language [6,7] (p. 1). In the current digitalised society, communication level requires high predicative competence and concept clarity to avoid predicative fallacies and to manage the contemporary information overload successfully. In this paper we review the fundamental conceptual and operative requirements to achieve this goal. This paper presents a relevant contribute to models and simulations, offering an example of new forms of evolutive inter- and trans-disciplinary post-Bertalanffy modeling.

2. Universe of Discourse

In every discourse, whether of the mind conversing with its own thoughts, or of the individual in his intercourse with others, there is an assumed or expressed limit within which the subjects of its operation are confined. Now, whatever may be the extent of the field within which all the objects of our discourse are found, that field may properly be termed the "universe of discourse". This concept, probably created by Irish mathematician, educator, philosopher and logician George Boole in 1847, played a crucial role in his philosophy of logic, especially in his stunning principle of "wholistic reference" [8,9] (p. 941). The term "universe of discourse" generally refers to the collection of symbolic objects being managed and discussed in a specific discourse. In current model-theoretical semantics, a universe of discourse is the set of symbolic entities that a model is based on. Furthermore, this universe of discourse is in the strictest sense the ultimate subject of the discourse and human ability to use logic, to integrate the evidence of our senses in a noncontradictory way, is part of our rational faculty, the very faculty that makes us human. Obviously, we also have the capacity to be illogical, but that is because our rational faculty also entails volition, the power to choose to think or not to think.

Psychologists of reasoning have created algorithmic models of human reasoning and of its fallacies. The "mental models theory of reasoning", developed by Philip Johnson-Laird and Ruth M.J. Byrne in 1991 [10] is one of the most famous among these theories. Ongoing research on mental models and reasoning has led the theory to be extended to account for counterfactual thinking in 2005 [11], and probabilistic inference in 2006 [12]. In this article, we follow a different path: it is a computational approach and so, complementary to previous ones.

3. Predicative Competence

According to Swiss clinical psychologist Jean Piaget, human adults normally know how to use properly classical propositional logic. Piaget also held that the integration of algebraic composition and relational ordering in formal logic is realized via the mathematical Klein group structure [13,14]. The Klein group structure Piaget used, can be used to help us understand better what happens in spontaneous human reasoning and in the production of fallacies. In fact, in mathematics, the Klein four-group or "Vierergruppe" is the smallest non-cyclic group, and every non-cyclic group of order 4 is isomorphic to the Klein four-group. The cyclic group of order 4 and the Klein four-group are therefore, up to isomorphism, the only groups of order 4. Both are abelian groups in mathematics. Klein four-group applied to binary connectives is such that a given connective is associated first with itself (in an identical (I) transformation) and then with its algebraic complement (its inverse (N) transformation), also with its order opposite (its reciprocal (R) transformation) and finally, with the combination of its N and R transformations (that Piaget calls its "correlative" or C transformation) [13] (Chapter 17). This correlative corresponds to what logicians usually call the "dual" (D) transformation [14]. The Klein group structure generates squares of opposition (SOO), and an important component of human rationality resides in the diagram of the SOO, as formal articulations of logical dependence between connectives. SOO are considered as important basic components of logical competence and of human predicative rationality [15].

Invalid reasoning can be computationally modelled as logically equivalent to degenerate Klein four-groups (crushes) and such a modeling allows a deeper explanation of what happens in fallacies and suggests predictions on other fallacies and on strategies for teaching their avoidance. In fact, the formal rationality provided by the SOO is not spontaneous and therefore, should not be easy to learn for adults. This is the main reason why we need reliable and effective training tools to achieve full propositional logic proficiency in decision making, like the elementary pragmatic model (EPM) [16].

4. Evolutive Elementary Pragmatic Model (E^2PM)

The relational "Model of the Rational Mind" (EPM for short) allows the adoption of a different perspective from that of traditional psychology. In Italy, EPM was introduced in 1979 by De Giacomo and Silvestri [17], and a complete description of first clinical applications was then made in the course of the 1980s and 1990s [18]. In the past decades, EPM has shown to be a highly operative and versatile tool and new application areas have been continually envisaged in many different disciplines with successful result, from engineering to artistic application.

In 2013, the EPM intrinsic Self-Reflexive Functional Logical Closure has even contributed to finding an original solution to the dreadful "Information Double-Bind" (IDB) problem in classic information and communication science [19], just at the inner core of human knowledge extraction by experimentation (only a few researchers are aware of and no traditional scientist likes to talk about it seriously, in contemporary scientific arena). As a consequence, one of the first practical results has been to realize that the classical experimental observation process, even in a highly ideal operative controlled condition, like the one achieved in current, highly sophisticated and advanced experimental laboratories such as CERN in Geneva, can capture just a small fraction of the total ideally available information from unique experiment. Usually, the remaining part is lost and inevitably dispersed through environment into something we call "background noise" or "random noise", in every scientific experimental endeavor. In turn, this new awareness has forced the scientific formalization of this process and to develop new tools to reliably quantify the information dissipation process in current instrumentation systems, by a pioneering, advanced scientific community [20]. EPM has allowed us to enlarge our panorama for neurocognitive system behavior understanding, to develop information conservation and regeneration systems in a numeric, self-reflexive/reflective, evolutive, reference conceptual framework [21]. A detailed description is reported in De Giacomo and Fiorini [16].

By an abstract point of view, EPM can be seen as the logic description of the fundamental interactions of two Klein groups. In other words, EPM can model all the elementary narrative and rhetoric articulations between two rational, interacting subjects. Currently, the notion of reasoning or conscious reason may be interpreted in terms of the reasoning process itself being itself explicitly modeled by the reasoning agent [22]. In this way, we arrive at the core understanding of "the difference that makes the difference" [23] (pp. 457–459). Such an approach, developed initially by English anthropologist and social scientist Gregory Bateson, is advocated by De Giacomo and Fiorini [16], and Wheatley [24] for management and leadership. EPM further cognitive extension, known as "Evolutive Elementary Pragmatic Model" E^2PM [25], represents the latest, relevant contribute to modeling and simulation, offering an example of new forms of evolutive behavior by inter- and trans-disciplinary modeling (e.g. strategic foresight, uncertainty management, embracing the unknown, creativity, etc.) for the children of the Anthropocene [26].

5. Conclusions

Traditional EPM can be thought as a reliable starting subsystem (closed logic, operative management) to initialize a process of continuous self-organizing and self-logic learning refinement (open logic, strategic management subsystem). This method can capture natural logic dynamics behavior, as a function of specific unpredictable perturbation, unknown at system design level. The E^2PM hypercube and cuboctahedron logical geometry define a notation that goes beyond a format distinction with the purpose of facilitating inferences either on a diagrammatic representation, or a lexical one [27]. The latter particularly allows operations on complex propositions within hypercube and cuboctahedron with more than three dimensions, mentally difficult to imagine. Though the hypercube logical geometry seems to be a straightforward method to depict the logical relations in propositional logic, further research must be planned beyond this first approach to the notation. Future studies ought to validate empirically the contribution of this logical geometry approach to the understanding of logical relationships, notably in educational settings. The intuitive character of the related algebra to apprehend logical relations must be tested in comparison with classical methods of learning. Examples are presented and discussed.

Conflicts of Interest: The authors declare no conflict of interest.

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