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A New Knowledge-Architecture for Cosmology

Tarkko Oksala
Docent, Aalto University, TUT, IIAS, International Academy of Art, Science and Engineering
E-mail: Tarkko.Oksala@gmail.com

Abstract. The aim of this paper is to describe a knowledge-architectural system to control cosmological study. First the ideas of logical basis, graphic description, and development studies in cosmology are considered. Secondly measurement, law-likeness, and technical applications in cosmology are discussed. This all is made in order to create a framework to classify achievements in cosmology.

1. Introduction

The pure idea of science is often mixed with doctrines containing normative connotations. At the other end of the spectrum there is also space for applications especially in relation to technology. Classical vocabulary of scientific doctrines contains open forms like:

Logy, -graphy,-gony
Metry, -nomy, -(tech)nics

The content of these notions is given under sub-paragraphs in relation to cosmology. In addition to that, we will show that the system created forms a knowledge-architecture of cosmology. Cosmology is age old and clear conception. Its users have avoided the literal problem of astrology vs. astronomy. This pair of words has historical load and the use of them do not correspond to the meaning hidden in base-words. - Knowledge-Architecture develops rapidly in collaboration with data-, information-, and "knowledge"- processing techniques. It has, however, its origin in epistemology [1].

2. Doctrines of Cosmology A

2.1. Cosmology

Cosmology is the umbrella of cosmic studies. It gives the ontological and normative basics for study. The central questions include "what and how cosmos is" or "how it should be studied". In addition to that the traditional cosmology gives most important concepts and theories in the field. As basic the doctrine of cosmology has its relations to:

Ontology, epistemology, praxiology
Ecology, aesthetics, ethics

Ontology of cosmos is related to the ontology of the world [2, 3]. Then nature has its own ontology added with the problems of mentality [4] and culture or values. Historical eras of philosophy have their epistemological ideas of cosmology. In near history we may refer to logical empiricism [5]. As mentioned praxiology is part of the game starting from the role of instruments in science. In fact in the Morphological idealism concepts eulogy, eunomy and eupraxis refer to this connection [6, 7].

In case we are interested in practical cosmology, it is natural to notify ecological aspects in it [8]. Aesthetics and cosmology have been joined since the times of Plato and in the words of Timeaeus when he said that "Cosmos is created to be eternal, beautiful and the best (optimal)". (Figure 1) The joint problematic of cosmology and ethics has been manifested nicely in the words of Kant concerning his famous admiration of the sky of stars and conscience. (Compare [9]).

The basic definitions in cosmology include those of the parts of cosmos, like quantum, atom - solar system etc. They constitute the form system of the study [10]. Important branches of theoretical study correspond the forms of energy [11].

2.2. Cosmography

Cosmography concentrates to the graphic representation of cosmos [12, 13]. (Figure 2) A graph is a subset of Cartesian product [14, 15]. To understand the idea of graphic representation in sciences near to mathematics we need notions, like:

Restriction, power, Cartesian product
Relation, function, operation

These notions have their standard meaning in mathematics and we do not repeat them here.

In cosmology we have two main ideals of perception the haptic and the optic one [7]. Their models are Euclidean vs. projective geometry. Optic perception is the most developed and suits for remote and micro-sensing. Electrographs are main tools to represent cosmic information. Electromagnetic spectrum [8] can be re-mapped with the aid of photography. Typical example of these procedures is the map of background radiation [8] (Figure 3). Graphs of functions are economic way to communicate cosmic information [16]. The idea of using graphs has been always hidden in the cosmological work starting from the star figures (Big Bear etc.).

2.3. Cosmogony

Cosmogony studies the types of cosmos and its parts. It also has as its targets the origins, development and destiny of cosmos and its parts [13]. Central background concepts include:

Type, typology, taxonomy or nomenclature

Origin, development, destiny

Recent cosmology discusses a lot of various types of cosmos like static, expanding, cyclic [17]. The study of parts of cosmos gives rise to form various typologies and taxonomies starting from the variation of the mass of the target. There are critical forms like black hole [13], giant star, "sun-size" etc. (Figure 4)

The time dimension in describing cosmos is basic for human understanding [6, 13]. Today the standard theory is based on the idea of "Big Bang" [8]. (Figure 5) This leads naturally to the idea to see Universe in its dynamic state [17, 18]. The destiny of universe is in a certain sense an open question. In spite of that we have a lot of information concerning the stories of single stars. For example we know how long the sun has its power to keep solar system in a stable state.

The development of universe in general or the development of life and mind is today discussed in growing extent using the concept of emergence [3, 19, 20].

3. Doctrines of Cosmology B

3.1. Cosmometry

Cosmometry has its scope in the measurement and measures [21] of cosmos. Its archetype is geometry [22, 23, 24]. Euclidean geometry suits for measurement of restricted areas on Earth. Problems arising in cosmic scale are partly solved in Relativity Theory [5, 25, 26] or in its critique [6, 27]. As well known problems arouse also at the other end of the "spectrum" in quantum level [28]. Ideas like "The Constant of Planck" and "The Uncertainty Principle of Heisenberg" tell about this [11, 13]. The field of measuring all kinds of events of phenomena in the cosmic universe is too wide to be discussed here. We concentrate here to give a view to measurement and measures in probability calculus and information theory [21, 29]. (Figure 6) In physics we know the idea to measure order in event field using entropy (of thermodynamics) as start idea. This kind of measurement of cosmic things, states, situations; events, cases and phenomena is based on measures, like:

p, inf, cont (probability, information, content)
p/q, transinf, transcont (conditional probability, transinformation, transcontent)

Probability is a measure of certainty, but the concept may be interpreted in various ways [23] since Cicero [30]. In case we have a suitable probability measure it may be used as a standard base to measure information [31] (Cicero, Shannon, Carnap, Hintikka) or content (Popper). The values of these measures are inf (s) = - log p(s) and cont (s) = 1 – p(s).

In real world events depend on each other and we have to use complex theory of conditional probabilities (Bayes) and induced measures like transinf and transcont. Entropy measures the degree of order in universe and is technically "The expected value of information". Cosmos contains order over semi-chaos and this idea leads to the problematics to find aesthetic measures or cosmic scenes [32, 2, 33].

3.2. Cosmo-n(aut)ics

Cosmotechnics investigate the relation of cosmology to skills and technology or in applied forms to phenomena like the tools of space-traveling. A skill consists of abstract forms [37], like:

Right, rational, potential
Acting, emotion-based, ability

Cosmological study has to be made in the right way accordingly to the criteria of the era. The main guiding idea has been rationality (Newton, Leibniz). The field of cosmic phenomena is so large that we need an open potential in order to answer to the multitude of question raised.

An experienced cosmologist works evidently acting in an emotion-guided way when his/her ability is highly developed. Many cosmologists have affirmed that intuition plays a central role in hypotheses formation.

Today cosmology is in an extensive dialogue with high-tech and ICT. Typical examples include electron microscopes, radio-telescopes and Large Hadron Collider (LHC) [38]. (Figure 9)

4. Conclusions

We have shown how the basic architecture of knowledge represented covers the central concerns of cosmological study. For more advanced system we may "multiply" the basic knowledge architecture with the ideas of "form system" or with "extended energetic meta-field" of cosmos (universe). This result is given in the Appendix.

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Appendix

Cosmology, cosmography, cosmogony - cosmometry, cosmonomy, cosmon(aut)ics
(Clusters, galaxies)
"Astrology", astrography, astrogony - astrometry, astronomy, astro(naut)ics
(Solar systems, planets (moons))
Geology, geography, geogony - geometry, geonomy, geonics (geonautics)
Materiology, materiography, materiogony - materiometry, materionomy, material technology
-Atomology, atomography, atomogony - atomometry, atomonomy, atom technology
-Quantology, quantography, guantogony - quantometry, quantonomy, quantum technology

Energology, energography, energonomy - energometry, energonomy, energy technology
(Gravitation, kinesis, electromagnetism, warmth, explosion, cohesion)
Microbiology, microbiography, microbiogony - microbiometry, microbionomy, microbionics
Nanology, nanography, nanogony - nanometry, nanonomy, nanonics (nano technology)

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