Japan Geoscience Union Meeting 2012
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G01-P01 Room:Convention Hall Time:May 20 13:45-15:45

Decrement of Night-Sky Brightness after the Tohoku Earthquake

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Night-sky brightness caused by artificial lights with human activities has become a serious obstacle to the ground-based astronomical observations. Undesired brightness called ”Light Pollution” is known as one of the environmental hazard, and observational data of night-sky brightness have been reported by the Ministry of Environment of Japan. In the other hand, statistical observation of night-sky brightness and artificial light are desired to clarify the relationship between them.

We installed an digital camera to measure night-sky brightness in Yamanashi Prefectural Science Center located at Kofu city, and had directly compared the night-sky brightness with artificial lights from October 2009. The night-sky brightness highly correlates with artificial lights measured for two years. This result means that bright sky over cities are strongly affected by the artificial lights. Under the assumption that the correlation between night-sky brightness and artificial lights depend on size of city and population, we installed new camera in Sumida Lifelong Learning Center of Tokyo from November 2010. This camera can observe more polluted night-sky of Tokyo, and we expected to clarify the time variation of brightness over Tokyo.

We adopt commercially available digital cameras to measure the sky brightness. We use green channel of RGB bands for measurement because visibility of human eyes has peak of green. In addition, for accurate measurement, we chose RAW format of digital camera, which is not compressed and combined the Bayer pattern. We calibrate sensor response against input light intensity to achieve gamma linearity using calibrated gray scale chart. Because digital camera sensitivity is individually changing, we calibrate sensor gain by measuring standard star on the images. We adopt Johnson V magnitude as a standard star brightness because spectral characteristics of green band on consumer digital camera has similar response of Johnson V band filter. Both camera takes the images every 10 or 15 minutes from 18:00 JST to 6:00 JST for every night.

After the Tohoku earthquake at March 11, 2011, city lights in Kofu city decrease about 40% compared to the lights measured before. As the city light is reduced, the night-sky brightness in Kofu city and Tokyo decrease about 40% after the earthquake. The brightness in Tokyo on April 4, 2011 shows value of 17.1 mag/arcsec^2 while the brightness from November 2010 to February 2011 shows value of 16.5 mag/arcsec^2. Because no intended power outage was brought in operation during observation period and it was found that billboard and outdoor lightings turned off from the night view of Kofu city, only energy saving made the night sky darker. In most cases, light sources which illuminate night sky are waste of electric power. For assessment of light pollution and evaluate the efficient power usage, it is desired to measure night-sky brightness over the long term.

Keywords: night-sky brightness, photometry, digital camera, light pollution

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G01-P02 Room:Convention Hall Time:May 20 13:45-15:45

How to launch the Science of Science

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We envisaged the creation of a science which deals with the seventh major event in the history of the earth, that is, the rise of science itself. We named it the Science of Science. The aim of our paper is to map out a blueprint for bringing the science of science it into shape.

Needless to say, even now there are some rudimentary attempts which could fall into the category of the science of science; cognitive psychology of scientific reasoning, sociology of science, scientometrics, anthropological study of laboratories and so on. And also we have long-established field called history of science, which describes the actual developmental process of science in detail. What we lack is something like a canvas on which we can synthesize findings of these preexisting research fields and paint a phenomenon called science with the whole history of the earth in the background.

We claim that a radically naturalized Kantian philosophical project can play a role of such kind of platform for launching the science of science. The Critique of Pure Reason can be re-interpreted as a task analysis of modern science. First, Kant posits a information processing agent which receives manifold of sense as an input and delivers scientific worldview as an output. Then, he sets about a task analysis which tries to answer the question what kind of subtasks are necessitated for this agent to complete the computation of the cognitive function described above.

Nevertheless, Kantian task analysis lacks a viewpoint of evolution which can make an issue of how such a unique information processing agent could and did emerge. In addition, Kantian analysis is too individualistic in that it models an agent doing science as a mind of an isolated individual man. However, the real science is being done by a complex made of many scientists and artifacts such as experimental instruments and institutions like a peer review system etc.

So, the challenge we are facing is to answer the question how we could build social and evolutionary viewpoints into the pioneering project of Kant.

Keywords: science of science, philosophy of science, naturalism

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G01-P03 Room:Convention Hall Time:May 20 13:45-15:45

A natural view of the World in philosophy of science provided by interpretation of the Earth's evolution history

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We are proposing one of the new designs of the World view, which is not science but metaphysics, whereas it is based on the latest scientific understanding on the origin and development of life and its evolution to higher ability of sensing environments, processing of information acquired, and further feedback to itself together with environments. Anthropic view is emphasized in designing the World view, since our intellectual ability of understanding the World through science is a result of a particular evolution path with specific cultural history under the specific environmental condition for anthrop. Our intrinsic requirement is to acquire the hopeful view and strategy on the successive survival, or 'ikitsugi', which is identified with a successive continuation of intellectual working to understand the World further.

Our natural World view is designed primarily as consisted of the minimum number of essential factors in a causal space in time domain. Our idea is to choose the three; (A) past, (B) present and (C) future all in a form of question and answer. (A) is how the World has been working on the metaphysical basis, (B) is how the epistemology called science works, and (C) is how we design the future World by incorporating axiology naturalized with science and technology in the society.

(A) is given by summarizing interpretations of the latest 'historical science knowledge' acquired by (B) on the evolution of space (e.g., big bang), coevolution of life and Earth environments, our whole culture including philosophy and science as natural phenomena and also creation of the World view in (A).

(C) shall be our relevant target of 'future science' unifying all of our intellectual activities towards the survival continuation or 'ikitsugi' of intellectual agent for the World in (A) to keep working in a self-reference by feedback.

We have assigned (B) to play a central role in constituting the whole view by interpretation, and the 'ikitsugi' as our hope to be a central dogma. Therefore, the World view proposed here is metaphysical in character, whereas its foundation is placed on science concept and also on real intension of anthrop and its possible successors.

The world view above is not unique since it is based on the supposedly reasonable interpretation of science knowledge beyond its extent. Any alternative goes as a matter of course. A sound world view is expected to possess a potential of wide span including everything. We have presented only a basic framework of the world view alone without any discussion and application to specific subjects in detail in this abstract. However, this view is a result of our intensive exploitation so as to be useful for scientists, philosophers and other professionals in their respective works in detail. Further we intend to make it useful for the people in acquiring the comprehensive and systematic science literacy essential for designing our future society.

We are now working on the description of detailed structures of this world view in each of (A), (B), (C) and their interrelations. Some of them will be presented in detail at the time of JGU meeting. We note several practical utilities of the new world view as exemplified below.

(1) The present World view is designed to provide us with a basic framework of reconstructing the philosophy of science to match with the sense prevailed in working science laboratories.

(2) It will promote a really naturalized attitude in philosophy itself to be adapted to science age. The consequence is the practical and realistic stance towards the axiology substantially naturalized to match with 'future science' for our own future 'ikitsugi'.

(3) Many philosophical concepts and terminology are interpreted or translated into the comprehensive and useful ones for scientists and others by means of this framework of World view.

Keywords: philosophy of science, world view, decoding Earth evolution program

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G01-P04 Room:Convention Hall Time:May 20 13:45-15:45

Where and how did science come from? A cognitive approach.

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Scientific activities started as one of the greatest events in the history of the earth. Thus the historical question 'where and how did science come from?' can be also investigated in geoscience in so far as one of the aim of geoscience is to reveal the history of the earth (e.g., Kumazawa, Ito, and Yoshida 2002).

In fact, such origin and historical development of science has been vastly studied in the traditional metasciences such as history, philosophy, and sociology of science since the 19th century. However, these traditional metasciences have not focused on the following questions: What and how do scientists do think? When and how did humans acquire the scientific thinking in their evolutionary history? Why is it impossible for other non-human animals to engage in scientific activities? Especially, the last two questions are important to consider the history of science in terms of the geoscientific time scale.

To consider these questions, first, it is useful to look at recent developments in cognitive studies of scientific thinking (e.g., Anderson, Barkar, and Chen 2006; Carruthers, Stich, and Siegal 2002; Feist 2006; Giere 1992; Gorman 1992; Holyoak and Thagard 1995; Mithen 1996, 2002; Nersessian 2008; Simonton 2004; Thagard 2012), where the results of cognitive science and other metasciences are connected to elucidate how scientists do think in their activities. A consensus from these studies is that abstract thinking such as analogy and modeling is necessary for creative reasoning in science.

Then where did such abstract thinking come from? This is a question we would like to investigate in this talk. More specifically, first, we will outline some of the above works developing insightful arguments on the question (e.g., Holyoak and Thagard 1995; Nersessian 2008). Second, we will extend and update these arguments through examining more recent arguments in philosophy (e.g. Carruthers 2006, 2008; Dutton 2009), cognitive archaeology (e.g., Coolidge and Wynn 2009), and comparative studies of huamns and non-human animals (e.g., Haun and Call 2009; Penn, Holyoak, and Povinelli 2008).

Keywords: metascience, history of science, philosophy of science, cognitive science of science

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G01-P05 Room:Convention Hall Time:May 20 13:45-15:45

Model, where earth science and the philosophy of science meets

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We carried out a project called "Decoding the Whole Earth History", in which we identified the birth and development of science as the seventh big event in the Earth's history. A natural extension will be to locate science in the Earth's history through a more intensive investigation. On the other hand, philosophy of science is also trying to locate science in a broder perspective of human intellect. Having this aim of locating science in a broad perspective in common, we have organized a group of scientists and philosphers.

Nevertheless, we have realized difficulties in finding topics with common interest. Since modern philosophy of science originates from logical reconstruction of mathematics and the advent of quantum mechanics, the main theme of philosophy of science has been the logical reconstruction of the logic of science and the ontology of physical object. These topics are distant from the interest of earth sciences. However, with the recent turn of philosophy toward naturalization, we have found various common topics, one of which is the problem of scientific models.

In earth sciences, models play a central role in explaining various natural phenomena. On the other hand, in the philosophy of science, semantic conception of scientific theories tries to characterize models as representations of the world. However, the characterization has been found difficult due to the diversity of scientific models (Nakao, 2011). We have thus tried to classify scientific models from the viewpoints of both science and philosophy, with examples taken from earth sciences. We classify models into three categories: reality-representing type, idealization type, and hypothesis type. We further classify the reality-representing type into prediction type and causal-explanation type. With these classification, we explore the diversity of models, thereby trying to characterize explanations in earth sciences.

Keywords: model, classification, earth and planetary sciences