

# A NEW SCIENCE OF HUMANITY: A TRIAL FOR THE INTEGRATION OF NATURAL SCIENCES AND THE HUMANITIES TOWARDS HUMAN SECURITY AND WELL-BEING

HIDEAKI KOIZUMI

## 1. INTRODUCTION

The modern age, especially science and technology, achieved great progress through the philosophy of reductionism proposed by Descartes. The idea of breaking things down into their basic elements led to the establishment of an exact science, enabling a more accurate understanding of nature, and generating new technological applications and industries. Disciplinary fields, however, were as a result subdivided, characterized by sectionalism and specialization, which made mutual discussions of a trans-disciplinary nature difficult. The coming 'post-modern age' is predicted to see an increase in the interaction between and fusion of these segmented disciplinary fields and the creation of new integrated fields. Such a post-modern age might be referred to as 'the age of integration with a comprehensive overview', whereas the current modern age is called 'the age of reductionism'. A methodology or behavior pattern to allow such integration with an overhead view might be a trans-disciplinary approach that synthesizes the science of humanity, the social and natural sciences, and integrates disciplinary and practical fields [1].

One prototype for the trans-disciplinary integration with overhead view is a 'New Science of Humanity'. This paper attempts a partial 3-D spiral synthesis of brain science, developmental behavioral science, cognitive science, psychology, anthropology, linguistics, pedagogy and ethics, based on physics and biology, using completely non-invasive high-order brain-function imaging, with a goal to integrating them in a New Science of Humanity. In synthesizing different fields into a New Science of Humanity,

those fields must be integrated and sequentially combined as an interactive entity, taking advantage of the fundamental concepts shared by those fields. This paper regards all natural phenomena as a probability process, and surveys and integrates the existence of matter as reciprocal, that is, the time during which a state might be sustained ( $t = \tau \exp(E/kT)$ ,  $\tau: 10^{-13} \sim 10^{-14}$ s, by E. Schrödinger (1951)). Assuming that a hierarchical structure of matter is formed, based on the sustainable time of that state, the basis is the dynamical mutual interaction of the four kinds of forces. Based on such a perspective, the same logical development can be applied to physical and biological evolution. Morphologies, structures and functions generated from them can be surveyed and integrated from a topological perspective. In this paper, the combination of physical and mental elements from such a perspective is attempted for understanding contributing to the achievement of human security and well-being.

## 2. PRACTICAL INTEGRATION BETWEEN DIFFERENT DISCIPLINES

The primary points of the survey and biological entities to be integrated in this paper are as follows:

- No. 1: The essential conditions for generating, driving and sustaining the global biosphere are defined by the mass of the earth (its gravity), and the distance between earth and the sun.
- No. 2: The above conditions allow the creation of a thin-film atmosphere that consists mainly of nitrogen, oxygen, vapor and carbon dioxide.
- No. 3: For Nos. 1 and 2, the average temperature of the earth's surface is kept at 15°C (288 K) (including the greenhouse effect of 33°C) corresponding to a thermal energy of 0.0248 eV.
- No. 4: For Nos. 1 and 2, the global biosphere can work as a thermodynamic external-combustion engine, because it is irradiated by high-energy low-entropy photons from the sun and emits low-energy high-entropy photons to the universe.
- No. 5: For Nos. 1 and 3, hydrogen bonding (bonding energy: around 0.1 eV) can handle entropy, which is necessary for hydrologic circulation and sustaining life forms.
- No. 6: The conditions for Nos. 1 and 3 enable DNA (base bonding energy: 2~3 eV) to sustain genetic information for a long period of time.
- No. 7: The global biosphere and plant cells containing chloroplast are

- regarded as partially isomorphic from a topological perspective on energy and entropy.
- No. 8: Animals take in plants and other animals in the food chain and therefore can be considered as thermodynamic internal-combustion engines.
- No. 9: With a topological survey of biological evolution, the structures of all animals from lower vertebrates to humans can be considered to be isomorphic.
- No. 10: Genes slowly adapt to environments by repeating intergenerational gradual modification, and the cranial nerve system adapts by nerve selection (synapto-genesis and elimination) within one generation of individuals.
- No. 11: Using non-invasive high-order brain-function measurements, mental activities are observed as physical phenomena based on neuronal network information processing, and quasi one-to-one correspondence between the mental and physical elements may be possible.
- No. 12: 'Learning' is considered to be a process of establishing central nerve circuits by receiving external stimuli from environments (all surrounding things and people excluding oneself), and 'education' is the process of controlling and supplementing such external stimuli.
- No. 13: Modern man's cerebrum, which still retains the trace of evolution, works on a subtle balance of information processing between the old cortex (the cerebral limbic system) and the new cortex.
- No. 14: A New Science of Humanity can help develop a deeper understanding of humans and human behavior by grasping the essence of the human brain and incorporates research related to social systems.

The abovementioned does not mean determinism because the genetic and epigenetic processes are highly interdependent. The large part of the brain, an information processor, is constructed by stimuli from the environment. Uncertainty often appears in complex systems.

### 3. THE PURPOSE OF 'A NEW SCIENCE OF HUMANITY'

The abovementioned accumulation of special physical factors created the global biosphere. How will a global biosphere with a 3.8-billion-year history transform into a solar system estimated to last another 5 billion years? Can humans sustain their existence? It may be necessary to ask if

the existence of humans who themselves are drastically changing the global environment, is really desirable from the perspective of sustaining the global biosphere. We humans have been destroying tropical forests, turning land into deserts, destroying the ozone layer, and polluting the hydrosphere and atmosphere. We are also contributing to the rapid extinction of many species. We cannot deny the possibility that the existence of humans, with our hypertrophied cerebral new cortex, radically increasing every kind of human artifact and deteriorating the global environment, is like a cancer to the global biosphere. The hypertrophied cerebral cortex, however, has also enabled reason, wisdom and complex sensitivities. Human-specific religions, ethics and morality were born, and a high-level mentality such as 'compassion' is a result.

On the other hand, 'hatred', which also emerged during evolution, is a persistent and intense emotion, sometimes passed down to descendants, hidden at the bottom of a culture. Current international conflicts involve 'chains of hatred and violence'. Research to eliminate such hazardous chains, combined with such concepts as 'human dignity' and 'acceptance of diversity', is highly practical, substantial and desired by people worldwide.

As a realistic research system, research addressing new bioethical issues might also be valuable. For the first time in our history, we humans are close to obtaining a methodology for reading minds from the outside. We must be cautious and meticulously so, however, in our approach to the possibility that even a small part of the mind might be exposed. To address this ethical issue, an innovative ethical committee to concurrently connect and conduct the practice and study of ethics is being prepared under international alliance and guidance. One of the principal goals of the New Science of Humanity is to understand 'learning' and 'education' as an exact science. In this paper, I have attempted to prepare guidelines for basic ethics through an overview and integration, since a desirable future for humans will be based on 'education', in its extended meaning. We are committed to the achievement of human security and well-being.

#### 4. PRACTICAL TRIALS

As a concrete methodology, the focus is on non-invasive brain-function measurements to propose a new framework of human science. 'Optical Topography', an original creation of the author and his colleagues, is a completely non-invasive higher-order brain-function imaging technology which

may be used anywhere (even at the bedside, in the living room or in an automobile), anytime (even during sleep or motion), by anybody (even by neonates, children or elderly people) [2]. The author believes that this could be the first instrumentation to integrate natural sciences and the humanities. Practical applications of Optical Topography will be mentioned, as well as the present status and the future of the 'Brain-Science & Society' Research Initiative including 'Brain-Science & Education' [3], 'Brain-Science & Ethics' [4], etc., are some Japanese national programs being conducted from the viewpoint of human security and well-being. In the 'Brain-Science & Education' initiative led by the author, there are 12 trans-disciplinary projects over 3 years for each; 1 major developmental cohort study project (National Children's Study), and 6 satellite cohort study projects with non-invasive higher-order brain-function analysis at least over 5 years.

## 5. BRAIN-SCIENCE & ETHICS

'Brain Sciences and Ethics' is also a possibility for a new field of study; to render the brain function images of the limbic-type which attacks or defends on perception of personal danger, the reward-seeking-type which perceives reward (from instinctive pleasure to prestige), the relationship between the new and old cortex which controls emotions such as love and hate, and the ability to read others thoughts (Theory of Mind) to research. The frontal lobe, particularly well-developed in humans, is where humanness is born. A warm heart, the ability to empathize, consider things from another's viewpoint, are an extrapolation of the mind theory, and perhaps the type of ethics that the world today needs.

At the same time, ethical issues regarding brain science itself have been raised. The brain houses the most private intimate thoughts of a person. In 1999, on the request of families of ALS patients (Amyotrophic Lateral Sclerosis), the author and his colleagues measured the brain activity of ALS patients in a completely locked-in state in cooperation with a medical school. When the son of a patient spoke, the area of the brain which controls semantic understanding (the Wernicke area in the left hemisphere) was activated. Next, when we asked the patient to turn and try and speak to his son, the area of the brain which control speech (the Broca area in the left hemisphere) was activated. It was then, for the first time, that we realized that this patient had full consciousness and mental capabilities. Further, using brain imaging techniques, we were

able to allow the patient to communicate with the family for the first time in two and a half years. By asking the patient to imagine different things for a 'yes' or 'no' reply to questions, it was possible to distinguish the different responses [5]. While providing a glimmer of light to the unimaginable anguish of the patient on life support and the family, it also raised the ethical question of whether it was a good thing to be able to observe what a person is thinking about from the outside.

It is commonly held that science and technology itself is neutral, and that whether it is good or evil depends on the humanness of the people using it. At the same time, the naïve logic that therefore a scientist may research whatever takes his or her fancy, is no longer accepted. An ethics which defines the ideal human nature is also required by scientists, not an ethics which determines how much 'progress' may be permitted in a given line of research. A workshop entitled 'Brain-Science & Ethics', sponsored by JST, was held in March 2005.

## 6. CONCLUSIONS

'Warm-heartedness', as human nature, has many meanings including compassion, but I believe it is based on an ancient Indian philosophy which finds its origins in the Pali terms *metta*, *karuna*, *mudita*, *upekkha*. *Metta* is unconditional loving kindness, such as that in the gentle heart of a good friend or a mother; *karuna* translated as compassion, is the ability to share another's pain as if it were one's own; *mudita* is the altruistic joy in another's good fortunes, and *upekkha* (also *upeksa*), translated as equanimity, is a balanced state of mind with no strong attachments.

The Pali language has been used for about 2,500 years, originating from regional and unsophisticated ancient Indian languages. The original thoughts on the above words existed before Buddhism. I believe these qualities are at the very core of human nature, going beyond the boundaries of a religious concept, and are a key to human dignity and happiness. Advanced neuroscience has recently begun to succeed in scanning functional areas responsible for these neurological mechanisms, and developmental precursors using noninvasive brain-function imaging. For example, there is growing evidence suggesting a relationship between the medial frontal lobe which projects nerve fibers from the old cerebrum cortex to the new cortex, and imagining oneself in another person's situation (Theory of Mind). Finally, I believe that in pursuing human happiness and to break the

'chain of hatred', it is essential to understand the workings of the brain and mind. This is why I am devoted to the 'Brain-Science and Education' Initiatives mentioned above. It is my sincere wish that today's infants, children and their offspring will find a happy and peaceful future.

#### REFERENCES

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