MEASUREMENT AND EVALUATION OF HUMAN BEINGS FROM THE VIEWPOINT OF PHYSIOLOGICAL ANTHROPOLOGY

Akira Yasukouchi
Department of Physiological Anthropology,
Kyushu Institute of Design, Fukuoka, 845-8540, Japan

1. Physiological Anthropology

Physiological Anthropology is a study that branched out of the Anthropological Society of Nippon. The research philosophy is originated from a lecture of "Physiological Anthropology" first delivered by Professor Toshihiko Tokizane at the University of Tokyo in the 1940s. This was followed by organized research efforts by Professor Masahiko Sato, a student of Professor Tokizane, to eventually establish the current status of the Japan Society of Physiological Anthropology (Sato, 1994). Although the word "physiology" in the original context of the Chinese characters, or kanji, may be interpreted as 'taking the living human beings as the subject of study', we have since conducted our research studies in the spirit of incorporating the 'reasons for or principles of living' for human beings as well.

Physiological anthropology focuses particular attention upon human beings as the subject living in today's highly technological society. This is because while more than 99.8% of human history spanned across a period of hunting and gathering during which the human race has gradually adapted, our present technological civilization, where an environment encompassed with sudden development, presents many challenges to the intrinsic physical resources of human beings.

Therefore, while attaching importance to evaluating the characteristics of human beings from a viewpoint that takes the past, present and future into consideration, it is important to create living environments and/or systems which precisely converge and accommodate with those characteristics.

The following quote is taken from the 'Aims and Purposes' of the Japan Society of Physiological Anthropology:

"Rapid advances in science and technology are having a profound effect on the human community, in terms of not only lifestyle and culture but the physiological capabilities of the human body as well. The Japan Society of Physiological Anthropology conducts research into humans in modern society from both a physiological and a cultural standpoint, in an effort to create a truly healthy and comfortable living environment."

2. The Significance of the Pursuit of Human Comfort in Physiological Anthropology

As is stated in the 'Aims and Purposes', we focus special attention on such terms as "comfort/pleasantness" or "comfortable". Not only humans, but at least all vertebrates are likely to sense comfort/pleasantness or discomfort/unpleasantness. It is only obvious that the brain processes these emotional elements. Olds and Milner (1954) discovered voluntary intracranial self-stimulation which leads to a rewarding effect, and this sensation is thought to have triggered by emotions related with comfort/ pleasantness in most probably the brain. According to research conducted since then, regions which respond to reward/comfort and aversion/ discomfort exists in brains of the Animal kingdom - from fish to humans. This is proof of the existence of an emotion center/system in the brain. It can be implied that this emotion center/system has

played a pivotal role in the history of evolution and adaptation of vertebrates.

Continued existence for animals hinges upon an important factor adaptation to the ever changing environment persistently being encountered. Behaviors, influenced by the process of perception or cognition of environmental stimuli, therefore mould into a response constituted with either reward/comfort or aversion/discomfort in encounters where beneficial or detrimental stimuli are respectively sensed; accordingly the animal approaches in the case where reward/comfort is perceived, and retreats in the case where aversion/discomfort is sensed. Such behaviors contribute to not only sustaining lives, but also promoting a better lifestyle. However, as the highly developed intelligence of the intricately evolved neocortex has to be factored in the case of Homo sapiens, vast individual differences in emotional reactions thereby prevail.

Persistent previous attempts to study central nervous system (CNS)-associated reward and aversion in experimental animals have revealed transition in size of emotion-related neuronal nuclei in the evolution of primates. Stephan and Andy (1979) and Eccles (1989) have demonstrated the size of nuclei associated with especially the amygdala and septa (Table 1). Application of the size of nucleus as an index in interspecies comparisons of primates involves correction of the interspecies differences in body weight.

The centromedial group is closely associated with aversion such as anger and aggression, whereas the reward-related cortico-basolateral group and septal region are thought to be the reward centers (Table 1). Insectivorae, the most primitive primates, harbor the reward and aversion systems in the amydala with both these elements occupying 50% each of the nuclei. On one hand, the relative size of aversion in human amygdala registers one-half that of insectivorae, manifesting a size index of 2.52 folds. On the other hand, when the reward-associated cortico-basolateral group expands to a capacity of 75%, the size index increases to 6.02 folds when compared with primitive primates. In the septal region related to similar reward feedback, the tendency is comparably similar.

The brain regions related to reward/comfort in humans has thus been developed markedly, emphasizing the importance of such CNS sites in the human pursuit of achieving a better living lifestyle beside facilitating human evolution, adaptation and survival promotion.

Through evolution, humans have managed to attain an highly developed and intricate neocortex that facilitates structuring technical development to build an artificial environment and construct livelihood-related tools in promoting a security system for sustaining life forms by humans per se. As such, further developing the reward/comfort-associated brain

Table 1. Size comparisons of the amygdala and septum in insectivores, prosimians and simians.
(Stephan and Andy, 1979 cited from Eccles, 1989)

	AVERSION		REWARD		
	Centromedial group		Cortico basolateral group		
	TAC (% vol)	SI	TAC (% vol)	SI	Septum
Basal Insectivora, Aver. (N = 4)	46.8	1.00	53.2	1.00	1.00
Insectivora, Aver. (N = 50)	46.8	1.08	53.2	1.13	1.22
Prosimians, Aver. (N =18)	31.1	1.16	68.9	2.23	1.91
Hylobates (Gibbon)	23.4	1.20	76.6	3.24	2.46
Gorilla	26.4	0.88	73.6	1.94	2.16
Pan troglodytes (Chimoanzee)	27.4	1.11	72.6	2.28	1.87
Pongidae, Aver. (N = 3)	25.7	1.06	74.3	2.49	2.16
Homo sapiens (N = 1)	24.7	2.52	75.3	6.02	5.45

Abbreviations: TAC; total amygdala complex, SI; size index, Aver.; average, N; the number of species

systems would lead to promotion of a better living lifestyle. Since birth, humans have thus establish a status quo where the aspiration and desire to persistently secure a pleasant living lifestyle are incorporated within the living systems, orientating the Homo sapiens to purposely develop a human environment that would afford better comfort and amplify pleasantness.

However, this trend has been successfully evolved up to the period where humans led a lifestyle by hunting and gathering, i.e. more than 99.8% of human history to date. It should also not to be taken for granted that the modern civilization/society was born out a transient geological scale.

According to Masanao Toda (1992), emotion is regulated as a behavioral adaptation system that appropriates special features of the wild untended environment. This implicates that a rational behavior is guaranteed when a specific behavior follows the emotion molded in a certain wild environment. For such a system to adapt to a civilized environment, certain discrepancies are bound to occur. When humans seek comfort/ pleasantness based on instincts in a civilized society, Homo sapiens often do not realize that such discrepancies would provoke various potential problems. Physiological anthropology focuses on reward/comfort because improving and securing a better living lifestyle by suggesting and establishing appropriate "reward/comfort" reflecting human nature are the physical/mental features intrinsic of Homo sapiens.

However, the complex/integrated and highly developed human brain is structured physically according to anatomical constructions of the body as well as moulding and innovating various procedures to successfully compete for the opposite sex and food within a group, whether on an individual vs individual or group vs group basis, in securing mutual cooperation and avoiding interactive friction. In the midst of this, development of the brain, especially the neocortex, is preferentially promoted (Sawaguchi,1996). The accompanying development of intelligence enriches communication when expression of emotions from an individual could be transmitted to and appreciated by the others, further stimulating the reward-associated systems as a result of sharing feelings and appreciating gratitude. This chain-development cultures reciprocal altruism and promotes moulding of prosocial behaviors (Sogon, 1997). This shared beneficial behavior prevailing in the numerous constituting members of such a social group is transformed through a selective process on a long-term basis in that particular

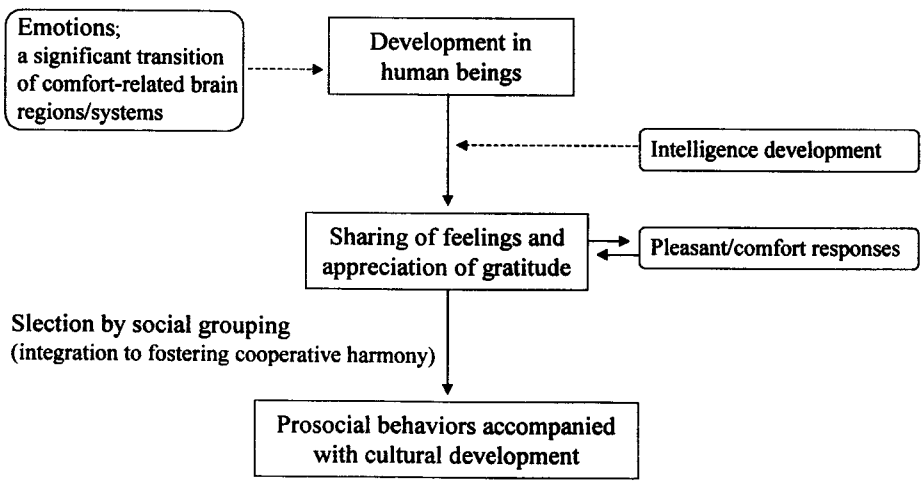


Fig. 1. Relationships between emotions and prosocial behaviors/culture

group to eventually intensify and integrate to structure a form of culture such as habits and traditions (Fig. 1). In short, culture is a purposeful vehicle that adapts to a certain environment through a performing process in life activities by humans (Sato, 1994).

In the pursuit of comfort/pleasantness, humans have fabricated civilization/culture. As such, the pursuit of human reward/comfort would accompany by the development of civilization/culture, and attention has recently been focused on establishing symbiotic existence with the immediate surrounding living system and global environment on mother Earth in such pursuits.

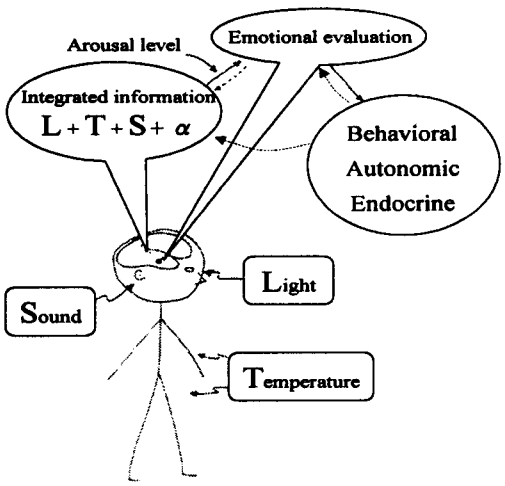
3. Determination and evaluation of reward/comfort responses

Aspiring for technical advancement, the trend of development taken may not conform to the basis depicting special biological features of humans. In the midst of such an attempt, attention has shifted to subjective responses encompassing human emotions such as comfort/pleasantness and feelings, emphasizing on coordinating environment- friendly industrial products. As such, comfort/pleasantness depicted here should/must conforms to and coincides with the concept of KOSES and Physiological Anthropology.

3.1. Mechanism of comfort/pleasantness responses

Information via the sensory nervous system in brains is first processed by the primary sensory area corresponding to the respective modality, chain-processed then at the unimodal association site followed by proceeding to the polymodal association area and the information is eventually integrated before being conceptualized and contextured via processing in the hippocampus and relaying terminally to the amygdala. It is at this site that evaluation of emotions associated with comfort/ pleasantness is finally realized.

Fig.2 illustrated an example for an actual situation. When receptors of the retinae, hypodermis and inner ear respond to the respective stimuli perceptive to the physical environment such as lighting,ambient temperature and sound, signals are transmitted to the respective primary sensory area of the neocortex. From there, the polymodal sensations are integrated and then processed on transmission via the hippocampus, enriching the inputs with the peculiar valuation and preferences molded via previous memories, learning and actual physical experiences in the individual concerned (α in Fig. 2).



The information is then "stained with colors" before relevant significance is interpreted by the individual per se, whereupon biological significance evaluation/recognition are processed at the amygdala, followed by emerging emotional experiences.

As such, when physical conditions such as lighting and acoustic stimuli given at the same ambient temperature are altered, the physiological and psychological states of subject are affected, even in thermal sensation. In doing so, comfort/pleasantness is not subjected to a unimodal sensory input, integration of all inputs/information is actually required - a single word would not be appropriately precise enough to express and describe such responses. This is actually the sensibility/rationality pursued by KOSES. In addition, as pleasantness/comfort responses or sensibility is reflected by global information

through the neocortex, the responses are most likely composed of rationality.

Therefore, it can be said that the attitude of evaluating pleasant/comfort responses as emphasized in physiological anthropology converges completely with the pursuits of KOSES.

3.2. Evaluation methods of reward/comfort responses

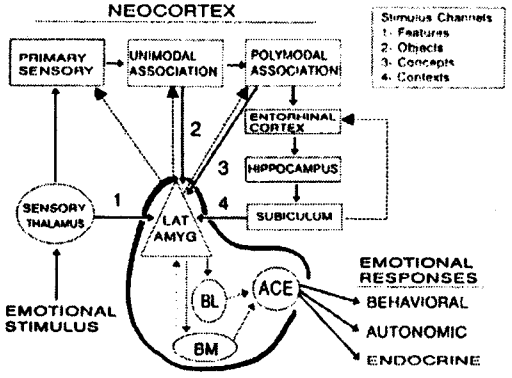
Emotions (biological significance evaluation/recognition) generated through functions of the amygdala mould the output systems in coinciding responses from the autonomic nervous, hormonal and motor systems (Fig. 3).

Fig. 2 illustrates integrated information preceding to evaluation of emotions is subjected to a bias by the arousal level. The arousal level therefore influences the output systems after evaluation of emotions.

For instance, when a pleasant office environment is subjected to evaluation, more than being cozy an environmental condition that facilitates work performance concentration and encourages motivation in working is preferred. To therefore complement such a physiological condition, the arousal level of humans has to be maintained at a certain appropriate state, a level that is near or just optimal. Moreover, the tonus of parasympathetic nervous system in the autonomic nervous system attenuates to render the relative activities of sympathetic nervous system prominent. However, in the case where coziness in a living room is demanded on returning home after work, a relaxing atmosphere is much desired. A situation or an atmosphere where the arousal level is tuned to a appropriately lower level, triggering a condition where preferentially parasympathetic activities are enhanced to a more pronounced/prominent level.

Equipment required for determination and materials that are supposed to be measured in this field of study are not particularly unique in mode and nature. The approach and concept innovated for analysis/evaluation of the themes are in fact important and essential.

Although the evaluation methods for pleasant responses have not been homogenized and fully coincided to establish a perfect approach/system through our conferences, the current trend focuses on analyses of the arousal level and autonomic nervous system-derived responses. More concrete studies focused on the effects of artificial lighting/illumination and color temperatures will be introduced in our presentation.



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