

身体知 - Emotion の視点から - *

Natural Intelligence

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Abstract: Until now, emotion has been discussed mainly in terms of the individual, and in a passive way. However, with the rapid changes in society and the expansion of our living space, it has become important to consider emotion from a broader perspective, from the individual to society. Although our perspective has broadened, our way of thinking remains as passive as ever. However, the original Latin word for emotion means to take action, and such active discussions have hardly taken place. Therefore, in this lecture, I will discuss how we can utilize emotion to create the next generation of society.

1. INTRODUCTION

"Social Emotion" is getting wide attention these days. Indeed, although "Emotion" has been discussed many times, most of them discuss personal emotion. "Social Emotion" points out that emotion should also be considered and discussed in much wider framework of society. I totally agree with this opinion. But the current discussion of "Social Emotion" is only paying attention to emotion in the current framework of society.

This paper proposes that we should further consider developing a new society by making the most of emotion. As the Industrial Society is getting close to its end and now we need to design and develop the next society. The Industrial Society was brought forth by the Industrial Revolution, which is product-centric. So their productivity and performance were important. And as they are tangible, we could count them. We could apply quantitative and objective evaluation.

But the Industrial Society brought forth many issues, too. One of the important problems is excessive consumption of energy. We are running out of energy. We cannot sustain the society in the present framework of the Industrial Society. Today, such tools as ChatGPT, generative AI are expected to be solutions for these problems. But they use a lot of energy, too. Thus, unless we design and develop a completely different society, we

cannot survive anymore.

Fig. 1 shows the change of society with time. The world 1.0 is the current Industrial Society and the world 2.0 is the next society. The world before the Industrial Society is world 0.0.

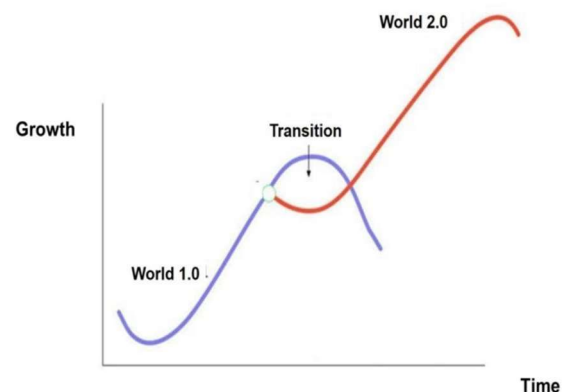


Figure 1. Society change with time

What comes up as a promising solution is that we, humans, can think about the future. We can live for tomorrow. In fact, in the old days, we challenged to make our dreams come true. And "Emotion" played an important role for motivating us to this challenge. We, human, are different from person to person. Thus their ways of feeling are very much diverse.

This paper points out that the current Industrial Society is coming to its end. So, we must start to design and develop the next society. The Industrial Society has created many problems, such as decreasing labor force, excessive consumption of energy. Although population is

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increasing in the developing countries, it is quickly decreasing due to decreasing childbirth in the developed countries. Therefore, the developed countries cannot sustain industry due to the lack of labor force. In the developing countries, there are enough number of labor force, these people lack literacy, so they cannot run the system. More important issue is excessive consumption of energy. We are running out of energy source.

Therefore, we need to design and develop a next world in a completely different framework. This paper discusses how we can design and develop such a new society for the next generation and proposes an approach to achieve this goal.

2. WHAT CHARACTERIZES HUMANS

we can think about the future. Animals live for now. They do their best to adapt to the current environment and situation. So, when they change, many animal species die out. But we look for emotional satisfaction, so we grow emotionally. Thus many human species survive. In short, we keep on with evolution.

We, humans, live for tomorrow. As Abraham Maslow pointed out (Maslow, 1943) we, humans, try to satisfy our material needs, such as food and housing, for today just as animals do, but with time, we come to pursue mental satisfaction. i.e., emotion and finally we make our maximum efforts to satisfy our emotions. And we are different from person to person. Our body builds and the way of feeling vary individually. Yes. That is "Selfactualization". We would like to establish the world of "Self" (Fig. 2). Interestingly enough, the title of his paper in which he proposed this idea is "A Theory of Human Motivation". It truly indicates how emotion and motivation are closely related.

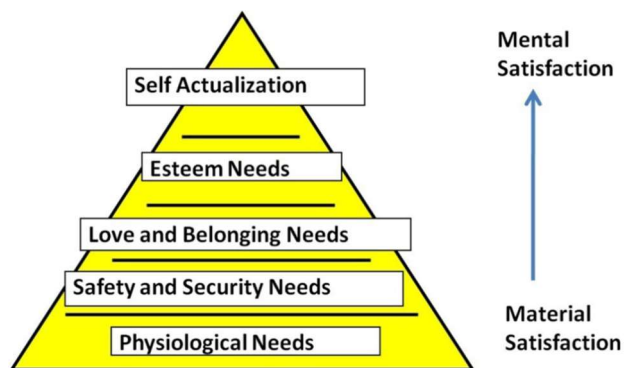


Figure 2. Maslow's human needs

As we pay our efforts to establish the world of "Self", the human species increase diversity. Therefore, even the outside world changes, and many animal species die out, many human species survive.

About 40 years later after Maslow, Edward Deci and Richard Ryan proposed "Self Determination Theory" (Deci and Ryan, 1985), in which they clarified that we get the maximum happiness and the feeling of achievement, when we do the job internally motivated and self-determined, and no external award can provide this level of happiness and the feeling of achievement.

Thus, the current Industrial Society certainly satisfies our material needs, but it cannot satisfy our mental needs. We are not emotionally happy in the current Industrial Society.

Deci and Ryan clarified another important point. Self-Determination is deeply associated with "Growth".

This brings us to realize that Maslow's human needs meant that humans would not be able to adapt to changes in the outside world if they continue to respond like animals. Thus, this leads us from satisfaction of material needs to spiritual growth.

3. PERCEPTION-MOTIVATION-DECISION MAKING-ACTION-EMOTION (PMDAE) CYCLE

Fig. 3 shows how we pursue emotional satisfaction.

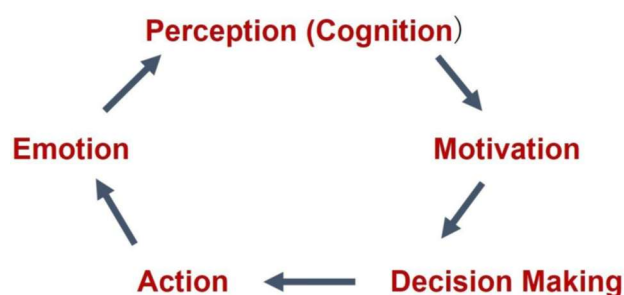


Figure 3. Perception-Motivation=Decision Making-Action-Emotion (PMDAE) Cycle

4. EMOTION AND MOTIVATION

We should remember that "Emotion" and "Motivation" come from the same Latin "Movere". And emotion means "e=ex+motion". Thus, emotion literally means to "move

out". In short, it means that we go out into the outside world to establish our own world.

Up to now, we have been considering emotion on a personal basis. The emergence of "Social Emotion" changed the scene. But still we see emotion as an outcome. However, if we consider its Latin origin, we realize that emotion motivates us to take action.

So what tools do we have? We are currently in an age of rapid changes and it is impossible to predict what will happen next. Until now, changes were smooth, so we could differentiate them and predict the future. However, now changes are so sharp that we cannot predict anymore.

So what do we do? Babies teach us. Babies learn to crawl, walk, and even speak without being taught by anyone. Babies are making the most of their innate talents. That's right. They are making the most of their instincts and becoming independent. Jean Piaget clarified this process (Piaget).

5. EMOTION AND DECISION MAKING

Thus, emotion is deeply associated with decision making. When we think of decision making, we often think of knowledge. In fact, the term "intelligent person" is used to mean someone who has the ability to make good decision and intelligence is associated with the amount of knowledge. However, knowledge is a structure of each individual's own experiences and varies greatly from person to person.

In times of great change, what is important is not knowledge but wisdom. Wisdom is how the body responds when it comes into direct contact with the outside world Fig. 4 compares humans and octopuses. Humans rely on knowledge. Knowledge is processed by brain. So, human intelligence is brain intelligence.

Octopuses, on the other hand, have large heads. But their brains are small and their capabilities are those of dogs. But octopuses directly interact with the outside world with their bodies, making the most of their eight arms. Thus, they are known as expert of escape. They can even escape from the screwed container. What we need now is wisdom. In short, it is body intelligence.

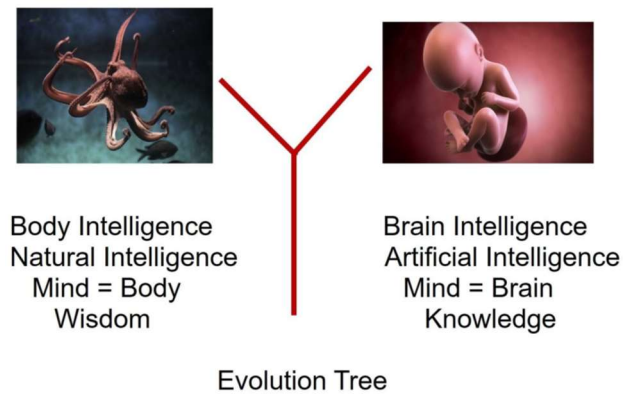


Figure 4. Human and octopus

6. EMOTION AND SOCIETY

Until now, we have perceived emotion passively. However, if we consider its Latin origin, it is easy to see that emotion means to move out, and rather it encourages positive decision-making as described above. Thus, "Emotion" started to be regarded in the broader perspective, i.e., "Society".

Up until now, computer processing has only paid attention to solving problems, i.e., how to solve them. However, for example, in business, the top priority is the strategy, that is, what to do. The goal, or its purpose, is important.

"Social Emotion" is rapidly gaining attention due to the recognition that it is important to consider emotion from a societal perspective in light of the drastic change in society and the rapid expansion of our living space.

The word "Society" also comes from the Latin which means "comrade, friend". In other words, it means to make friends. So, we have to consider how we can design and develop a society which increases friend-making opportunities.

When we hear the word "Society", the words "Culture" and "Civilization" come up. Interestingly enough, wherever we look at in the world, the seeds of a new culture are born in the first 20 years of each century, and then, they develop by about the middle of that century. Then they go on to create a civilization that will shape the culture of the next century.

Therefore, now is the time to create a new society, i.e., we should create a new "Culture" which will be changed to "Civilization" in the 22nd century. "Emotion" plays a key role in driving such changes.

7. WHAT BABIES TEACH US

Then, how can we create such a new world of emotion? The world is changing rapidly. Tomorrow is becoming more and more unpredictable. But babies survive and grow in such environment and situation. The environments and situations vary from baby to baby. But they directly interact with their outside worlds and learn to crawl, walk and speak!

Jean Piaget (Piaget) made it clear that we learn how to cope with our outside world when we are babies. What they have nothing other than their "Instinct". They have an inborn capability, i.e., "Instinct" to grow in the unexperienced world. But they apply "Instinct" by trial and error. If we can develop an instinct support tool. We can develop "Social Emotion" in more effective way.

8. WHAT BABIES TEACH US (MDP)

APPROACH to SUPPORT INSTINCT

MDP is developed. To understand it easily, let us take swimming as an example (Fig. 5).

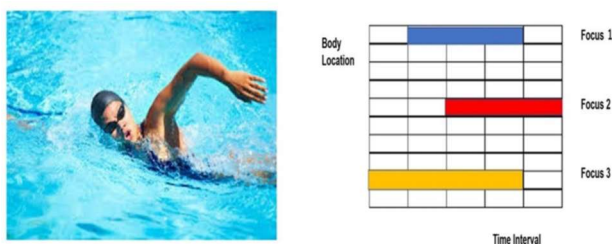


Figure 5. MDP approach

Mahalanobis Distance was developed to remove outliers in design of experiment [4], but if note that it is ordinal scale, we can prioritize our decisions. In the widely and rapidly changing world, we need to prioritize our strategy.

In swimming, water changes continuously. So, we cannot apply mathematical approaches. This is the same situation as in the outside world now. But if we put wearable sensors on the swimmer, we can produce such a table in Fig.5. Each row corresponds to each muscle at its location. And if calculate MD between time T1 and T2, we can obtain distance and divided this distance by this time span, we can get speed. And acceleration is obtained by dividing it again by this time span. Thus, this table shows the total movement of the swimmer's muscle. If MD is decreasing, it means that that muscle is moving in the

desired way. If increasing, then we need to change its way of movement. Thus, we can improve our movement.

Pattern in this MDP approach is related to Fourier Transform (FT). When we observe in time spec, we cannot identify its characteristics. But if we shift to frequency domain. we can identify its characteristics. In fact, we succeeded in detecting emotion from face by introducing cartoon face model [5]. Even from a static cartoon image, we can identify the emotion of a character in a cartoon. Thus, by introducing FT, we can identify the characteristics of the movement in swimming. Thus, we can self-learn how to swim.

This approach is, therefore, applicable to a wide areas. Not only sports, but business, etc. In fact, medical diagnosis is carried out based on flows. Blood flow, heart beat, etc. It may be described that we are making decision based on body emotion.

9. SUMMARY

Let me summarize by quoting Mark Twain: 20 years from now you will be more disappointed by the things you didn't do than by ones you did do. So throw off the bowlines. Sail away from the safe harbor. Catch the trade winds in your sails. Explore. Dream. Discover.

Let us explore, Dream and Discover the new world of "Social Emotion"

REFERENCES

- [1] DECI, E. LAND RYAN. R. M.: INTRINSIC MOTIVATION AND SELF-DETERMINATION IN HUMAN BEHAVIOR, BERLIN, SPRINGER SCIENCE & BUSINESS MEDIA , (1985).
- [2] MAHALANOBIS, P. C.: [HTTPS://EN.WIKIPEDIA.ORG/WIKI/MAHALANOBI S_DISTANCE.](https://en.wikipedia.org/wiki/Mahalanobis_distance)
- [3] Maslow, A. H. (1943): "A theory of human motivation". Psychological Review, 50 (4): 370–396.
- [4] Piaget, J. W. F. [https://en.wikipedia.org/wiki/Jean_Piaget.](https://en.wikipedia.org/wiki/Jean_Piaget)