

Preface to the Special Issue

In 1989, Francis Fukuyama, an American political economist, published a paper entitled “The End of History” (his book *The End of History and the Last Man* was published in 1992). In this context, “The End of History” indicates the eventual triumph of democracy and free economy and anticipates the collapse of socialism. Indeed, the fall of the Berlin Wall (1989) and the abandonment of the Soviet Communist Party dictatorship (1990) followed his paper. The history of modern Western Europe has been shaped by struggles for freedom, equality, and democracy. The modern spirit emerging after the seventeenth century freed people from forms of oppression such as feudalism and monarchy and led eventually to the formation of modern nation-states. Enlightenment and the French Revolution were representative of this spirit. Fukuyama’s idea is that the Western world, in overcoming imperialism, fascism, and totalitarianism, reached an end by winning the historical struggle. His assertion is based on a dialectical and speculative historical view, and needless to say, it depends on the modern civilization pursued by Europe as the background.

At the end of this history, has the world been unified under a sense of values? As an antithesis to Fukuyama’s doctrine, Samuel Huntington, an American international political scientist, presented in 1996 a book entitled *The Clash of Civilizations and the Remaking of the World Order*. The world after the end of the Cold War was by no means the era in which the West won and its doctrines held sway. Rather, he argues that civilizations advance under each ideology in each region, and against the Western view of modern civilization, they clash with each other on the borderlines. His idea seems to be based on the conjecture that after the ideological competition of the Cold War, each region looks back on its own history and returns to its own regional identity characterized by its ethnicity, religion, language, and culture. In other words, “the relativization of civilization” can be observed. This phenomenon signifies a decline in the influence of modern Western civilization. Based on diverse values and cultural backgrounds, the world’s civilizations drift into chaos.

Such chaos is exactly what is unfolding before our eyes today. Human civilization is truly in danger, featuring political and ideological issues such as environmental problems, conflicts and wars between nations and regions, and the coronavirus pandemic. Environmental problems are entering a serious phase on a global scale today, with unusual weather, wildfires, and marine pollution caused by microplastics. This situation can also be seen in the alarm bells set ringing by P. J. Crutzen (anthropocene) and J. Rockström (planetary boundaries). The outbreak of the coronavirus pandemic added to the environmental problems. At the start of 2023, the number of infected people was 675,000,000 globally (33,100,00 in Japan), and the number of deaths was 6,870,000 (72,000 in Japan). Nevertheless, economic activity across the world is recovering, which is attributable to concerns that waiting for the coronavirus to pass will reduce human activity to the point of no return. Rather, we no longer have to choose living “with coronavirus”; there is an urgent need to build a system for “after

coronavirus.”

In this *Civilization* (Special Issue), we have set exactly this problem as the subject. We must aim for the construction of a new model—a reconstruction based on our reflection of the past, which is the meaning of the subtitle “Special Issue on a New Cultural Environment: Remodeling New Forms of Cultural Environment after Coronavirus.” This theme is closely related to the problem of modern Western Europe—the problem of modern knowledge—that was mentioned earlier. Modern civilization is supported by science and technology, and people living in modern civilization have great expectations of them. Underlying such knowledge of science and technology is Kuhn’s scientific revolution theory, which states that such knowledge has developed materially and mechanistically, leaving humans behind. For example, modern scientific knowledge has clarified the nature of the coronavirus and provided a way to deal with it, but we are human beings with consciousness and emotions. Therefore, we must re-question human knowledge because it seems that science and technology have advanced excessively, leaving humans behind.

This special issue presents research from this perspective. Regarding the problem of human knowledge, Polanyi’s tacit knowledge and Nonaka’s SECI-model based on it are discussed. This problem concerns not only human knowledge but also consciousness and emotions (Nakashima, Hirano, Adachi), and the possibility of applying this argument to human activities, especially daily activities such as tourism trends, is discussed (Lee, Nakashima). In addition, given the further development of the information society, the problem of human existence is addressed: how are the human mind and body related to the real world and the virtual space? (Shuvalova, Tanaka). More fundamentally, the question of how our technology relates to our thinking and values remains important. This is related to trans-disciplinary humanities studies promoted by the Institute of Civilization Research (Watanabe). Simultaneously, it is interesting that this research can be incorporated into science education (Hirano, Nakamura).

Nowadays, modern civilization calls for double standards: the promotion of globalization and respect for diversity. It is unclear how such a perspective will lead to solutions to today’s global problems, but for that reason alone, the Institute of Civilization Research should find various prospects under the theme of “Dialogue between Civilizations.”

Fukuyama’s “The End of the World” and Huntington’s *The Clash of Civilizations* certainly provide important perspectives; however, based on the history of human beings, our institute intends to proceed with the study of human activities and civilization from the perspective of humanities—especially that of trans-disciplinary humanities.

Yoichi HIRANO

Takuo NAKASHIMA

Shogo TANAKA

Institute of Civilization Research

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The Dialogue between Civilizations
Special Issue of New Cultural Environment:
- Remodeling New Forms of Cultural Environment after Coronavirus –

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Organizing Committee:

Yoichi HIRANO (Institute of Civilization Research, Tokai University)

Shogo TANAKA (Institute of Civilization Research, Tokai University)

Takuo NAKASHIMA (STEM Education Center , Tokai University)

Program & Steering Committee Chair

Yoichi HIRANO (Institute of Civilization Research, Tokai University)

Secretary

Mina ADACHI (School of Cultural and Social Studies, Tokai University)

I. Special Topics:

*Remodeling New Forms of Cultural
Environment after Coronavirus*

Research Paper

Applying the SECI model to studies of the human awareness of natural and social environments: A perspective based on Polanyi's tacit knowledge

Takuo NAKASHIMA¹, Yoichi HIRANO² and Mina ADACHI³

Abstract

In the history of research on human knowledge, the studies of Polanyi and Nonaka have taken on outstanding importance. The former, examining the philosophical essence of human knowledge, introduced the concept of tacit knowledge. The latter, considering the relationship between individual knowledge and collective knowledge, constructed a SECI model that promotes the activation of human knowledge within a group. After examining their research, this paper attempts to apply their ideas to the development of human consciousness and emotions. Here, the two following examples are discussed: (1) Fostering of human awareness of the "environment-related QOL (e-QOL), (2) Human fear and anxiety against COVID-19. Finally, from these applications, the paper discusses the structure of how individual consciousness and emotions spread in society.

Keywords: tacit knowledge, explicit knowledge, SECI-model, individual and social emotions

1. Preamble

What is knowledge? It is said that knowledge is the outcome of the human recognition of an object but the structure of knowledge is complex. Human beings do not recognize and analyze phenomena merely objectively and rationally; they also subjectively recognize objects in relation to themselves. Therefore, knowledge is constituted for every person as a customized composite. Therefore, knowledge takes on a Gestalt characteristic for individuals and encompasses a subjective aspect. The situation becomes different when knowledge transcends individuals and is shared within a community, the situation is different. Such knowledge must be understood and shared by a plurality of people; therefore, it requires the inculcation of objective elements. Therefore, knowledge exists from an epistemological perspective within a complex realm in which subjectivity and objectivity must intertwine.

Michael Polanyi introduced the concept of "tacit knowledge" (and "explicit knowledge") in 1966. Tacit knowledge is defined as the personal understanding created about an object by an individual and alludes to an awareness that is difficult to present or convey externally. This classification of knowledge also includes skills acquired along with subjective understanding.

On the other hand, explicit knowledge can be shared with others and signifies the apprehension that can be formulated for transmission through verbal expressions and diagrams. Therefore, explicit knowledge can be logically and rationally expressed and can be shared within a community. Ultimately, human beings acquire tacit knowledge about a certain object within their consciousness and share explicit knowledge externally with others (within a community) through representations.

¹ STEM Education Center, Tokai University.

² Institute of Civilization Research, Tokai University

³ School of Cultural and Social Studies, Tokai University

In 1996, Ikujiro Nonaka postulated a knowledge model in response to this conceptualization of knowledge and the two above-stated concepts. Nonaka's conception represents a knowledge framework labeled the SECI model, which targets sharing and activating knowledge within a community and denotes a type of knowledge management system. This model can effectively materialize, share, and create new knowledge to achieve the objectives of companies with clearly established goals.

The problem of human cognition underlies research on tacit and explicit knowledge. These two kinds of knowledge could also be regarded as related to the problem of consciousness, including human sensibility. For example, questions regarding how individual consciousness develops into social awareness or what kinds of new knowledge individuals can generate from social consciousness become pertinent in contemplating the recent environmental problems and the countermeasures adopted against the novel coronavirus pandemic. If we adopt a broader view of human consciousness in such instances, we can discuss how a certain type of personal emotion may be shared across society and debate whether certain such emotions can expand into waves of feelings that can reposition societies.

This study examines the possibility of applying Polanyi's concept of tacit knowledge and Nonaka's SECI model to varied environmental problems affecting human beings; for example, the spread of COVID-19 and the problem of people's awareness of the disease and more broadly, the relationship between the environment and human quality of life (QOL). We analyze the dissemination and communication of individual consciousness and emotions through these case studies, intending to propose a possible direction for future applications of tacit knowledge and the SECI model to environmental problems that confront human societies.

2. Tacit knowledge according to Polanyi

Hungarian philosopher Michael Polanyi answered how human cognition may be understood, introducing the concept of tacit knowledge to the human cognitive framework through his critique of positivist considerations of cognition [Polanyi(1996)]. Tacit knowledge signifies the totality of the experiential comprehension human beings can utilize but cannot clearly (explicitly) articulate in words. In Polanyi's words, "We can know more than we can tell" [Polanyi(1996), p.4]. According to Gestalt psychology, people perceive objects as complete integrated structures (Gestalt). Thus, the existence and power of personal knowledge is essential for the construction of the Gestalt. Polanyi attained insight into such knowledge and apprehended its power, perceiving it as the tacit knowledge generated in human beings. Such knowledge incorporates phenomena that cannot be described in words or expressed through sentences or diagrams. Polanyi posited that such knowledge exists unconsciously—or almost unconsciously—and underlies human cognition.

Polanyi's argument is principally vested in his criticism of positivism in the philosophy of science, which asserts that the discovery of new facts by scientists (scientific creation) is entrusted to their implicit knowledge and creativity. The same is true for arts and sports performances. Knowledge (and skills) potentially—and sometimes unconsciously—imbibed by people form the basis and background of their actions: such latent awareness is labeled tacit knowledge.

Tacit knowledge is rooted in the depths of individual consciousness and is, therefore, "a richly revealing representation of thought" [Polanyi (1996), p.xviii]. For human beings, the act of "knowing"

symbolizes the acquisition of two types of comprehension: practical and theoretical. However, tacit knowledge stems from the recognition of an action or object and the cognitive behaviors that cause the result are not necessarily explicitly represented and therefore, remain unstated or tacit. Polanyi established the structure of knowledge by employing two terms to explain tacit knowledge. When a human recognizes something (first term), a reaction or action occurs as a result (second term). Conversely, “we know the first term only by relying on our awareness of it for attending to the second” [Polanyi(1996), p.10]. Consequently, the two terms are functionally interrelated, and the first term is implied by the represented second term.

In contrast, explicit knowledge can be expressed through sentences or diagrams. As mentioned above, Polanyi’s implication of tacit and explicit knowledge became a starting point for his research on scientific knowledge. Indeed, Polanyi examined the structure of knowledge in scientific creation in his seminal work *Personal Knowledge* (1958). We would like to briefly elucidate his conception even though it is somewhat supplementary to the objective of this paper.

Polanyi stated at the beginning of the book that human cognition is based on both subjectivity and objectivity and that scientific creation should essentially encompass the same parameters. However, he highlighted that for the actual practice of science, “modern man has set up as the ideal of knowledge, the conception of natural science as a set of statements which is ‘objective’ in the sense that its substance is entirely determined by observation” [Polanyi (1958), p.16]. Polanyi asserted that human beings own the innate ability to evaluate objects, and such ability is also an aspect of the knowledge that drives discovery. He labeled such human awareness as “personal knowledge,” claiming that

“...the act of knowing includes an appraisal; and this personal coefficient, which shapes all factual knowledge, bridges in doing so the disjunction between subjectivity and objectivity. It implies the claim that man can transcend his own subjectivity by striving passionately to fulfill his personal obligations to a universal standard.” [Polanyi (1958), p.17]

In brief, scientific facts are determined through individual subjectivity and public objectivity. Conversely, the text cited above suggests that scientific creation cannot be judged based solely on explicit knowledge even if science is originally explicit and that we cannot deny the existence of individually dependent knowledge.

Returning to the discussion of this article, human knowledge is understood as the dichotomous construct of both tacit and explicit understanding. Explicit knowledge can be expressed and communicated to others but tacit knowledge remains as individual intuition and is therefore incomprehensible to others. In science, the proof of a proposition requires its public statement and admission. Tacit knowledge, however, indwells solely within individual consciousness and experience.

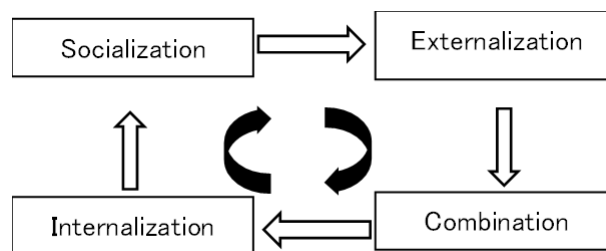
3. Introduction of SECI-model by Nonaka

Ikujiro Nonaka applied Polanyi’s conception of tacit and explicit knowledge to organizational theory, presuming that all knowledge comprises ontological and epistemological dimensions. For the ontological dimension in particular, he argued that knowledge of a group is “constructed through a process of

crystallization into the network of the group” [Nonaka (1996), p.88], which entails the process of aggregating and amplifying individual knowledge. With respect to the epistemological dimension, Nonaka followed Polanyi’s discussion of tacit and explicit knowledge, saying, “Polanyi believed that humans create knowledge by actively organizing their experiences” [Nonaka (1996), p.89] and emphasizing that tacit knowledge lurks in experiential human awareness. Nonaka also sublimated Polanyi’s idea to a practical direction, aiming to decompose the traditional dichotomies between subject and object or reason and sensibility. Nonaka’s theory is presented as what is now called the SECI model.

The SECI model represents a dynamic creation model” of the human intellect and denotes a framework based on knowledge conversion: “human knowledge is imagined and expanded through [the] social interaction of tacit knowledge and explicit knowledge. In particular, these two kinds of knowledge are interrelated and extended in organizations such as companies through the four steps of socialization, externalization, combination, and internalization [Nonaka (1996), pp.90-91]. In this model, socialization indicates the phase of creating tacit group knowledge from individual tacit knowledge; externalization signifies the stage of generating systematic explicit knowledge in an organization from individual explicit knowledge. Further, combination symbolizes the step of creating explicit systematic knowledge in an organization from individual explicit knowledge. New tacit knowledge is formed in an individual once explicit knowledge is established within the organization in such a manner: this stage signals the process of internalization. Therefore, these four steps construct a “circulation model of knowledge creation” (Fig. 1). Nonaka proposed to apply this model to form, share, and activate knowledge within organizations (companies).

[Fig. 1] Structure of SECI-model



The utilization of the SECI model is considered to contribute to knowledge management in companies. Individual knowledge and skills originally exist as inherent tacit knowledge and are not exposed. The SECI model delivers a system that extracts individual tacit knowledge to share within an organization in the form of explicit knowledge. Thus, Nonaka’s intentions can be apprehended as the introduction of a business management method that allows organizations to be effectively formed and efficiently operated. This model elucidates how individual experiences and knowledge can flow and be shared within a group and positioned as new knowledge. Thus, the model is deemed to present an effective direction for a corporate organization with clearly specified objectives and goals.

How can individual tacit knowledge be described? Polanyi contends that tacit knowledge is the potential awareness embedded within the mind and body of an individual and states that the subjectivity of the scientist works in examinations designed to determine scientific knowledge. Scientists express the results of their own subjectivity within the objectivity of being “officially recognized.” This subjective

judgment denotes the tacit knowledge of the scientist. Therefore, judgment and value consciousness similar to individual senses and emotions are also apparently included in scientific determinations. In this context, Nonaka's SECI model seems invested with developmental potential: it is applicable to problems concerning the diffusion, acceptance, and recognition of emotions that accompany individual values. We will examine this point with examples in the sections that follow.

4. Application of the SECI-model based on tacit knowledge

At the end of the last section, we questioned how Polanyi's tacit knowledge and Nonaka's SECI model could be applied. Originally, the SECI model represented a cyclical system that crystallized tacit individual knowledge into explicit knowledge, sublimated it to collective knowledge, and encouraged the creation of new tacit individual knowledge. If so, this model can also be applied to instances in which public knowledge is cultivated from individual awareness as collective social knowledge. In this section, we attempt to apply the SECI model to problems of human consciousness and emotions based on tacit knowledge. In other words, we will examine the possibility that this model can be regarded both in terms of knowledge creation and the generation of human sensibility (consciousness and emotion).

The SECI model represents a “circulation model of knowledge creation” within a group and responds to a process through which an effective individual consciousness and emotion are shared and diffused within a community, gradually shaping the public consciousness of the society. Human consciousness and emotions are molded by mental impulses. They indwell implicitly in the depths of individual minds and thus correspond to (or are similar to) tacit knowledge. These consciousnesses and emotions overlap on certain occasions with those of others and are sometimes shared and augmented (socialization). Subsequently, the shared consciousness and emotions are at some point expressed in words and actions (externalization). In addition, expressed consciousness and emotions are no longer confined to the depths of the human psyche; they are shared within the group and develop into concrete words and actions (combination). The movement of the group is embodied and shaped in this fashion. Further, new and more effective consciousness and emotions emerge during this process in individuals within the group (internalization).

It should be noted at this juncture that shared awareness is not always positive; rather, it includes negative cases. A discussion is deemed positive when consciousness and feelings are discussed within the purview of common ethical and humanitarian sense; for instance, to foster local knowledge about environmental problems and disasters. On the other hand, negative awareness signifies the denial of human existence: for example, the historical witch trials perpetrated in the West and the justification of inhumane dictatorships, collective madness, etc. In sum, this model can be similarly invoked with respect to the prevalence of negative organizational consciousness. We examine recent tangible examples of the spread and sharing of human awareness and emotions in the next section.

5. Case studies

5.1. Fostering awareness of e-QOL

Our research group has tackled environmental problems by applying Hirano and Nakashima's (2017, 2018, 2019) concept of e-QOL. This concept is derived from a dual perspective of abundant human life and the

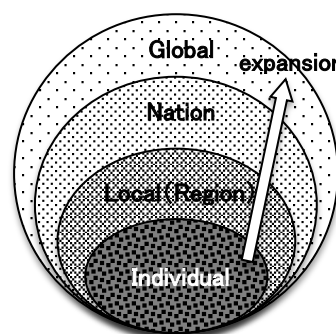
maintenance of the natural environment and refers to the satisfaction of humans through the care and conservation of nature to promote sustainable coexistence. The concept is also notably intended both for natural and sociocultural environments.

In this framework, it is crucial to ask how the awareness of e-QOL evolves in people. Our research established the following four steps in the process of fostering e-QOL (Fig. 2) [Nakashima & Hirano (2018), p.93]:

- Step 1 (Individual Level): Consciousness transmits from the individual to the local community.
- Step 2 (Local community level): This stage is connected to the nurturing and development of one's consciousness of value.
- Step 3 (National Level): One's consciousness of value is diffused from the individual to local communities to the society at large.
- Step 4 (Global Level): The national and worldwide dissemination of several models.

We collaborated with another research group⁴ in 2021 to conduct a questionnaire survey of Japanese youth on the relationship between the environment and QOL. Many respondents to the questionnaire revealed a strong interest in water quality with respect to QOL. Half the respondents were residents of Kumamoto Prefecture in Japan, which is commonly called “the City of Water.” This connection suggests that the local situation affects the environmental assessments of respondents. Finally, the survey results indicated that fostering the awareness of e-QOL in people necessitates an initial awareness within them of their regional (local) environmental problems. Such individual attitudes can be expected to later develop in public awareness on a global scale.

[Fig.2] Structure of the Four Steps



Such individual regional consciousness is not equivalent to tacit knowledge; the above-stated four steps also do not correspond directly to the SECI model. Nevertheless, it is very possible that the potential feelings of individuals about their region of residence could be represented as actions to preserve the regional environment. This personal consciousness is shared within the region and is manifested as local activity. The awareness of e-QOL is likely to be disseminated over a wider area as information pertaining to a region spreads to other regions and conversely, a region receives information about other regions. A system similar to the SECI model may be observed in this exemplar with respect to the communication and diffusion of knowledge and awareness.

⁴ Prof. Takahashi's research group on e-QOL at the Kumamoto Campus of Tokai University. The results of this questionnaire survey were reported as follows: Hirano, Y, Nakashima, T., Takahashi, M., Hattori, T., and M. Adachi. "Expansion of Environment-Related Quality of Life: Considering Awareness of Locality," *16th International Conference on Innovative Computing, Information and Control (ICICIC2022)*, Sept. 15–16, 2022 (oral presentation).

In relation to e-QOL, the notion of bricolage examined in the previous issue of this Journal can also be regarded as the development of tacit knowledge [Hirano et al. (2022)]⁵. An environmental bricolage, for instance, could be defined as the skillful use of local knowledge and know-how to recover from a natural disaster and can also signify tacit knowledge as human wisdom. Natural disasters are sudden environmental changes; in many instances, the use of the knowledge specified in the manual is not timely. Therefore, it is meaningful to hasten restoration by utilizing personal knowledge and skills and employing diverse resources that exist on the spot. Such personal knowledge and skills affect people and promote their recovery activities. Particularly distinctively, such bricolage acts are transmitted to other areas and shared as information. Consequently, personal wisdom is accumulated as explicit knowledge, which again creates new ideas in instances when disasters occur in other regions and activates reconstruction activities in that area.

5.2. On the COVID-19 pandemic

The COVID-19 pandemic began dispersing globally in early 2020. It has diminished more than once but its spread continues without any signs of eradication. The number of people infected on a global scale was 675,000,000 (33,100,00 in Japan) at the beginning of 2023, and the number of deaths was calculated at 6,870,000 (72,000 in Japan). Nevertheless, policies such as “with coronavirus” or “after coronavirus” are beginning to appear in countries around the world, resulting from the difficult choice of infection prevention and the maintenance and promotion of economic activities. The ideas and actions of people about COVID-19 can be discussed in accordance with the SECI model, notwithstanding whether as a positive or negative case. The negative aspect is symbolized by the public fear and anxiety about COVID-19 and the positive facet concerns the advancement of human activities against COVID-19. In any case, the consciousness and emotions of people can be found at the roots of both the positive and negative dimensions. We will discuss the negative aspects, especially the spread of people’s fears and anxiety, in the sections that follow.

The structure of intensifying fear and anxiety in people is complicated. Initially, many people were afraid because COVID-19 represented a very lethal infectious disease. The information conveyed daily on TV, newspapers, and the Internet fueled fear and anxiety in the public. Civic institutions called on people to act cautiously: countermeasures were proposed, such as avoiding the “3Cs” (crowded places, close-contact settings, confined and enclosed spaces), wearing masks, disinfecting, etc. Such information made people increasingly anxious about preventing infection. There were discrete speculations about the novel coronavirus at the outset because its components were largely unknown. People were compelled to adopt measures based on information they obtained personally; as a result, they repeated suspicions and thought processes.

In the previous issue of this Journal [Adachi (2021)], we discussed what emotions mean to people and how emotions work in society. For example, Rosenwein introduced the concept of “emotional communities,” signifying “a group of people who share the same norms related to emotional expression and place (or do not place) the same value on the same emotion.” This concept clarifies that individual

⁵ The concept of a “bricolage” signifies the behaviors exhibited by people belonging to primitive cultures who applied materials found in their immediate surroundings to achieve their objectives.

emotions are directed toward the emotions of the group. Therefore, human emotions sometimes promote the formation of a group that shares that emotion. Thus, emotions are deemed a type of device that promotes people to the notion of “emotional practice” posited by Monique Scheer.

In this context, the emotions of fear and anxiety about COVID-19 formed emotional communities of what Rosenwein labeled individual negative emotions. People shared their fears of death in such communities and amplified their anxieties about the unknown: for instance, viruses of which the treatment remains uncertain. In this instance, emotions of fear and anxiety sensed by individual minds were shared through information on the social situation of infection and were represented as specific actions such as infection prevention measures. This process precisely describes Monique Scheer’s notion of emotional practice. The represented social situation causes further fear and anxiety, and this negative chain tends to continue for a while.

The situation mentioned above certainly exemplifies a negative cycle triggered by the COVID-19 pandemic. However, positive aspects were also observed. Infection control measures were strengthened during this cycle eliciting emotions of fear and anxiety. Thus, people also acquired new directions (knowledge and skills) in their experiences and shared them, which further encouraged them to create an awareness of escaping the spread of COVID-19. Consequently, the consciousness of people incorporated the idea of living with the novel coronavirus.

Lucien Febvre, a pioneer of the Annales School (l’*école des Annales*), stated that “emotions are contagious” [Febvre (1941), p.7]. In other words, emotions are treated not just as specific to the individual mind but also as major driving forces that can incite groups. The same holds true for positive and negative emotions. Regarding the instant example of COVID-19, some types of individual emotions and experiences of COVID-19 were shared within communities and created cycles that formed new value standards. Thus, this exemplar also corresponds with the SECI model.

6. Tentative conclusion and future perspective

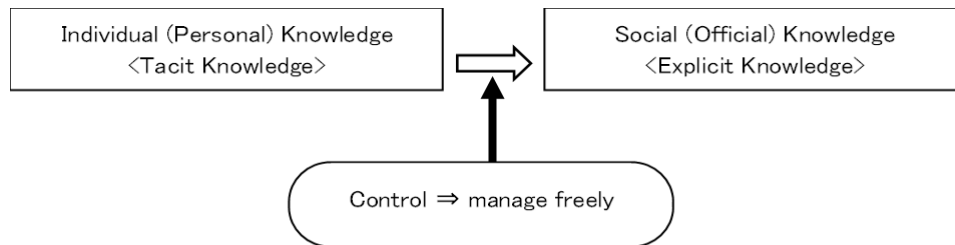
The outcomes of the current study reveal the following two points regarding Pornnie's idea of tolerant knowledge. First, tacit knowledge denotes potential human knowledge. For example, it includes individual knowledge and skills such as craftsmanship. Second, the public knowledge shared by societies is originally determined by the knowledge indwelling in individual minds. On the other hand, Nonaka’s SECI model represents a cyclic framework that allows groups to create new values of awareness by sharing and intensifying individual values. This model is useful, especially in closed spaces such as companies that can develop tacit individual knowledge within the organization and revitalize it into new knowledge.

This paper attempted to present a theoretical trial by using Polanyi’s conception of tacit knowledge and Nonaka's SECI model to develop individual consciousness and emotions in wider and more open spaces. Certainly, the SECI model need not be adopted when consciousness and emotions are spread merely within groups. However, the SECI model can work effectively when the consciousness of groups is greatly influenced by the consciousness of each individual and depends greatly on the continuous consciousness of the people. Such efficiency occurs because the SECI model analyzes situations and creates new developments.

Nevertheless, this trial certainly presents some points that remain to be contemplated. First, it

neglects to consider the problems of control and management. Knowledge control (regulation) tends to occur when knowledge is shared within groups. Explicit knowledge disseminated in a social group is generally shared within the scope of social ethics and good sense or as traditionally legitimate knowledge. As a result, some knowledge may be controlled. However, the controlled and regulated knowledge is itself closed and it is difficult to create new awareness from it. Knowledge management toward the direction of freedom of thought is important for the germination of individual knowledge and for knowledge to develop constantly without impairing the possibilities of individual imagination (Fig.3).

Fig. 3 External influence in Knowledge Conversion



The abovementioned example of e-QOL indicates that the individual awareness of one’s environment and emotions involves other people and fosters a wider awareness of environmental conservation. Thus, the personal consciousness of individuals can be accepted by other people as their own consciousness. In other words, an individual’s tacit knowledge turns into explicit knowledge through the free will of other people. However, even if the government shouts about becoming carbon-neutral, for example, the lifestyles of people are not immediately affected because nuances of control may be discovered. To cite another example, it is difficult to foster the consciousness of a sustainable world even if people understand the motto of its realization. In the case of social issues, there appears to be a difference in the new tacit knowledge people can imbibe depending on the content of the explicit knowledge shared by their society.

Another problem concerns the variations in the directions of individual consciousness and emotions depending on positive or negative content. Naturally, it is quite difficult to define what is negative or positive: we can merely consider whether the directions taken by human lives are positive or negative.

In discussing the case of the COVID-19 pandemic, we examined the process of individual consciousness and emotions of fear and anxiety inculcating negative awareness in society. However, the quality of the consciousness and emotions to be deployed (whether positive or negative) is not questioned by the basis of the theoretical structure of the SECI model. For example, the act of wearing masks was informed by the consciousness of not infecting others or not being infected; however, it could also develop awareness and acts that encompassed removing masks.

The SECI model exemplifies the process of revitalizing knowledge to actualize the purposes and interests of a group. The use of this model ensures that individual consciousness and emotions are shared in social consciousness, and eventually, the established structure would encourage a major wave of societal knowledge. Nevertheless, the SECI model exhibits the potential of being used to develop consciousness and emotions evincing discrete conceptions of value, and this context remains to be discussed.

Diversity is now respected and it is difficult to apprehend the world through the mere mechanical

thinking of a civilization based on science and technology. Certainly, modern science provides one paradigm (Kuhn's paradigm) to humans, but it is difficult for people to grasp the world holistically from this single perspective. Discrete systems of knowledge and consciousness indwell in human minds. Human beings now possess legitimate (explicit) knowledge both globally and within every society. However, that knowledge is stored on the bases of implicit knowledge indwelling within individual minds. It is important to know how such tacit knowledge has led to our current world and how it guides us toward the future. Polanyi's conception of tacit knowledge and Nonaka's formulation of the SECI model do not completely resolve such problems of human awareness and knowledge creation.

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REFERENCE

- Fevre, Lucien (1941), *La sensibilité et l'histoire: Comment reconstituer la vie affective d'autrefois?*, *Annales d'histoire sociale (1939-1941)*, Jan.-Jun., T. 3, No. 1/2 (Jan.-Jun., 1941), pp. 5-20.
- Nonaka, Ikujiro (1996) and Takeuchi, Hirotaka, (translated by Katsihiro Umemoto), *The knowledge-creating company: how Japanese companies create the dynamics of innovation*. [野中郁次郎, 竹内弘高著 ; 梅本勝博訳、『知識創造企業』、東洋経済新報社, 1996年].
- Plamper, Jan (2012), *Geschichte und Gefühl. Grundlagen der Emotionsgeschichte*, München: Siedler.
[(Japanese translation by Motita, Naoko), 森田直子訳『感情史の始まり』みすず書房、2020年].
- Polanyi, Michael (1958), *Personal Knowledge: Towards a Post-Critical Philosophy*, University of Chicago Press. (Enlarged Edition of 2015, University of Chicago).
- Polanyi, Michael (1966), *The Tacit Dimension*, University of Chicago Press. (Edition of 2009, Amartya Sen).
- Adachi, Mina (2022), "Correlation between Emotions and Society," *Civilization*, No. 29, pp.43-48.
- Hirano, Y., and Nakashima T. (2017), "The Core Project Research Report: An Essay on the Introduction of Environment-Related QOL," *Civilizations*, Institute of Civilization Research, Tokai University, 22, pp. 35-44. (in Japanese) [平野葉一・中嶋卓雄 (2017), 「コア・プロジェクト「森里川海研究」の方向性—環境QOLの導入の一試論として—」, 『文明』, No.22, 2017, pp. 35-44.]
- Nakashima, T., and Hirano, Y. (2018), "The Relation Between Human Activities and the Natural Environment: An Essay on the Introduction of Environment-Related QOL," *Civilizations*, Institute of Civilization Research, Tokai University, No. 23, pp. 87-94.
- Nakashima, T., and Hirano, Y. (2019), "Nature Oriented Metrics of Wellbeing Based on Environment- Related QOL," *Civilizations*, Institute of Civilization Research, Tokai University, No.24, pp. 18-24.
- Hirano, Yoichi and Takuo Nakashima, Toru Hattori, Mina Adechi (2022), "A study of environment-related QOL from the perspectives of "placeness" and "bricolage," *Civilizations*, Institute of Civilization Research, Tokai University, No.29, pp.15-24.
- Hirano, Y and T. Nakashima, M. Takahashi, T. Hattori, M. Adachi (2022), "Expansion of Environment-Related Quality of Life: Considering Awareness of Locality," *16th International Conference on Innovative Computing, Information and Control (ICICIC2022)*, Sept. 15-16 (oral presentation).

Research Paper

A Survey of the Tourism-Related Awareness of Students During the COVID-19 Pandemic

Soji LEE¹

Abstract

Tourism is considered an important factor for subjective wellbeing and quality of life because it generates feelings of satisfaction and relaxation. However, both travel and daily activities were greatly restricted during the COVID-19 pandemic, impairing individual quality of life. The general tourism-related positive and negative attitudes and feelings of young people who have experienced COVID-19 must be quantitatively assessed vis-à-vis the pandemic. The present study conducted a questionnaire titled “Survey of Tokai University students' awareness of tourism during the COVID-19 disaster.” The results of the study indicated that travel is a familiar habit of everyday life, even for students, many of whom hoped for an increase in the number of tourists after COVID-19. Most students also displayed positive feelings toward tourism. Moreover, most respondents agreed that tourism development would improve infrastructure, enhance employment opportunities in the tourism industry, and intensify attention to cultural inheritances and natural environments. Participants understood the condition of overtourism and were relieved that Japan was safe. Further, many young people desired contact with tourists at events such as festivals and concerts. Thus, we found that the respondents were proactive in co-creating experiences with tourists.

Keywords: Tourism, Students' Awareness, Overtourism, COVID-19, Questionnaire

1. Introduction

Tourism is considered an important factor for subjective wellbeing and quality of life (QOL) because traveling generates a feeling of satisfaction and relaxation. Tourist experiences and activities are found to positively affect a variety of life-related domains, such as family, social interactions, leisure, and cultural attainment. The existing literature reveals that tourism-related experiences and activities significantly impact the overall life satisfaction of tourists as well as the wellbeing sensed by local inhabitants (Uysal et al., 2016). The World Travel and Tourism Council (WTTC) produces reports on the economic and employment impact of travel and tourism on 185 countries/economies and 25 geographic or economic regions across the globe (WTTC, 2022). Their annual research report revealed that the travel and tourism sector contributed 10.3% to the gross domestic product in 2019. This share decreased to 5.3% in 2020 because of global mobility restrictions and increased to 6.1% in 2021, as countries began to allow leisure travel. The three-year span of the COVID-19 pandemic that began in 2020 has greatly restricted tourism-related activities. The number of people infected by COVID-19 mutants has not necessarily decreased, but tourism activities are restarting in 2023 because of widespread vaccination and the reduction in the rate of severe cases.

Questionnaire surveys have often been used to assess indicators related to tourism. Kasama et al. (2019) conducted a questionnaire survey focusing on many tourist destinations in Japan to analyze factors

¹ School of International Cultural Relations, Tokai University

that could enhance their attractiveness, especially the length of tourist visits. Specifically, they asked people who had experienced tourism in Japan and overseas about their evaluations of tourist spots and how they spent their period of travel to the concerned destination. Nara et al.'s (2019) study focused on Kyoto, a city visited by the largest number of tourists traveling to Japan, and examined the characteristics of the phenomenon of overtourism in Kyoto through a questionnaire survey. They are contemplating future directions for Kyoto's tourist resort management based on their verification results. In particular, the questionnaire targeted Kyoto citizens, and its results will benefit those who have directly experienced overtourism.

We are engaged in probing tourism-related problems associated with environmental changes with the desire to devise solutions for such issues. The present study comprised the administration of a questionnaire titled "Survey of Tokai University students' awareness of tourism during the COVID-19 disaster." This survey purposed to investigate the types of awareness displayed by young people, such as students apropos tourism and tourists. We investigated the respondents' understanding of situations triggering major environmental changes, for instance, overtourism and COVID-19. The questionnaire probed the awareness of students from three principal perspectives: the positive change that the visited area would become a tourist destination, negative changes such as overtourism in tourist destinations, and contact with tourists. The analysis of the survey results will allow for the contemplation of new directions for prospective tourism-related activities through the scrutiny of the negative and positive factors of tourism and the emotions articulated by locals toward tourists.

2. Methodology

The impact of the COVID-19 pandemic was not limited to economic aspects; the spread of the disease also caused anxieties to flood the daily lives of people. This pandemic period demonstrated that environmental changes are closely related to individual QOL. The metric of the environment has been introduced as a criterion for the evaluation of QOL. Hirano and Nakashima (2017, 2018, 2019) introduced the concept of environment-related QOL (e-QOL), derived from the dual perspective of abundant human life along with the maintenance of the natural environment. QOL pertains to the definition and amelioration of the value of human existence through measures such as satisfaction and comfort. However, e-QOL relates human satisfaction with the maintenance and conservation of nature to promote sustainable coexistence.

The conception of the environment has expanded to include both the natural and social surroundings of human beings. The present study applied the e-QOL concept to the domain of tourism at the following four levels:

- 1) Individual: This indicator relates to the local perception of the value of the local environment and the satisfaction of tourists and residents, and thus pertains to the e-QOL of residents and tourists at tourist destinations.
- 2) Local community level: A common understanding of e-QOL is generated by residents and tourists through their satisfaction and consciousness of maintaining the local environment and culture.
- 3) National level: A shared national-level satisfaction of e-QOL is evaluated using environmental metrics on the culture of tourism that represents the nation.

- 4) Global level: Varied nations share their national-level e-QOL to achieve a mutual tourism-related cultural exchange.

The current investigation addressed the perspectives and awareness of local inhabitants at the level of the indigenous community. Specifically, we targeted the negative feelings elicited in residents toward tourists in instances of overtourism and attempted to determine their adverse reactions against the discrete damages caused to their region by the visits of many tourists. In addition, we focused on co-creative activities between tourists and residents as a positive factor and analyzed the emotions evoked by those specific activities. Ultimately, we aim to improve the QOL of both tourists and residents and evaluate the obtained data through a qualitative problem-solving approach.

3. Questionnaire results

3.1 Basic information

- 1) What is your gender?

Table 1: Gender

male	female
46	68

- 2) Please inform us about your current residential region (prefecture name, municipality name).

Hokkaido, Tokyo, Kanagawa, Chiba, Kumamoto, Saitama

- 3) How many annual trips did you take before the COVID-19 pandemic?

Table 2: Frequency of Travel

Once every 2–3 years	1–2 times a year	3 or more times a year	I rarely travel
13	60	18	23

- 4) What do you think about tourist arrivals after the COVID-19 pandemic?

Table 3: Expectations of Increase in Tourist Numbers

Really want tourists to visit	Want tourists to visit	Cannot say either way	Do not want tourists to visit	Really do not want tourists to visit
55	23	28	8	0

Table 1,2 and 3 shows type of gender, frequency of travel and expectations of increase in tourist numbers respectively. Many students reported traveling once or twice a year, and travel was cited as a familiar habit of daily living, even among students. In addition, many people hoped that the number of tourists would increase after COVID-19, and most respondents exhibited positive feelings about tourism.

3.2. Perspectives on the residential region turning into a tourist destination

- 1) How do you feel about the positive changes that occur at tourist destinations?
- (1) Infrastructure such as buildings, roads, and scenic landscapes are developed through tourism policies.
 - (2) The development of the tourism industry causes regional revitalization
 - (3) Urban development triggers population growth.

- (4) Employment opportunities increase because of advancements in the tourism industry.
- (5) The cultural heritage and natural environment of tourist areas receive more attention and are preserved.

Table 4: Positive Changes Occurring Because of Increased Tourist Numbers

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
(1)	36	57	16	5	0
(2)	55	51	7	1	0
(3)	40	31	25	18	0
(4)	44	55	10	5	0
(5)	45	50	10	8	1

Table 4 shows how positive changes occur on tourist destinations due to the increased tourist numbers. This question probed the impressions of respondents apropos the types of positive situations that could be created if their residential region became a tourist destination. No agreement was detected in 16% of the respondents on population growth due to urban development. These answers indicate that respondents generally felt that the development of tourism would result in a certain degree of economic development. However, the findings do not indicate the opinion that large-scale development would increase the population.

- 2) How do you feel about the negative changes occurring at tourist destinations?
 - (1) The environment deteriorates because of noise from tourists and the dumping of garbage.
 - (2) The increase in tourist numbers causes traffic snarls because of buses, making transportation inconvenient.
 - (3) The bad manners of tourists make residents uncomfortable.
 - (4) Security deteriorates because of a decline in the typology of tourists.
 - (5) Food and beverage prices rise because of tourism.
 - (6) The landscape deteriorates because of new developments.

Table 5: The Negative Impact of Tourism on Tourist Destinations

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
(1)	45	47	18	3	1
(2)	28	47	22	17	0
(3)	29	49	29	7	0
(4)	26	28	39	20	1
(5)	19	45	31	18	1
(6)	17	32	40	24	1

Table 5 shows the negative impact of tourism on tourist destinations. We specifically asked students about the negative aspects of tourist destinations, especially in conditions of overtourism. Young people

agreed that the bad manners of tourists caused noise and garbage dumping and discomforted residents. However, around 15% of the respondents did not agree on traffic congestion due to buses and security deterioration; deficient security was apparently difficult to imagine in Japan. Further, 21% of the respondents disagreed with the deterioration of the landscape. Thus, a certain number of young people believe that Japan's ability to conserve the environment will prevent any such deterioration.

3.3. Contact with tourists

Relating contact with tourists, Table 6 and 7 show positive contact with tourists. Since the patterns of answers to the questions are different in (1) and (2) to (9), the tables representing the results are separated into Tables 6 and 7.

(1) I want to have positive contact with tourists

(2)

Table 6: Positive Contact with Tourists

I want it	I want it if I get the chance	I cannot say either way	I do not want it	I never want it
29	43	28	12	2

Many young people were positive about accepting tourists and coming into contact with them.

(3) I would like to participate if I get the opportunity to be with tourists at events such as festivals, concerts, and sports competitions.

(4) I want to actively talk to tourists in my daily life and give them directions when they do not know where to go.

(5) I want to get involved with tourists through my daily work.

(6) As a volunteer, I would like to work on the maintenance, cleaning, beautification, etc. of the local environment related to tourism.

(7) I want to get involved with tourists as a staff member or volunteer at events and festivals.

(8) I want to get involved with tourists as a member of an organization related to tourism and community development.

(9) I want to get involved with tourists as a tourist guide, experienced tour guide, instructor, etc.

(10) I want to transmit the charm of the region through SNS or other means.

Many young people wanted contact with tourists at events such as festivals and concerts. On the other hand, the number of young people desiring professional contact with tourists through their daily work is decreasing. However, the respondents expressed a favorable view about coexisting with tourists.

Table 7: Diverse and Positive Contact with Tourists

	Strongly agree	Agree	Neither agreed nor disagree	Disagree	Strongly disagree
(2)	33	47	19	14	1
(3)	23	34	35	18	4
(4)	21	44	25	22	2
(5)	24	47	26	14	3
(6)	26	49	23	14	2
(7)	22	40	34	17	1
(8)	23	34	31	22	4
(9)	26	35	31	15	7

4. Conclusion

The present study conducted a questionnaire titled “Survey of Tokai University students’ awareness of tourism during the COVID-19 disaster.” The survey purposed to investigate the types of awareness young people such as students displayed toward tourism and tourists.

The results revealed that many students traveled once or twice a year and that traveling was familiar as a habit of daily life, even among students. In addition, many young people hoped that the number of tourists would increase after COVID-19, and numerous students expressed positive feelings about tourism. The respondents understood the condition of overtourism and were comforted by the sense of security in Japan. Further, many young people desired contact with tourists at events such as festivals and concerts and articulated a positive view of coexistence with tourists.

We would like to analyze the correlations between all expressed opinions in our future research endeavors and aspire to verify the transformations in the perception of tourism because of environmental changes.

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REFERENCE

- Hirano, Y., and Nakashima T. (2017), “The Core Project Research Report: An Essay on the Introduction of Environment-Related QOL,” *Civilizations*, Institute of Civilization Research, Tokai University, 22, pp. 35–44 (in Japanese) 平野葉一・中嶋卓雄 (2017), 「コア・プロジェクト「森里川海研究」の方向性—環境 QOL の導入の一試論として—」, 『文明』, No.22, 2017, pp. 35-44.
- Kasama, S. (笠間 聡), Matsuda, Y. (松田 泰明), (2019). アンケート調査に基づく観光客の観光行動と観光地評価の国内外比較, *景観・デザイン研究講演集*, No.15, pp.349-357. (in Japanese)
- Nakashima, T., and Hirano, Y. (2018), “The Relation Between Human Activities and the Natural Environment: An Essay on the Introduction of Environment-Related QOL,” *Civilizations*, No.23, pp. 87-94.
- Nakashima, T., and Hirano, Y. (2019), “Nature Oriented Metrics of Wellbeing Based on Environment- Related

QOL,” *Civilizations*, No.24, pp. 18–24.

Nara, M. (奈良美和子), Maekawa, K. (前川佳一), (2019). 京都のオーバーツーリズムの現状と観光地のデ・マーケティング, 京都大学経営管理大学院, KAFM-WJ014, pp.1-36, https://www.gsm.kyoto-u.ac.jp/wp-content/uploads/KAFM-WJ014_nara_2019.pdf.

Uysal, M., Sirgy, M. J., Woo, S. E., Kim, H., (2016). Quality of life (QOL) and well-being research in tourism, *Tourism Management*, Vol. 53, pp. 244-261.

World Travel & Tourism Council (WTTC) (2022).

Economic Impact Reports, Available: <https://wttc.org/Research/Economic-Impact>

Research Paper

Existence and Activation of Tacit Knowledge in Tourism

Soji LEE¹ and Takuo NAKASHIMA²

Abstract

Information obtained as a positive impression or good experience in an individual's life is accumulated as knowledge. We suppose that it is easy to accumulate information on activities that improve subjective well-being through experience. Tourism is considered an important activity that can generate a feeling of satisfaction, and enhance subjective well-being and quality of life. Personal knowledge includes "explicit knowledge," which is verbalized and symbolized knowledge, and "tacit knowledge," which is subjective and physical empirical knowledge that is difficult to express through language or symbols. Nonaka (1994) proposed the Socialization, Externalization, Combination, and Internalization (SECI) model for the formation of explicit and tacit knowledge generated by both individuals and organizations. In this study, we discuss how to verify the validity of tourism activities by applying the SECI model. In addition, we will discuss whether characteristic tourist activities improve subjective wellbeing using data obtained from previous our studies.

Keywords: Tourism, SECI Model, Tacit Knowledge, Explicit Knowledge

1. Introduction

In the same way that knowledge is accumulated through personal experience, the accumulation of knowledge by organizations is an important topic for consideration from the perspective of "organizational learning." March (1991) defined organizational learning as learning through experience, acquiring new knowledge, and reflecting it in an organization as an outcome. Argote and Miron-Spektor (2011) provided a circular process of learning as a theoretical framework for analyzing organizational learning. In this study, the process of learning is divided into three categories, "organization," "knowledge," and "organization/person/tool," and each transition is detailed as consisting of three sub-processes. In the first step in the transition from "organization/person/tool" to "organization," a "knowledge search" is implemented. This is considered important for organizational activities. Organizations have limited knowledge based on experience; for this reason they conduct "knowledge exploration" when they need to expand their experiential knowledge base. The second step is the transition from "experience" to "knowledge," through which the organization acquires new knowledge. In this process, knowledge creation, knowledge transfer, and vicarious learning all occur. The third step is the transition from "knowledge" to "organization/person/tool." This is the process through which subjects memorize the knowledge gained. Argote and Miron-Spektor (2011) defined learning in organizations using the functioning of this framework.

We suppose that it is easy to accumulate information on activities that improve subjective well-being (SWB) through experience. If SWB improves not only through the establishment of forms through physical exercises, but also leads to activities geared toward the acquisition and understanding of

¹ School of International Cultural Relations, Tokai University

² STEM Education Center, Tokai University

knowledge, such as reading a book, then knowledge will be accumulated. The personal knowledge that forms an individual includes “explicit knowledge,” which is verbalized and symbolized knowledge, and “tacit knowledge,” which is subjective and physical experiential knowledge that is difficult to express through language (Polanyi, 1966). In general, most knowledge is stored as tacit knowledge. Explicit knowledge is formalized as knowledge and is easy to recognize and extract. Tacit knowledge by comparison is difficult to formalize and is thought to manifest through the experience of certain events. There are two types of tacit knowledge. The first is contained within an individual's body and is obtained through repetition of a particular experience. Repetitive practice by athletes and musicians carried out to improve their skills are appropriate examples. Second, there are cognitive skills embodied in the individual, such as intuition, inspiration, personal beliefs, and empirical knowledge. Explicit and tacit knowledge are different each individual. It is thought that personalities, which include tacit knowledge, collide with each other through interaction or merge through engagement with multiple people. Such explicit and tacit knowledge is not fixed but changes daily. Exchanges, conversations, and discussions with other people have a tangible impact and can alter the structure of knowledge. The structure of an individual's knowledge itself changes when SWB improves.

2. Methodology

The SECI model defines four stages of socialization, externalization, combination, and internalization in relation to the creation of new knowledge through mutual exchange of explicit and tacit knowledge among multiple people in an organization. Explicit and tacit knowledge is created by repeating these stages.

(1) Socialization: This is the stage of the formation of new personal tacit knowledge from an individual's tacit knowledge. At this stage, an individual acquires tacit knowledge through empathy, face-to-face interactions with others, and interaction with the environment. The body and the five senses are used to share and create tacit knowledge through direct experience. These are tacit knowledge “communalization processes.” New tacit knowledge could be created through the empathy generated during a joint experience at a factory site or watching and imitating works in a business sales scenario. In addition, “cognitive tacit knowledge” is constructed through sharing, and empathy through dialogue.

(2) Externalization: This is the stage at which explicit group knowledge is formed from individual tacit knowledge. Tacit knowledge from socialization cannot be used alone, and needs to be verbalized as explicit knowledge. This is a process in which concepts, images, and hypotheses are created through dialogue, thought, and metaphors, and tacit knowledge between individuals is transformed into collective explicit knowledge. There are many approaches to realizing this process. In design thinking, the process of realizing the management philosophy is classified into five stages and expressed with characteristic names (Plattner, 2011). Explicit knowledge is formed by expressing metaphors in a logical form, called abduction, and formalizing causal relationships. The cause of abduction is not necessarily true, but it is an approach that recognizes its importance. As a result, explicit knowledge can be formed by the organization.

(3) Combination: This is the stage where explicit organizational knowledge is formed from group explicit knowledge. Information utilization and knowledge systematization are performed by combining explicit collective-level explicit knowledge and organizing it into stories and theories. Although it has not yet materialized, it is the stage of sharing what will happen in the future as an organization. It aims to

share the ideals of the organization in the new environment and to in turn alter the image of the future organization.

(4) Internalization: This is the stage in which an individual's tacit knowledge is formed from the organization's explicit knowledge. It is the process of embodying explicit knowledge through action and practice, and is learned and understood as new tacit knowledge. By putting explicit knowledge at the organizational level into practice, a new value is created. This is also the stage at which new tacit knowledge is obtained as know-how at the individual, group, and organizational levels.

Nonaka et al. (2001) further developed the SECI model to be applied to knowledge management, and provided examples of its practices in specific companies. They presented the theory of organizational knowledge creation as a basic theory of knowledge management which contains the following four elements: The first is the SECI model, the second is the field as a shared context for knowledge creation, the third is knowledge assets as materials and outcomes in the knowledge creation process, and the fourth is "knowledge leadership," which facilitates the knowledge creation process. This shows that "knowledge management" becomes possible through the interaction of these four factors. Nonaka (2002) further argues that the source of sustainable competitive advantage in the market is high-quality tacit knowledge, and that a knowledge base is essential for new business development. In addition, he pointed out that the knowledge base is a knowledge asset that is difficult to trade in the market, and its development should enable the "economy of perseverance" with regard to human resource development.

3. Application of SECI model to Tourism

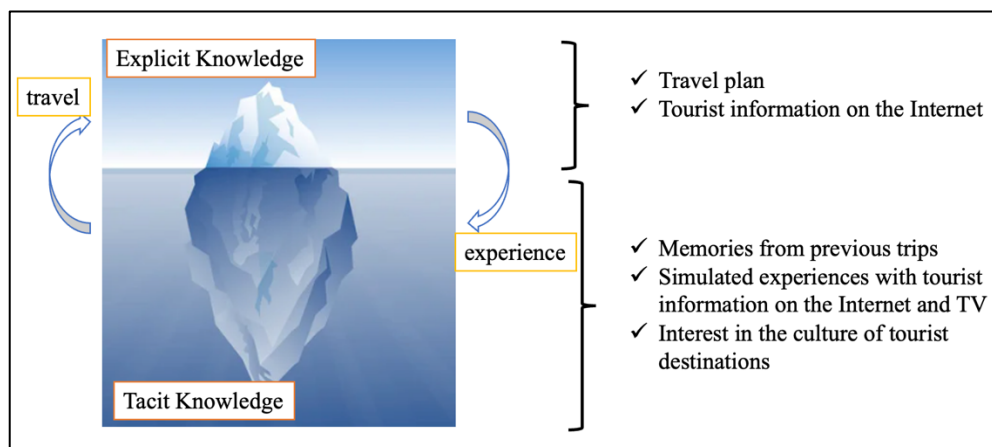


Figure 1: Structure of Individual Knowledge of Tourism

We examined modeling based on the SECI model to determine the purpose of certain tourism activities. Figure 1 shows the structure of the individual knowledge of tourism. Explicit knowledge refers to activities in characteristic tourism destinations that have already become tourism packages and sightseeing tours. Specific tourist activities proceed in chronological order along the sightseeing route, but tourists choose specific activities that are highly likely to provoke "impressions" at tourism destinations. Elements that improve individual SWB through experience, such as good memories from previous tourism destinations, moving experiences seen on TV, and so on, exist as tacit knowledge in an unorganized form. Organizations and groups are assumed to share the same concept of tourism. Under the assumption that the characteristics of a tourism destination improve individual SWB, we focus on choosing a tourism destination and examine

the corresponding four steps in detail.

(1) Socialization: This is the stage at which tacit knowledge is formed through other travelers with the same purpose, and draws upon the tacit knowledge of individual travelers. Individuals gain tacit knowledge in the form of the merits and psychological comforts provided by tourism activities, and based on their own experiences. Travelers gain empathy with other individuals in the group by sharing opinions and impressions of common "goodness" through social media.

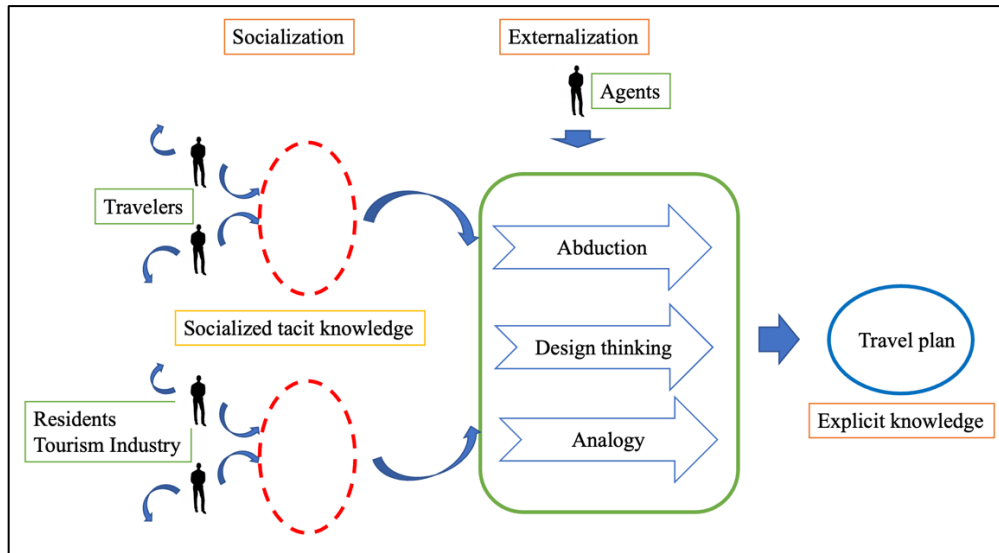


Figure 2: Externalization in tourism activities

(2) Externalization: This is the stage at which explicit group knowledge is formed from the individual, socialized tacit knowledge of travelers and residents/tourism industries. Figure 2 shows a conceptual diagram of externalization in tourism. Both types of socialized tacit knowledge are combined with the process of externalization. Abduction examines which aspect of the event led an individual traveler to generate SWB from the experience through design thinking. Explicit group knowledge can be formed by selecting appropriate abductions in the group. Since a group of volunteers cannot organize themselves for the purpose of constructing explicit knowledge, we suppose that this responsibility should be consciously constructed by travel planning organizations.

(3) Combination: This is the stage at which explicit knowledge is formed through the travel process of the travel group, and is drawn from the group's explicit knowledge. The actual travel process is decided from the collective action agreed upon by the group, with abduction as the premise, and leads to a new form of explicit knowledge being formed. Explicit knowledge contains important elements relating to future activities and is not necessarily possessed by individuals participating in a group. For example, in a trip focused on the natural environment, it is possible to discover tourism conditions that include new "environmental" elements that may be necessary for future consideration.

(4) Internalization: This is the stage in which the tacit knowledge of individual travelers is formed through travel, drawing once more from the explicit knowledge of travel groups. Sightseeing trips are carried out with a specific purpose based on explicit knowledge. For example, in a trip focused on the natural environment, it is possible to experience the elements necessary for conservation, with these elements in turn recognized as tacit knowledge. These elements may also be reflected in future tourism

activities.

To apply such a SECI model to tourism activities, it is necessary to study the collection of empirical data. Statements on social media platforms such as Twitter can be thought of as expressing “emotions” that form part of the tacit knowledge of individuals. Thus, we believe that communication on Twitter forms tacit knowledge at a group level. We assume tourism activities based on such positive remarks on Twitter. Since there are many comments about events that have occurred on Twitter, it can be considered that the implemented tourism activities have produced changes in explicit knowledge. The SWB behind this positive tourism activity is an important factor, especially the improvement of SWB between tourists and residents. From our previous research, we have also obtained results that indicate that "co-creative" activities have the effect of improving SWB for both participants and planners. This “co-creation” activity can be considered as the explicit knowledge of the group for the future. The goodness of "co-creation" activities affects individuals, and the contents of "co-creation" activities may in turn further deepen into individual tacit knowledge.

4. Conclusion

In this study, we applied the SECI model of explicit and tacit knowledge to the field of tourism. We believe that the activities that lead to the improvement of individual SWB associated with tourism activities are accumulated. In this application, we gave meaning to tourism under the terms of Socialization, Externalization, Combination and Internalization. Furthermore, in our previous research, we showed that "co-creative" tourism activities may lead to the accumulation of such knowledge.

In the future, we would like to verify emotional expression in each state of the SECI model based on concrete data.

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REFERENCE

- Argote, L. & Miron-Spektor, E. (2011). Organizational Learning: From Experience to Knowledge. *Organization Science*, Vol. 22, pp. 1123-1137.
- March J. G., (1991). Exploration and Exploitation in Organizational Learning. *Organization Science*, Vol. 2, No. 1, pp. 71-81.
- Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science*, Vol.5, No.1, pp.14-37.
- Nonaka, I. (野中郁次郎) & Umemoto, K. (梅本勝博) (2001). Managing Existing Knowledge Is Not Enough: Recent Developments in Knowledge Management Theory and Practice in Japan. *人工知能学会誌*, Vol.16, No.1, pp.4-14. (In Japanese)
- Nonaka, I. (野中郁次郎) (2002). 企業の知識ベース理論の構想、*組織科学* Vol.36, No.1, pp.4-13. (In Japanese)
- Plattner, H., Meinel, C., & Leifer, L. (2011). Design Thinking: Understand-Improve-Apply. *Berlin: Springer-Verlag*. <http://doi.org/10.1007/978-3-642-13757-0>.
- Polanyi, M. (1966). Michael Polanyi, The Tacit Dimension, *London: Routledge & Kegan Paul Ltd.* マイケル・ポランニー著, 高橋勇夫訳, 2003. 暗黙知の次元、ちくま学芸文庫. (In Japanese)

*II. Special Topics:
Perspective on
Information-oriented Society*

Research Paper

Self-identity in a virtual space: Consideration from an embodied perspective

Mariia SHUVALOVA¹, Shogo TANAKA²

Abstract

We aim to discuss the issue of self-identity in its relation to information technology, especially that of virtual reality (VR). Although self-identity is originally an open process in a constant change, it seems to become even more fluid in VR, where the users can control their self-image by choosing avatars. In this paper, considering self-identity from the perspective of embodiment, we describe how the users adapt themselves to VR through the avatars, being reinforced by bodily illusions. Then, focusing on narrative selfhood in the virtual world, we suggest that VR users would go through two fundamental changes concerning their self-identity. (1) From body schema to body image: The self in VR adapts to the surrounding environment mainly through the avatar, that is, the body image chosen by oneself and constructed by VR settings, rather than body schema that the self normally relies upon in interacting with the real world. (2) Beyond real-virtual parallelism: Through the development of VR technology, the virtual world has been incorporated gradually into the lifeworld, and we are witnessing the emergence of “real-virtuality” as seen in the case of the Metaverse. Although it is still unforeseeable, this may cause a profound change in the process of identity-making. The avatar that each user chooses in the virtual world can play a core part in integrating all other aspects of our narrated selves.

Keywords: self-identity, virtual reality, avatar, body image, embodiment

1. Notion of self-identity from an embodied perspective

Self-identity is an open process in a constant state of creation and reproduction. In diverse situations of life, we ask how we can define ourselves, and we give a temporary (but depending on the situation, stable) answer.

From an embodied perspective, self-identity has its basis in embodied actions in and interactions with the world, ranging from pre-reflective to self-reflective, from subjective to intersubjective, and from collectivistic to individualistic. Furthermore, all these modes of self-identity derive from different focuses on bodily experiences (Tanaka, 2017, 2018). Let us briefly summarize our basic view before dealing with our research question.

To begin with, we can distinguish the phenomenological aspects of one’s body into two: the body-as-subject and the body-as-object (Ichikawa, 1992; Sartre, 1956; Tanaka, 2020). Our ordinary experiences, such as walking, breathing, and listening to music, are underpinned by our own body-as-subject. I act in the world through and with my body, and I perceive the world through and from my body. However, in certain situations, the same body appears to me as an intentional object as well as the subject of action and perception. For example, I look at my body when I put on clothes, touch a spot where I feel pain, and rub my fingers when they are numb with cold. In all cases, the same body appears on the one hand as a “body-

¹ Lomonosov Moscow State University

² Institute of Civilization Research, Tokai University

as-subject” and on the other hand as a “body-as-object.”

In relation to the classic theory of self by William James (1890), the distinction corresponds to that of the self. The body-as-subject corresponds to the “I” as the knowing-self and the body-as-object corresponds to the “me” as the known-self. As is also emphasized by James, the self is shaped through the connection between “I” and “me.” At the level of bodily experiences, it is obvious that the “I” (body-as-subject) and the “me” (body-as-object) are connected and inseparable. In addition, this connection is the same source for self-identity in both individualistic and collectivistic modes.

When one is focused on the experiences of the body-as-object for oneself, one becomes self-reflective. That is, one is oriented to perceive oneself through bodily experiences such as internal feelings, motivations for actions, habits, and dispositions. As Markus and Kitayama (1991) pointed out, the individualistic self in Western cultures is based on behaviors that are organized and made meaningful with reference to one’s own internal repertoire of thoughts, feelings, and actions, and this self-reflective bodily agent would construct an individualistic self-identity.

In contrast, when one is focused on the body-as-object for others, one becomes socially oriented. One perceives one’s own body as a part of “me,” which can also be perceived and worked upon by other members of the family, interpersonal groups, local community, online networks, and the wider society. In such bodily experiences, one regards oneself through others’ eyes in terms of dress code, social role, gender, class, ethnicity, disability, and so on. As a result, one’s behavior tends to be organized and determined by what one considers to be the feelings, thoughts, and actions of others in the shared context. This kind of bodily agent would construct a collectivistic self-identity, or at least an interdependent one. Thus, one’s body-as-object is the primary source for the self to diverge into either the individualistic or collective (Tanaka, 2017). “I” can perceive my own body in diverse ways as a part of “me,” but the same body as “me” can also be perceived by others. At this point, however, it should be noted that the experience of self-reflection between “I” and “me,” which constitutes an individualistic self-identity, is possible only after having experiences of “me” being mediated by others. In his classic text, George Mead (1934) pointed this out as follows:

The individual experiences himself as such, not directly, but only indirectly, from the particular standpoints of other individual members of the same social group, or from the generalized standpoint of the social group as a whole to which he belongs. (p. 138)

From a genetic (or developmental) perspective, we need to pay attention to the fact that one’s personal/individual identity is shaped within the pre-established sociocultural context in which one’s body is embedded.

Of course, individuals may create activities that form new social contexts (e.g., the action of groups, communities, the formation of social networks and institutions). At the level of facticity, we can find a reciprocal interaction between society and individuals. As individuals act (but within a given context), a new social structure emerges from these actions, which in turn shapes individuals’ patterns of actions.

2. Network identity

The problem of self-identity when considered in virtual space opens up new possibilities for its consideration. Today, communication is methodically structured according to models set by technologies

of systemic integration of information processing and transmission. Built on this principle, communication between people acquires the character of network communication, which has certain features, namely, multichannel, high-density logistic ways of information movement.

Before dealing with issues of self-identity on a network, let us make clear the very concept of a “network” to give space for our socio-philosophical analysis. The concept of a network relating to social and philosophical research is relatively new and arises from the rapid development of internet technology in the late 20th century. There is an understanding of human activity within cyberspace that is associated with the emergence of a number of questions about the network identity of a person and his/her actions within network groups, which can spontaneously be formed on the internet. But it is also a question of shifting the traditional hierarchical structure of society to a network structure, which has its own characteristics, that is, the possibility of transferring the experience of network space, understood in the technical sense in the field of computer science, to social processes taking place in the modern world. The definition of a network can be presented as follows: “A network is a poly highway structure in which two points are always connected by a set of highways, and each highway consists of a set of segments and paths” (Nazarchuk, 2008). We can say that a network, which includes in its structure various directions and paths, forms a kind of network space, which is organized due to the emergence of communication within the network. This interpretation reflects an essential characteristic, namely, a plurality of connections, possibility of a choice of alternatives, and decentralization, which are inherent to the network space organized on the principle of a network.

According to Korobeinikova and Gil (2010), the network as a form of organization manifests itself in the following characteristics:

- connectedness and continuity of communication
- horizontal organization – the absence of a single center
- equity
- relative openness of input-output
- adaptability to changes in the internal and external environment
- capability of self-organization and self-regulation

These characteristics of a network distinguish it from the purely technical sphere. It is fair that this understanding of network structure leads us to use it as part of the application to the study of social processes. Turning to such characteristic of network structure as openness, it is possible to note two approaches of interpretation. First, a network can be open inside its organization (there is a possibility of internal freedom of elements related to each other), but such a system will remain closed to the outside world. Second, the network structure can have open borders both within itself and with its environment. Based on this characteristic of network communication, the user’s self-identity in a network has some characteristic features (Voyskunsky, 2013), among which some should be singled out here. First is the person’s conscious construction of his/her network identity. And here we can speak of narrative identity because narrative allows the individual to construct and understand his/her identity as a multi-layered phenomenon, as not only the individual and personal aspects, but also the social and cultural contexts which the individual fits in. Second, as is often mentioned, it is open to modification and (re)construction through dialogicality, that is, through interactions with other users in the network as well as through

interactions with the computer interface. Third, many researchers point out that network identity can be held not only by individuals but also by communities and macro-communities. Finally, based on these considerations, Martyanov (2015) pointed out that space is the major factor in understanding self-identity in a network, with the caution that the content of space can be reconstructed and changed due to a network's fluidity.

We would like to note that some researchers distinguish between self-identity in a network and self-identity in a virtual space. In his review paper "From network identity to internet identity politics: A paradigm shift?" Marthanov (2015) identifies several types of self-identity in internet space: mobile, electronic, online, cyber, network, and virtual. Basically, this division is made according to the way one enters the space of the internet, or, more precisely, according to the means one uses to do so. Beyond this detailed distinction, it is important to note here that the difference between self-identity in a network space and self-identity in a virtual space is accepted by many researchers.

What we focus on in the rest of this paper is self-identity in a virtual space rather than that in a network. Following Segal (2017), in this paper we define the virtual space (or virtual reality) as "a field of images emulating with a degree of similarity time, space, objects located in it, acting subjects and the relationship between them." This understanding of virtual space will allow us to further consider virtual identity through the example of the avatar. The evaluation of influence of the future individual's current behavior is called time perspective (Levin, 1939). People are increasingly concerned about health and tend to regularly exercise and get medical examinations. In addition, many choose to avoid behaviors that may be harmful to health, such as smoking,

3. Virtual reality and network identity

Network identity (i.e., self-identity in a network space) can be understood as "the construction of an image of the self that is its plausible and adequate representation in internet space" (Flenina, 2015) or as "the totality of textual and visual semiotic components of a person's network image, a variety of verbal and non-verbal texts of culture" (Flenina, 2014).

One of the variants of network identity, especially that in a virtual space, is an avatar. As is well known, an avatar is a graphic representation of a user in a virtual environment that is under his/her direct control. Interaction with the virtual world and other participants is conducted through the digital representation of the avatar, as the character is visible to other users who can simultaneously explore the same area. If their avatars are in proximity to each other, two participants can communicate (usually via text but possibly via voice, depending on the platform). Avatars also "represent access points in identity creation and social life. The bodies that people use in these places enable them to live in a digital world - a fully populated world" (Peachey & Childs, 2011). The avatar represents a new identity without any physical limitations, thus becoming an idealized "body project": Ultimately, it is the digital bodies that tell the world something about our identities. They are a public signal of who we are. They also shape and embody users' experience of their inner selves.

The following aspects can be distinguished in the virtual world: (1) the effect of presence is created; (2) users can interact in real time and synchronize their interactions; (3) a neutral space is created where users can interact with each other in a neutral atmosphere, thus creating a certain safe zone for self-

expression; and (4) the virtual world is a platform to embody self-identity in a virtual space, that is, the possibility of living self-representation and self-expansion (the avatar acts as a living being rather than as an artificially created figure). As is seen, networked identity can be fluid and relational due to the procedural mechanisms of the environment that allow for different identities in different games, or the changing appearance of an avatar in one game, in the process of virtual becoming or transformation.

Self-identity in the virtual space can be underpinned by intersubjective situations that multiplayer players participate in, with they themselves also using specified avatars. In this sense, we can say that the virtual environment manifests itself at three levels: the personal level, the interpersonal level, and the world level. Along with this classification, self-identity in a virtual space would be constructed at three different levels as follows:

- (1) The personal level is a certain set of “physical” characteristics that the individual ascribes to himself/herself and embodies in his/her avatar. It is the way in which the player sees himself/herself as a subject of action.
- (2) The interpersonal level includes role identification; identification with other participants, virtual artifacts, and meaningful objects; and a virtual life story (in other words, assumed by the individual through the avatar the social roles which characterize the social group to which the individual identifies himself/herself); and certain social characteristics that the person assumes and on the basis of which other users perceive the person and build relationships with him/her.
- (3) The world level is a higher level of generalization in which there are virtual relationships and communication; virtual community; and a virtual material culture, script, or virtual narrative.

Let us examine more closely what occurs at each level. First, at the personal level, the identity of the users controlling the avatar is revealed according to their preferences, and the avatar itself is completely malleable—one step removes us from our self in the real world. The flexibility of representing oneself through an avatar, the ability to choose a visual representation, and the ability to act through it have turned virtual worlds into a social laboratory for exploring identity. Then, at the interpersonal level, by joining a certain group, an individual assumes the obligation to perform a particular social role and accept the values and beliefs of the social group. Identification of the correlation between personal identity, role, and social group occurs.

However, we need to pay attention to the interconnectedness of these two levels and the third, world level. An individual's behavior depends on the world (situation) in which his/her self-representation takes place. The user is guided both by his/her desire for self-expression and by certain predefined characteristics of the virtual environment when creating the “physical” appearance of the avatar. This is because it is, in this case, the virtual space that sets the semantic context for behavior and the realization of identity. Virtual space sets this context using symbols/language that delineate positions in the social structure. The user, by acting in this virtual space, identifies other actors as well as designates and identifies himself/herself (i.e., creates internal meanings of his/her behavior and identity). The user's interactions with other users shape and construct the content of the virtual social space. Starting from the personal level, the user goes through the interpersonal level and the world level, shaping one's own identity explicitly by changing the avatar, but also being shaped implicitly by the semiotic settings of the virtual world.

4. Embodiment through the avatar

A person's relationship with their avatar can go far beyond simply creating an avatar and using it in a virtual space. After some time of interaction with the virtual world, the connection with one's avatar becomes so strong that what happens to the avatar and the space in which it is located can have an emotional or physical effect on the person. This level of connection can be called embodiment.

In considering actual experiences using an avatar, it would be better to differentiate the levels of embodiment into two: body schema and body image. Although both refer to our bodily experiences in the lifeworld and are closely related with each other, the basic functions are different. As is nicely summarized by Gallagher (2005), whereas body schema is a system of sensory-motor capacities that functions without awareness or the necessity of perceptual monitoring, body image is defined as a system of perceptions, attitudes, and beliefs pertaining to one's own body. The point is that body schema is an implicit system that executes one's bodily movements, but body image is an explicitly objectified (and mainly visual) image of one's whole body that one perceives, has emotional attitudes toward (such as likes and dislikes), and holds concepts on (such as healthy and sick).

In this regard, we can say that an avatar is a kind of extended body image that one can manipulate diverse properties of, such as gender, age, ethnicity, and even species (one can choose avatars of animals and undefined creatures if the virtual settings allow). It is also up to the users' preference to choose an avatar that reflects the properties of their real body or not, as well as the extent to which an avatar reflects the real body. Therefore, the users' choice of avatars involves the desires of transforming oneself, giving an ideal body image to one's presence in the virtual world.

Transformation has been a relatively major topic in the field of cognitive science since the phenomena of "full body illusion" was reported (Lenggenhager et al., 2007; Ehrsson, 2007). Applying the mechanism of rubber hand illusion (Botvinick & Cohen, 1998), which induces an illusory sense of ownership of the fake hand in a laboratory setting, researchers in a related field have attempted to expand illusory ownership toward the whole body. In a standard experimental setting of full body illusion, the subject wears a head-mounted display where the virtual body is projected. Receiving synchronous tactile stimuli on the real body as well as on the virtual body, an illusory sense of ownership is induced on the virtual body. That is, the subject feels that the virtual body is one's own and thus as if one's sense of self is localized in the place of the virtual body. Lenggenhager et al. (2007) claimed that "participants felt as if a virtual body seen in front of them was their own body and mislocalized themselves toward the virtual body, to a position outside their bodily borders" (p. 1096).

Full body illusion shows the malleability of our sense of self depending on body image accompanied by multisensory input. This cognitive mechanism has been explored using avatars in virtual reality settings. For example, Rosenberg et al. (2013) reported that participants who behaved as a "superman" through an avatar in the virtual world showed a greater tendency of helping behavior when they came back to the real world after the experiment. According to another experiment, white people who experienced an avatar with a black body in the virtual world showed a reduction in their implicit racial bias (Banakou et al., 2016). These findings are important because they indicate that a multisensory body image expands one's sense of self into a self-identity that is coherent with the narrative in which the body image is embedded.

Here again we find interconnectedness of three levels of self-identity in the virtual world: the personal, the interpersonal, and the world. The world level provides users with narratives according to which a user wishes to narrate his/her personal story. The range of an avatar's characteristics is given based on narrative settings of the virtual world (e.g., a world sustained by superheroes, a world without racism). At the personal level, a user gives a certain appearance to the avatar by choosing virtual bodily characteristics (e.g., gender, age, ethnicity), and the given appearance of the avatar serves as the user's body image, with which the user socially interacts with others in the virtual world (e.g., behaves as a "superman").

5. Narrative selfhood in the virtual world

As is observed in the real world, what users experience in the virtual world creates personal stories, according to which they construct their self-identity, that is, the narrative self or narrative identity (Ricoeur, 1991, 1992; Schechtman, 2007, 2011). In general, we have a strong tendency to tell stories or narratives about our lives to others and to ourselves. The point is that they are reflexive in the sense that the narrator and the central figure in the narrative are the same (Bruner, 2004) in contrast to fiction. This reflexivity is what underpins our narrative identity. Ricoeur (1991) stated:

According to my thesis, the narrative constructs the durable character of an individual, which one can call his/her narrative identity, in constructing the sort of dynamic identity proper to the plot which creates the identity of the protagonist in the story. (p. 77)

We tell our life stories as narratives, in which we are narrators as well as protagonists. Our narrative selfhood depends on the plot, which we create as narrators and onto which we project ourselves as protagonists.

Whereas the structure of narrative selfhood is rather definable, it should be noted that the actual idea of narrative is multifaceted. Brockmeier and Harré (2001) pointed out that, on the one hand, there are structures of narrative in most discourse types such as scientific, legal, historical, religious, and political texts. And therefore, on the other hand, they attempt to consider narrative as a unifying approach that would fill the gap between cultural discourse, psychology, and human identity disciplines.

They list three virtues of applying the narrative approach to social as well as human understanding:

- (1) Fleeting structure: A focus on narratives enables us to examine "fundamental aspects of human experience, its openness and flexibility, traditionally neglected by the human sciences" (pp. 52-53).
- (2) Narrative as model: Narrative serves as a flexible model to understand cultural phenomena because "narratives operate as extremely changeable forms of mediation between the individual (and their specific reality) and the generalized canon of culture" (p. 54).
- (3) Actual and possible worlds: Exploring narratives allows us to better understand the actual world because "the exploratory and experimental options of narrative are inextricably fused with our fleeting reality itself" (p. 56).

Based on this view, it would be obvious that one's narrative selfhood is not only a product of narrating one's personal life but is deeply rooted in one's cultural background. Narrative is given as a certain model of the world through which one carves out one's autobiographical identity.

The actual world that seems to be firmly constructed is inevitably embedded in possible worlds through narratives based on which both personal and cultural identities are constructed. This naturally

leads us to go beyond two traditional approaches to the study of human identity: soft and hard. The soft approach refers to the fluid, fragmentary, multiple nature of a person's identity, and the hard approach attempts to recognize stability, integrity, and homogeneity, that is, the presence of a certain “hard” core around which identity is created.

The hard approach has its oldest roots in the essentialism of culture. Though it has been criticized repeatedly, it may help us to discover some starting points that represent the formed identity of a person and allow us to describe linguo-cultural types, concepts, and stereotypes contained in the collective dispositions of the community (e.g., Hofstede, 1991). But this approach does not account for the fluid and temporal nature of human identity, nor does it question the concept of “identity” itself, as it takes it as a certain given. In contrast, the soft concept has its origins in social constructivism and makes it possible to view identity as a social variable that has a symbolic, discursive dimension. This approach considers the dynamic and fluid nature of identity and allows us to account for the multiplicity of contexts influencing its formation (e.g., Gergen, 2015). However, it also tends to reduce everything to the social environment of the individual.

Beyond these two approaches, the narrative approach allows us to understand self-identity in both a stable/fixed aspect and a fluid/flexible aspect. A person in a society finds his/her identity as stable and fixed as far as one can narrate one's personal story in accordance with the way that the majority of a community accounts for their lives, including topics such as family, job, health, hobbies, and even religion. As these cultural narratives involve multiple aspects in which one may find difference and malaise (e.g., in gender, sexuality, ethnicity, and social class), each person in a society finds many opportunities to narrate his/her life in a personalized way during his/her life course. In these aspects, it is possible to regard self-identity as fluid and flexible and being open to self-determination. As is the case with embodied self-identity, narrative identity can be not only personal and individual but also social and collective.

In relation to this point, one of the most significant markers of narrative identity is space. An appeal to the works of Bourdieu allows us to single out a trait that is given to social space in which an individual's life activity takes place: “the structure of social positionality” (Bourdieu, 2007). An individual appropriates or alienates a variety of social spaces. Once spatio-temporal characteristics are fixed in the narrative, the individual can separate himself from the Other, to integrate himself/herself into the sociocultural context. A sense of who you are comes through connection to the place in which you live. Physical and social space overlap and form a unique environment for the formation of one's self-identity. Through narrative, personal experience is transformed into social or even political action. A cultural discourse common to a certain number of people is formed, through which social practices are carried out. What is curious in considering narrative identity in the virtual world is its parallelism to the real world. Needless to say, throughout history, humans have always created various types of narratives that refer to another world that does not literally exist in the forms of myths, fairy tales, novels, and so on. However, the parallel worlds depicted in these narratives never co-occur with the natural world. In a psychological sense, narrative selfhood based on these fictive parallel worlds would construct the narrator's unconscious at best. In contrast, narrative selfhood in the virtual world is constructed in parallel to that of the real world because users can actually “live” in the virtual world through avatars. In phenomenological terms, the virtual world constitutes an important part of the lifeworld (*Lebenswelt*) as does the natural world (Husserl,

1970).

Today, activity in a virtual environment is self-documented and recorded, although there are certainly ways to delete information. However, for the most part, our narrative identity is fixed not only by us (e.g., when creating a social media account or creating an avatar), but also by our devices and by the technology we use. In some ways, we can say that our virtuality becomes reality. After all, in a particular sense, we transfer the horizontal relationships we have built in virtual space to real social discourse. As Castells (2009) wrote, in today's world there is a culture of real virtuality; that is, virtuality is becoming a fundamental dimension of our reality. In virtual space, which does not exist separately from social context, certain social ties are formed that generate messages and social meaning beyond the context of the virtual world.

This shift in virtuality will also bring a crucial change to our bodily experiences in the lifeworld. As indicated in the previous section, one normally relies upon one's body schema to perform diverse social actions in the lifeworld. Body schema is anchored in one's basic sensory-motor capacities, most of which are sophisticated and realized as what Bourdieu (2010) calls "habitus." It is through body schema that one finds one's own cultural and collective background in either a good sense (one is surely connected to collective lives) or a bad sense (one is separated from those who belong to other social classes), and this fact serves as a hidden source when one narrates one's life in accordance with the majority of a community. However, when virtuality precedes reality in the lifeworld as "real-virtuality," experiences of one's body image, especially those of avatars, achieve primacy over those of the body schema. Consider the case of the Metaverse as a paradigmatic example. The Metaverse is a VR social platform in which participants can perform most social actions necessary to everyday life, such as desk work, interpersonal communication, online conferencing, buying and selling goods and services, and transferring virtual currency. Surely, it is through the avatar that one socially interacts with others. All the features of one's avatar reflect one's personal choice, which is not necessarily anchored in the physical body. In the Metaverse, the avatar, which involves one's personal desires of transforming oneself, would be the primary source for narrating one's life. Personal/individual, fluid/flexible, and temporary features of narrative identity would become more dominant than other features.

6. Tentative conclusion

Starting from self-identity as considered from the perspective of embodiment, we have explored possible changes in self-identity as mediated by information technology, especially that of virtual reality. We found two fundamental changes concerning this point. (1) From body schema to body image: The self in VR adapts to the surrounding environment mainly through the avatar, that is, the body image chosen by oneself and constructed by VR settings, rather than body schema that the self normally relies upon in interacting with the real world. (2) Beyond real-virtual parallelism: Through the development of VR technology, the virtual world has been incorporated gradually into the lifeworld, and we are witnessing the emergence of "real-virtuality" as seen in the case of the Metaverse. Although it is still unforeseeable, this may cause a profound change in the process of identity-making. The avatar that each one chooses in the virtual world can play a core part in integrating all other aspects of our narrated selves.

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REFERENCE

- Botvinick, M., & Cohen, J. D. (1998). Rubber hands 'feel' touch that eyes see. *Nature*, 391, 756.
- Bourdieu, P. (2007). Physical and social space (N. A. Shmatko Trans.). In I. A. Savkin (Ed.), *The Sociology of Social Space* (pp. 49-63). Moscow, Russia: Aletheia.
- Bourdieu, P. (2010). *Distinction: A social critique of the judgement of taste*. London, UK: Routledge.
- Brockmeier, J., & Harré, R. (2001). Narrative: Problems and promises of an alternative paradigm. In J. Brockmeier & D. A. Carbaugh (Eds.), *Narrative and identity: Studies in autobiography, self and culture* (pp. 39-58). Amsterdam, Netherlands: John Benjamins.
- Bruner, J. (2004). The narrative creation of self. In L. E. Angus & J. McLeod (Eds.), *The handbook of narrative and psychotherapy* (pp. 3-14). London, UK: Sage.
- Flenina, T. A. (2014). Semantic space of the concept "network identity". *Proceedings of the Russian State Pedagogical University named after A. I. Herzen, 171*, 310-314.
- Flenina, T. A. (2015). Approaches to the psychological study of the network identity phenomenon. Retrieved from <http://www.emissia.org/offline/2015/2362.htm>
- Ehrsson, H. H. (2007). The experimental induction of out-of-body experiences. *Science*, 317, 1048.
- Gallagher, S. (2005). *How the body shapes the mind*. Oxford, UK: Oxford University Press.
- Castells, M. (2009). *The rise of the network society* (second edition). Oxford, UK: Wiley-Blackwell.
- Gergen, K. (2015). *An invitation to social construction* (third edition). London, UK: Sage.
- Hofstede, G. (1991). *Cultures and organizations: Software of the mind*. London, UK: McGraw-Hill.
- Husserl, E. (1970). *The crisis of European sciences and transcendental phenomenology: An introduction to phenomenological philosophy* (D. Carr Trans.), Evanston, Ill: Northwestern University Press. (Original work published 1954).
- Ichikawa, H. (1992). *The body as spirit [Seishin toshitenoshintai]*. Tokyo, Japan: Kodansha.
- James, W. (1890/1950). *The principles of psychology* (Vol. 1). New York, NY: Dover Publications. (Reprinted in 1950).
- Korobeinikova, L.A., & Gil, A.Y. (2010). Network structures in the context of globalization. *Proceedings of Tomsk Polytechnic University*. 316, 99-107.
- Lenggenhager, B., Tadi, T., Metzinger, T., & Blanke, O. (2007). Video ergo sum: Manipulating bodily self-consciousness. *Science*, 317, 1096–1099.
- Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review*, 98, 224–253.
- Martyanov, D.S. (2015). From network Identity to internet identity politics: A paradigm change? *Vestnik (Herald) of SPbU*, 6, 44-52.
- Mead, G. H. (1934). *Mind, self, and society, from the standpoint of a social behaviorist*. Chicago, IL: University of Chicago Press.
- Nazarchuk, A.V. (2008). Network society and its philosophical understanding. *Problems of Philosophy*, 7, 61-75.
- Peachey, A., & Childs, M. (2011). *Reinventing ourselves: Contemporary concepts of identity in virtual worlds*. Cham, Switzerland: Springer.

- Ricoeur, P. (1991). Narrative identity (M. S. Muldoon, Trans.). *Philosophy Today*, 35, 73-81. (Original work published 1988).
- Ricoeur, P. (1992). *Oneself as another* (K. Blamey, Trans.). Chicago, IL: University of Chicago Press. (Original work published 1990).
- Schechtman, M. (2007). Stories, lives, and basic survival: A refinement and defense of the narrative view. *Royal Institute of Philosophy Supplements*, 60, 155-178.
- Schechtman, M. (2011). The narrative self. In S. Gallagher (Ed.), *The Oxford handbook of the self* (pp. 394-416). Oxford, UK: Oxford University Press.
- Segal, A. P. (2017). The image of the future or virtual reality? On the space of personality formation. *Vocational Education in the Modern World*, 7, 1380-1387.
- Tanaka, S. (2017). The Body as the intersection between individuality and collectivity. *Civilizations, Special Issue 2017*, 128-139.
- Tanaka, S. (2018). Bodily basis of the diverse modes of the self. *Human Arenas*, 1, 223-230.
- Tanaka, S. (2020). Body-as-object in social situations: Toward a phenomenology of social anxiety. In C. Tewes & G. Stanghellini (Eds.) *Time and Body: Phenomenological and Psychopathological Approaches* (pp. 150-169). Cambridge, UK: Cambridge University Press.
- Voyskunsky, A.E., Evdokimenko, A.S., & Fedunina, N.Y. (2013). Networked and real identity: A Comparative Study. *Journal of the Higher School of Economics*. 10, 98-121.

III. Trans-disciplinary Humanities

Research Paper

A Remark on the Distance Between the Study on Trans-Disciplinary Humanities and Society—Focusing on Trends in the Humanities in Japan in the 1970s and the 1980s

Sei WATANABE¹

Abstract

Trans-disciplinary study research is becoming increasingly important in science and technology policy to solve the complex social problems of our time. In the humanities, it has long been examined as a new form of knowledge, as opposed to disciplinary study, with criticism of modern knowledge. As one example, this paper focuses on trends in the humanities in Japan during the 1970s and 1980s. This will make it clear that the quest for trans-disciplinary study was linked to the question of how the humanistic knowledge can examine the social environment, which is constantly changing and facing new difficulties. The possibility of trans-disciplinary humanities can also be found as an extension of this trends.

Keywords: trans-disciplinary study, trans-disciplinary humanities, clinical knowledge

1. Introduction

In recent years, the importance of trans-disciplinary study has come to be recognized again. Trans-disciplinary study is an intellectual approach or a framework that has been continually debated in Civilization Studies. For example, when studying civilization, Masahiko Kamikawa pointed out the necessity of shifting the mode of knowledge from discipline to inter-discipline and then to trans-discipline [Kamikawa (1994)]. This is because it is difficult to understand civilization as a synthesis, in which all human activities are organically related, from the viewpoint of only one discipline. Moreover, it cannot be said that inter-discipline, which brings together the research results of individual disciplines, is an appropriate, or adequate form of research method. Therefore, the ideal form of “research methods that transcend and intertwine each academic field (i.e., trans-disciplinary study) has been discussed.

Based on the above discussion, we have explored the possibility of constructing “trans-disciplinary humanities” as “a means of holistically studying human existence and human behaviors” [Watanabe & Hirano (2015), p.92]. During the study, the following two issues emerged: (1) The first is that in today’s science and technology policy, the term trans-discipline is taken as a practical intellectual form that solves real social problems; (2) the second is to re-understand the origin of the research attitude that dares to go beyond the intellectual form of discipline. Therefore, it is necessary to consider these two issues.

The aforementioned two issues are not independent of each other. They can be treated as interrelated because they share the problem of distance between academic disciplines and society.

This paper addresses these two issues through the following examples. First is the discussion of new methods of knowledge production by Michael Gibbons and others. Second is the trends in the humanities in Japan in the 1970s and the 1980s. To further explicate the second example, the paper examines Yujiro

¹ Student Achievement Center, Tokai University (previous affiliation)

Nakamura's "Clinical Knowledge" ("Knowledge of Pathos").

2. Trans-Discipline in Science and Technology Policy

—Focusing on the Recommendations of Gibbons et al.

In their *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies* published in 1994, Gibbons and others declare as follows:

"In recent years, growing public concern about issues to do with the environment, health, communications, privacy and procreation, and so forth, has had the effect of stimulating the growth of knowledge production in Mode 2." [Gibbons et al. (1994), p.7]

According to Gibbons and others, one of the features of intelligence seen in Mode 2 is trans-discipline (whereas Mode 1 is an individual discipline)².

At the same time, however, Gibbons and others emphasize that trans-disciplinary study involves not only researchers belonging to different academic fields of expertise but also engineers, lawyers, and business people. In other words, for them, trans-disciplinary study is collaborative research not only with researchers but also with people and groups who are actually involved in solving a certain social problem. This aspect can be seen as a feature of trans-disciplinary study that has come to be emphasized in the contemporary context of science and technology policy.

The importance of trans-disciplinary study has been linked to the heightened sense of crisis about serious social problems, for example, global environmental issues, the COVID-19 pandemic, and gender minority issues. A heightened sense of crisis raises expectations for a form of scholarship that contributes not only to solving problems within the specialized field but also to the resolution of real-world social problems. The expansion of Mode 2 to involve stakeholders, as opposed to academic inquiry, is likely a reflection of the growing demand for more practical and rapid problem-solving.

Gibbons and others point out: "Rather than the humanities being pre-scientific, it is the natural sciences which until very recently have been pre-social" [Gibbons et al. (1994), p.177]. In fact, there used to be a considerable distance between the natural sciences and society. Natural science has traditionally advocated "science for science's sake." However, the distance between them is now shrinking, and the close interlocking relationship between natural science (and even technology) and society is growing. At the same time, there is an increasing need for responsibility (social accountability) to explain to society the effects and benefits of individual scientific research, including its demerits.

Based on the above discussion by Gibbons and others, the meaning of the term "trans-disciplinary humanities" becomes clearer. If the humanities were originally developed under a close relationship with society, there would be no need to add the prefix to the term "trans-disciplinary." However, it is suggested that there is an awareness of the problem of the increasingly growing sense of distance between the humanities and society. Therefore, the question arises as to why the distance between the humanities and society has increased. This paper considers this question in the following section, taking the trends in the

² Gibbons and others define Mode 1 and Mode 2 as follows: "Mode 1 is disciplinary while Mode 2 is trans-disciplinary" [Gibbons et al. (1994), p.3].

humanities in Japan as an example.

3. Trends in Trans-Disciplinary Humanities Research in Japan

In Japan, the orientation toward trans-disciplinary humanities seems to have typically emerged in the 1970s and the 1980s. During this period in Japan, against the backdrop of rapid economic growth, material affluence spread among the people, environmental pollution increased in various places, and social awareness of this problem became widespread. Perhaps this remarkable change in the social environment was one of the causes that led to the widening distance between the humanities and society. In other words, a major change in the real world has caused a distortion. This meant that, amid a great change, the close relationship between the previous society and the existing humanities could not be preserved.

During the same period, as if in response to this change, collaborations across scientific (academic) disciplines were planned. The earliest example of this was the debate held between March 1971 and February 1972. This discussion was titled “An Attempt at Philosophical Anthropology” (人間学への試み) and was carried out through the magazine “TENBO (展望)” (The Perspective). The participants were Junichiro Itani, Shunpei Ueyama, Tokindo Okada, Kazuo Terada, Ei Teramoto, Tetsu Hiroshige, Masaki Furuya, and Keiji Yamada, whose majors were physical anthropology, philosophy, zoology, anthropology, biophysics, history of science, botany, and history of science, respectively. In 1973, this debate was compiled into a book, in which the following passage can be found:

“At the same time, the modern world itself, including not only politics, and economics, but also culture in general, is undergoing a major transformation. From this perspective as well, it seems that the demands placed on science and scholarship are becoming extremely large and deep, in response to this situation, or as something that should lead the way in this transformation.

(...)

What exactly are humans and the civilizations that humans have created, and how is it possible for humans to continue to live in the future? It should be said that this question is acutely related to today’s science and scholarship.” [Yamada (ed.) (1973), p.3]

Thus, we can see that interdisciplinary collaboration in various sciences and disciplines is being promoted by an awareness of the need for social accountability for science and scholarship, which is becoming stronger as the social environment changes. In addition, the fact that the issue of sustainability of humans and civilization is mentioned indicates that this half-century-old attempt is still ongoing today.

Another example is the formation of the “Assembly about the City” (都市の会), which was positioned as an attempt to demonstrate the trans-disciplinary humanistic orientation in Japan in the 1970s and the 1980s. In 1976, a meeting between Masao Yamaguchi, Kenzaburo Oe, and Shuntaro Tanikawa led to the organization of a kind of workshop called “The Assembly” (例の会). The participants of this workshop were Nobukazu Otsuka, Koji Taki, Yujiro Nakamura, and Yoshihiko Hanawa. Later, Hiroshi Ichikawa, Hayao Kawai, Ai Maeda, and Masashi Miura joined “The Assembly,” and ultimately, “Assembly about the City” was formed as a study group. This society is made up of members from a wide range of fields, including anthropologists, novelists, poets, businessmen, art critics, philosophers, journal

editors, psychoanalysts, literary scholars, and literary critics.

In 1979, Hiroshi Saito published “Queries toward Civilization” (『文明への問』). The aim of the work was to establish a new academic field called “Civilization Studies.” And the theme of this book is the pursuit of holistic knowledge that is not limited to the framework of a discipline of a specialized field. Saito writes:

“Civilization Studies cannot be positioned as a branch of the various specializations of modern scholarship, nor can it be thought of as an academic field with such a character. Civilization Studies already rejects the basic modus operandi of modern scholarship. In other words, the modern philosophy of scholarship, which states that the advancement of learning itself is the promotion of specialization and subdivision of learning, is rather seen as the dismantling of learning itself. Therefore, more concretely, Civilization Studies can be thought of as the sum total of all attempts to reflect on the ideas that lie hidden in the foundations of modern learning.” [Saito (1979), pp.3-4]

Civilization Studies can be considered as one of the intellectual trends of half a century ago. Here, a specialized discipline is expressed as a symbol of unequivocal modernity in the context of academic theory. Specialization is nothing more than an intellectual form that has arisen, expanded, and become influential in modern times. Rejecting the basic form of modern discipline means a reflection on the fact that “the development and commercialization of natural resources by modern science and technology has become a self-imposed goal for the pursuit of profit and the supremacy of efficiency” [Nakamura (1992), p.17]. As such, it is a shared position in trans-disciplinary humanities trends in general.

As mentioned previously, Civilization Studies targets the ideals that lie at the base of modern discipline. This fact suggests that there is a willingness to extract, scrutinize, and evaluate symbols that signify modernity from the perspective of not only academic theories but also various research fields.

Furthermore, by comprehensively treating the modern symbols collected in this process, it is possible to systematically understand the modern era and present an intellectual model different from it. This is where we can probably find the social accountability of Civilization Studies.

4. “Clinical Knowledge” as an Alternative

The new prospects obtained through criticism of the modern era are not unique to Civilization Studies but can be considered as a common destination aimed at by trans-disciplinary trends.

For example, Yujiro Nakamura, proposing “another alternative to the methods of modern science in response to the dissatisfaction that people must be feeling in various fields, especially in many different fields,” attempts to introduce the notion of “Clinical Knowledge” [Nakamura (1992), p.10].

According to Nakamura, the modeling of “Clinical Knowledge” began with the “sandplay therapy” practiced by psychiatrists such as Hayao Kawai. Nakamura came up with the logic that grounds this as a study of the humanities [Nakamura & Terasaka (2001), pp.285-286]. In other words, the starting point was an attempt to explain the fact that the patient was actually cured by creating a sandplay. Sandplay therapy is one example of expressing a reality that cannot be captured in the context of scientific medicine. “Clinical Knowledge may be conceived as an intellectual form that confronts this reality.” Nakamura

explains “Clinical Knowledge” as follows:

“The three principles of modern science, “universality,” “logic” and “objectivity,” have ignored and excluded one aspect of “reality.” Here, three important principles can be obtained to recapture this aspect of “reality”; they are “Cosmology,” “Symbolism” and “Performance.” And what embodies them together is the concept of “Clinical Knowledge” which I have modeled. In this way, I can thus obtain a method of capturing events is obtained, by fully considering the multiple meanings of the target in each place and time, and by interacting with it.” [Nakamura (1992), p.9]

In “Clinical Knowledge,” cosmology, or eigen-world, which corresponds to universality, is related to the problem of absolute time and space. These are regarded as one of the basic points of modern science, but the world which humans inhabit is not such an abstract space.

Nakamura states, “In the process of establishing the modern age literally, a universalist method freed from the control of place (which socially leads to communities and their traditions) became the central principle” [Nakamura (1991), pp.237-238]. Here, “place” signifies “Topos,” which is a place as a community with tradition³. Thus, cosmology in “Clinical Knowledge” asserts a position that emphasizes locationality.

The symbolism corresponding to logic can be rephrased as the ambiguity (multi meanings) of things. On the contrary, the logic mentioned here is given the feature of uniqueness. According to Nakamura:

“Science unifies things conceptually, and then consists of such things by connecting them logically. However, in reality, unification is just an abstraction, and therefore, such unification already simplifies things when we grasp them.” [Nakamura & Terasawa (2001), p.276].

However, the meaning of things is actually ambiguous. This ambiguity is tied to the locality mentioned above. The meaning of things is inseparable from how the people belonging to a certain community come into contact with the world. In addition, the meaning of things is bound to how it has been passed down from generation to generation and has formed traditions.

Regarding performances (physical actions) that correspond to objectivity, Nakamura argues as follows:

“There must be an interaction between the person who acts and the person who sees it or who is present there.” [Nakamura (1992), p.135]

Objectivity presupposes the separation of the subject and the object. In this case, the object is always passive; however, Nakamura attempts to undermine this premise by emphasizing the reaction of the subject when it acts on the object. With the reaction of the subject, the concept of the subject simultaneously includes both the activeness to act and the passivity to receive the action. A human being

³ “Topos” means not only the substantial place but also the conceptual space.

is a living organism with a body. Therefore, a human being as a subjective agent with a body is also an existence that cannot help but be passive.

Thus, “Clinical Knowledge” can be considered an alternative to modern knowledge that has been developed by univocally abstracting the world and seeing it as a passive object. This concept emphasizes the interaction between the world as a place with multiple meanings and the people who live in it. “Clinical Knowledge” sheds light on aspects of reality that modern knowledge overlooks or downplays. In doing so, it attempts to bring humanistic knowledge into line with more complex realities. The expansion of modern knowledge, especially which of scientific knowledge, was another factor causing a distance between the real world and the humanities. Nakamura’s “Clinical Knowledge” suggests the necessity to attempt to bridge this gap.

5. Conclusion

One of the reasons why the distance between the humanities and society is widening is that the real world is constantly moving forward and changing. Considering the trend of trans-disciplinary studies in Japan in the 1970s and the 1980s, we can see that modern knowledge was one of the main factors for this dynamism. Although this change has given us various benefits, it has also led to new social problems. When we become acutely aware of the seriousness of the new problem, we once again question who we are and how we should be. In other words, a different humanistic answer than the previous one is required for a reality that has undergone a major transformation.

Another reason for the widening distance between the humanities and society is that, due to the unrivaled progress of modern knowledge, only some aspects of the inherently complex reality have been shed light on. In that sense, Nakamura’s “Clinical Knowledge” can be regarded as one of the fruits of the intellectual system that has been established as an antithesis to the modern era in Japan since the 1970s. The formation of such an axis of opposition is nothing but an effort to escape from static logic. “Clinical Knowledge” aims to respond to the ever-moving reality and, at the same time, to bring to the surface the hidden facets of the complex reality that cannot be understood from a single point of view or logic. Although this effort will not solve social problems dramatically, it can surely point the way forward.

Recent anti-modern activities and expressions, such as efforts to protect the environment and respect for diversity, underscore the effectiveness of trans-disciplinary humanities trends that have continued for half a century. However, currently, trans-disciplinary study is still in the process of being promoted. As Gibbons and others point out, trans-disciplinary trends are being transformed into more practical activities in which various kinds of people participate. In addition, as 50 years have passed since the mid-20th century, society has changed further, and new problems have arisen.

Therefore, it is quite certain that the role that the humanities should play today is by no means a small one.

REFERENCE

- Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., Trow, M. (1994), *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, Sage Publications, p.7.
(Japanese translation: ギボンズ編著『現代社会と知の創造—モード論とは何か』、小林信一監訳、丸

善ライブラリー、1997年、31頁)

- Kamikawa, Masahiko (1994), “Contemporary Issues in Comparative Civilization: Looking Toward the 21st Century,” *Hikaku bunmei (Comparative Civilization)*, 10 (in Japanese). (神川正彦、「比較文明学の現代的課題—21世紀への展望のもとに」、『比較文明』、第10号、比較文明学会、1994年)
- Nakamura, Y. (1991), *Topos, Koubunndo* (in Japanese). (中村雄二郎『場所』、弘文堂思想選書、1991年)
- Nakamura, Yujiro. (1992), *What is Clinical Knowledge*, Iwanami Shoten (in Japanese). (中村雄二郎『臨床の知とは何か』、岩波新書、1992年)
- Nakamura, Yujiro., Terasawa, Katsutoshi. (2001), “Philosophy of Herbal Medicine”, IN: Yujiro, Nakamura. *Transformation of Knowledge, Knowledge Present*, Seidosya (in Japanese). (中村雄二郎、寺澤捷年「漢方医学を哲学する」、中村雄二郎『知の変貌・知の現在』、青土社、2001年)
- Saito, Hiroshi. (1979), *Queries towards Civilization: For the Foundation of Civilization Studies*, Tokai University (in Japanese). (斎藤博『文明への問』、東海大学出版、1979年)
- Yamada, Keiji. (ed.), (1973), *An Attempt at Philosophical Anthropology*, Chikuma Syobo (In Japanese). (山田慶児編『人間学への試み』、筑摩書房、1973年)
- Watanabe, S., Hirano, Y. (2015), “A Note on Civilization Studies from a Viewpoint of Trans-Disciplinary Humanities,” *Civilizations*, No.20 (in Japanese). (渡辺青、平野葉一、「文明研究に関する超領域人文学からの一考察」、『文明』、No.20、2015年)

Research Paper

A Remark on the Reform of Science (Mathematics) Education from STEM education to STEAM education

Yoichi HIRANO¹, Tomoko NAKAMURA²

Abstract

The Science, Technology, Engineering, Arts, and Mathematics (STEAM) education is becoming increasingly popular in today's science and technology education. This can be understood as adding "Arts" to the Science, Technology, Engineering, and Mathematics (STEM) education up until now. Then, what does this "Art" mean? In this study, focusing on G. Yakman's paper, which introduced the concept of STEAM, we examined what "Art" means in the context of STEM education and examined the direction of science and technology education in the future. Furthermore, as a concrete example, we take up mathematics during the Renaissance period and analyze the practical and comprehensive knowledge found in mathematics at that time.

Keywords: STEAM education, Renaissance mathematics, practicality of mathematics

1. Introduction

Modern civilization is supported by science and technology; however, today, it excessively depends on the progress of science and technology. Alvin Toffler once foresaw the coming of the Information Age, calling it the Third Wave [Toffler (1980)]. Considering the spread of the Internet and the introduction of artificial intelligence, our age is truly in the midst of information technology. Under these circumstances, in 1990, the National Science Foundation of the United States introduced the concept of "STEM" (Science, Technology, Engineering, and Mathematics), from the standpoint of improving the competitiveness of science and technology development and cultivating human resources who will lead the civilization of science and technology, including modern information and communication technology. STEM is an educational policy based on Science, Technology, Engineering, and Mathematics. In contrast, in 2006, G. Yakman proposed an educational method that integrated "Arts (A)" into the STEM education. This is an educational method, called STEAM education, which incorporates various human activities into science and technology education. At present, a wide range of research and practical applications regarding the STEAM education are being attempted.

In its "*Promotion of cross-disciplinary learning such as STEAM education*," the Ministry of Education, Culture, Sports, Science and Technology of Japan states that:

"Today, society is undergoing drastic changes and various issues are arising. There is a need to nurture the qualities and abilities that will lead to solutions and the creation of social value. In addition to STEM, the Ministry of Education, Culture, Sports, Science and Technology defines "A (Art)" in a wide range of fields including art, culture, life, economics, law, politics, ethics, etc., and encourages learning in each subject. We promote interdisciplinary learning that can be used to discover and solve

¹ Institute of Civilization Research, Tokai University

² Student Achievement Center, Tokai University (previous affiliation)

problems in the real world.”³

Furthermore, in the *Central Council Report Excerpt* (Jan. 26, 2022), the following words can be seen:

“Regarding STEAM education, even from an international perspective, there are various definitions in each country. There are those that narrowly define the scope of “A” which is joined to STEAM as design and sensibility, and those that define it in a broad range including art, culture, life, economy, law, politics, ethics, etc. Focusing on the aspect of STEAM education that aims to develop the qualities and abilities necessary for citizens living in modern society where each field of STEAM is intricately related, it is important to define the range of “A” in STEAM not only in art and culture but also in a wide range (liberal arts) including life, economy, law, politics, ethics, etc. and promote it.”⁴

This study examines mathematics education in today’s science education. In fact, because the STEAM education includes mathematics education, those involved in mathematics education are also responsible for performing this STEAM education. Beyond that, the significance and role of mathematics is considered important for science and technology literacy or in a wider range, including the aforementioned “A.” Here, by reaffirming this current situation, we will attempt to raise questions about what is expected of mathematics education in the future and, conversely, to what extent mathematics education can meet those expectations. Furthermore, given the addition of “A” to mathematics education, examining some cases in which mathematics is linked to human activity itself is also important.

In this regard, this study discusses the state of mathematics and mathematics education in the Renaissance period as an example and considers how mathematics should be as comprehensive knowledge for humans.

2. Introduction of the STEAM education by Georgette Yakman

2.1. Background

It is undeniable that individuals have become uninterested in science and mathematics as a background to the need for STEM and STEAM in science and technology education. In a highly developed science and technology civilization, the division between science and technology makers (those who create and provide) and users (those who enjoy and apply) is becoming increasingly noticeable. Individuals can live comfortably without knowing the principles and systems of science and technology that make up society, just as they can operate mobile phones and television remote controls. Here, one of the problems of today’s civilization can be found. It is true that users do not need the skills to disassemble and repair equipment; however, knowing the principles and background of how it was made is better. This is because such knowledge will lead to an understanding of the merits and demerits that the device brings to society.

In contrast, there is another problem in people’s awareness of science. Since the scientific revolution of the 17th century, mechanistic and material science has helped individuals understand the universal order,

³ Ministry of Education, Culture, Sports, Science and Technology of Japan, Homepage (in Japanese), https://www.mext.go.jp/a_menu/shotou/new-cs/mext_01592.html (accessed on Dec. 20, 2022)

⁴ Ministry of Education, Culture, Sports, Science and Technology of Japan, Homepage (in Japanese), https://www.mext.go.jp/content/20220518-mxt_new-cs01-000016477_00001.pdf (accessed on Dec. 20, 2022)

and thus, social legitimacy itself has become alienated from the human mind⁵. For individuals, science and technology has been established independently of themselves, and it has fostered the illusion that individuals can only be involved in subjective activities, such as art and culture. Therefore, individuals have a subconscious awareness that academic and technical education is enough for professional training, and this keeps individuals away from science and technology.

Nevertheless, individuals rely on science and technology. Believing that science and technology will enrich their lives, they blindly overestimate it. Therefore, it can be observed that science and technology is placed outside the realm of their lives, and they enjoy only the benefits that come from it. As a result, they cannot judge the value of science and technology by themselves and come to be simply ruled. Therefore, recognizing that science and technology should be part of human activities is necessary.

2.2. Evolution from STEM to STEAM

As mentioned above, the existence of science and technology in the present age is of great significance. Therefore, the cultivation of young individuals who will lead science and technology is essential, and in consequence, the introduction of the STEM education is considered inevitable. However, how to connect the STEM education to actual human activities is a hurdle. The STEAM education introduced by G. Yakman signifies one solution to this problem. In the following sections, we discussed the characteristics of the STEAM education with reference to Yakman's paper [Yakman (2008)].

Yakman calls a "silo" for individual disciplines, such as STEM. Furthermore, she began by rethinking how science, mathematics, language arts, and social studies have historically formed separate and independent silos in the K–12 education system (which is an education system from kindergarten to high school). In the STEM education, naturally, the four fields also form individual silos. In pursuing the possibility of an educational curriculum that integrates them, she eventually found the influence of various elements of language arts and social studies on each silo that constitutes the STEM education. With this in mind, she sought a direction in which each silo of the STEM education can be organically linked by introducing "A (Art)" into STEM. Here, "Art" consists of various divisions: language arts, traditional "fine arts," physical arts, manual arts, and the broader field of liberal/social arts. As shown below, mathematics in particular serves as a silo in itself and a common language for STEM in its entirety.

Regarding liberal arts and social arts, Yakman appreciated their importance as a basis for understanding other fields. Particularly, she estimated that the category of liberal arts is the broadest because it includes "the social sciences, such as sociology, philosophy, psychology, theology, history, civics, and politics, and, to educators, one of the most important classifications, the field of education itself" [Yakman (2008), p.12]. Consequently, liberal arts and social arts are positioned as "a cornerstone of the knowledge necessary for students to become education citizens able to understand the directions that they are responsible for guiding the world to go in" [Yakman (2008), p.13].

It can be assumed that Yakman's goal was to introduce "Art" to interconnect individual disciplines (silos). This is because understanding the interrelationships of each field and organizing them are important. Finally, she defined "Art" as follows:

⁵ This discussion agrees with what Watanabe argues in his paper of this journal as "the gap between academic research and society."

“Art: how society develops, impacts, is communicated and understood with its attitudes and customs in the past, present and future;
Physical Arts, Fine Arts, Manual Arts, Language Arts & Liberal Arts (including; Sociology, Education, Politics, Philosophy, Theology, Psychology, History & more...)” [Yakman (2008), p.16]

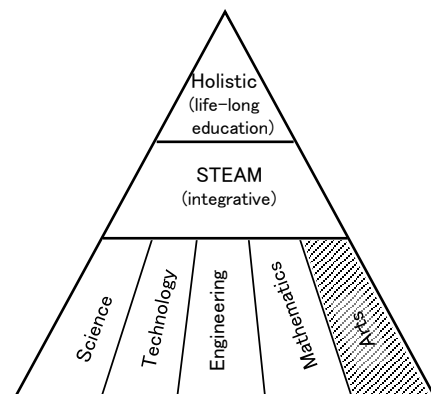
Here, it can be seen that “Art” is incorporated as an element for understanding the historical development of human activities and society as its product.

In her paper, Yakman presented STEAM in a pyramid diagram, which we rewrote as a schematic figure (Fig. 1). She wrote herself:

“I created the following diagram in order to establish a framework for giving structure to and analyzing the interactive nature of both the practice and study of the formal fields of STEM and the arts.” [Yakman (2008), p.16]

In this figure, individual disciplines are arranged at the bottom, and from there, the composition aiming at the total “knowledge” is shown by synthesizing the academic disciplines. At the top is the holistic knowledge that aims for lifelong education. The STEAM layer is positioned just below the holistic knowledge. In the lower layer, the five fields (i.e., Science, Technology, Engineering, Mathematics, and Art) are placed as STEM + A. Furthermore, the individual contents of each field are presented in the lowest layer. Conversely, comprehensive knowledge, which is important for human beings throughout their lives, is formed through each of these lowest levels working together and ascending the hierarchy in order.

[Fig. 1] Yakman’s pyramid diagram.



Yakman also mentioned the role of mathematics in the paper. Today’s science is closely linked to technology, and its achievements are realized in engineering. Yakman suggested that there, “Art” (art and craft) and mathematics are essential. It is the same as technology and engineering are based on the natural sciences. Science, technology, and engineering form their silos as a result of the Scientific Revolution (that Kuhn called), and mathematics is the common language that can elucidate their structural connections. In consequence, she asserts as follows:

“Mathematics is the primal language that cuts across all other field’s boundaries. It is not just a primal language but a network of practical and theoretical divisions that interact both with other subjects as well as stands alone. Since mathematics is the underlying language of all communication, it therefore becomes the linking agent between concept and understanding in education.” [Yakman (2008), p.17]

Yakman's argument accurately captures one aspect of mathematics. Consider the question of what kind of discipline mathematics is. It seems that there are various answers to this question. One answer is that mathematics combines abstraction and practicality. "Mathematics has the ultimate abstraction on the one hand and a high degree of applicability on the other" [Nagai (1967)]. Because of its abstractness, mathematics transcends the boundaries of various other fields, so is its practicality. Mathematics can be applied to various objects appearing in our activities. In fact, it interprets concrete phenomena that appear in front of us as abstract mathematical objects and clarifies those objects' properties [Nakamura & Hirano (2022)]. In addition, it should also be noticed that mathematics, itself, forms a part of "Arts." This point will be discussed in a later section.

3. On the meaning of "A (Art)" in the STEAM education

As mentioned above, Yakman actually put physical arts (physical skills and abilities), fine and manual arts (arts and craftsmanship), language art (language), and liberal arts, as the contents that form the bottom layer of the pyramid diagram. In other words, in contrast to the four science-based disciplines in the STEM education, the basic elements that make up the activities of individuals and society (i.e., culture and social activities) can be thought of as "A (Art)."

Nowadays, many studies have been conducted on the meaning and content of "A (Art)" in the STEAM education. For example, Tsujiai and Hasegawa historically verified the meaning of "A (Art)" using the Oxford English Dictionary and Oxford Advance Learner's Dictionary [Tsujiai & Hasegawa (2020)]. They reported that singular "Art" signifies at first the meaning of "skill as a result of knowledge or practice," followed in turn by "the so-called arts, such as painting and sculpture." It has also been shown that "Art" is placed in a position of contrast with "Nature," which is a characteristic of Western European thought. Moreover, they considered "Liberal Arts" from a historical perspective as well. Finally, they highlighted that the definition of "A (Art)" itself proposed by Yakman is not necessarily clear and that, if "A" is "Art," the effect of innovation creation by each interaction of STEM is expected; in contrast, "Arts" will have potential cross-disciplinary education effects.

In addition to this study, many studies have examined the definition and content of "A (Art)." In fact, what "A (Art)" means is important to be sure; however, for those engaged in science education, providing a clear meaning to "A (Art)" and approaching education with that awareness are also important. In today's education, it is often said that "A (Art)" has two meanings. The one means "fine arts" and the other means "Liberal Arts." Regarding the former, particularly in modern civilization, which is becoming increasingly complex, designing is necessary to organize and express the thoughts that can promote science and technology. The latter is essential to the development of human activities.

Through the aforementioned discussions, the fact that the "A (Arts)" added to the STEM education has a wide range of possibilities can be observed. Even if we simply say "Liberal Arts," the meanings have changed with the times. Historically, "Liberal Arts" (*artes liberales*), which appeared in medieval Europe, consisted of "quadrivium" (four subjects) and "trivium" (three subjects). The former consists of arithmetic, geometry, music, and astronomy, each of which is derived from the ancient Greek Pythagorean school. The latter is based on grammar, rhetoric, and dialectics (argument), which were part of the culture of ancient Greece. In contrast, "Liberal Arts" means a kind of basic and elementary education subject.

Furthermore, education, including skills similar to “reading, writing, and calculation,” found in the citizenship education in the United States is also called “Liberal Arts.” In the article of “Art” of the “Encyclopédie” published in France in the 18th century, this term is understood exclusively in the sense of “skill” and “technology.” Here, “Art” signifies a kind of human skill in relation to “Nature.” Particularly, “Art” is also introduced in relation to “artes liberales” (liberal arts) and “artes mechanicae” (mechanical arts); the latter means “skill” and “technology,” including a kind of artisans’ works and maneuvers; therefore, the superiority of “artes liberales” over “artes mechanicae” can be observed.

After all, it seems that one idea is to leave various possibilities for “A (Art)” of the STEAM education. In other words, thinking about how practitioners of the STEAM education define “A (Art)” and then considering what and how to make use of it in education are important.

Particularly in mathematics, which has logical and abstract thinking at its core, as Yakman highlighted, mathematics can be regarded as a common language for talking (discussing) science and technology. Furthermore, thinking of mathematics as a skill necessary for everyday human activities—a versatile skill in a sense for human lives—is also possible. Or we can look at the historical process of the development of mathematics, or we can bring up ethno-mathematics rooted in regions and times, such as Wasan (Japanese traditional mathematics). This is because such mathematics seems to reflect the consciousness and characteristics of the times and regions. In consequence, what is necessary is for those engaged in mathematics education to be clearly aware of what “A” means.

4. A case study of “A (Art)” as a human activity (1): Mathematics education in the Renaissance

According to the discussion in the previous section, “A (Art)” in the STEAM education represents human activity, which consists of fine arts, various techniques, skills, or even education. Therefore, it can be considered the totality of human activities. Science, independently of human will, has materialized nature and constructed theories. Furthermore, mathematics has reigned as an abstract and logical construct. Moreover, in modern civilization, technology has been developed based on such science and mathematics. Therefore, it can be considered that the attempt to introduce “A (Art)” is an attempt to bring STEM back to the human world in education.

Based on this idea, even if mathematics is inorganic and even insipid, we can find historical periods in which it was educated in a way that was closely related to human daily activities—one of such examples is the Renaissance.

The Renaissance is a cultural revolution movement that originated in Italy in the 14th century and eventually spread throughout Europe through the 16th century. Regarding this period, particularly from the viewpoint of the history of science, a large-scale and fundamental crustal change in the academic world has been highlighted. Particularly, it is “characterized by craftsmen and artists raising their voices and beginning to cross the boundaries within the literary culture and the academic world” [Yamamoto (2007), p.12]. Furthermore, P. Rossi, an Italian historian of science, exemplifying the existence of “a culture that unites the world of scholars and artists, craftsmen and engineers” in the workshops of Florence in the 1400s, suggested “the fusion of artisans’ activities and scientific activities, that is, that of handwork and theory” [Rossi (1971), p.47]. Such chaotic miscellaneousness and variability of knowledge and technology

can be considered a major characteristic of Renaissance knowledge.

In the history of mathematics, the Renaissance period is evaluated as lacking in originality and innovation, but rather corresponds to a transition period in which the next generation of knowledge emerges from chaos. In fact, certain immaturity in the mathematics of this period can be observed. Nonetheless, its miscellaneousness and concreteness, as well as its transitional practicability, reveal its inherent relevance to real human life and society. Such characteristics make us more clearly aware of the significance of mathematics in human activities. The same thing can be observed in mathematics education during this period. Boyer cited the following three characteristics of Renaissance mathematics: “the diversity of occupation of people (engaged in mathematics), the variety of language in which mathematical works became available, and the growth of mathematical applications” [Merzbach & Boyer (2011), p.271]. Particularly, the development of applied mathematics shows that individuals’ consciousness at the time was directed toward wide-ranging applicability, usefulness, and practicality, rather than the demonstrative nature and academic systematicity of mathematics.

Here, we introduced mathematics education (abacus school) in elementary and secondary education at that time.

In Italy, an educational system of primary and secondary education was introduced in the mid-1300s, and by the early 1400s, a standard school structure and curriculum had been established. It is only the boys from relatively wealthy families who attended school, and even so, the ratio was approximately 20%–30% of the total [Grendler (1995), p.162]. Children entered primary school at the age of 6 or 7 years and learned the basics of reading and writing with a primer textbook in Latin and vernacular language. Here, “vernacular” refers to the dialects of Italian that individuals used every day in each of their regions. After that, at the age of 10–13 years, children entered the next stage, the Latin or Vernacular School.

Latin Schools were institutions that provide full-fledged and authentic Latin language education and mainly targeted those who aim to become “intellectual elites,” such as doctors, lawyers, and clergymen. In contrast, Vernacular Schools were mainly aimed at the children of merchants and craftsmen, and in addition to literary education in vernacular, they taught commercial mathematics and accounting. Such a kind of mathematics was called “abbaco” (arithmetic), which is derived from Fibonacci (Leonardo Pisano), Italian mathematician of the 13th century. “Abbaco” was taught in a kind of classroom, which was called “bottega/scuola d’abbaco” (abacus school), and the teachers of the school were called “maestri d’abbaco.” This situation stemmed from the development of international trade and banking in Italy from the 13th century onward, and there, practical mathematical skills were required. In fact, abacus schools, which taught practical mathematics in vernacular language, were institutions that responded to the social demands of the time.

Throughout Italy, teachers compiled their own vernacular textbooks modeled on Fibonacci’s works and used them to teach practical mathematics. In fact, there remain lots of textbooks produced and circulated at that time [van Egmond (1980, 1989)].

When looking at universities, mathematics was not always the main subject. Since the Middle Ages, the universities in Italy had consisted of three higher faculties (theology, law, and medicine) and a liberal arts department (*artes liberales*). Mathematics content was dealt with in the quadrivium (arithmetic, geometry, astronomy, and music) of the seven liberal arts. Furthermore, mathematics education in abacus

schools was largely neglected [Grendler (2002), p.414]. There, a part of Euclid's "Elements" and Boethius' "De Arithmetica" were used as texts; however, only the first part of Euclid's "Elements" was dealt with, and the content was rather elementary. In terms of science education, astrology was placed at the top, and astronomy was studied for astrology. It is just for understanding astronomy that mathematics was learned.

As abovementioned, in Renaissance school education, mathematics was learned exclusively as a practical tool. Still, it seems that the contents were for understanding the world through human activities.

5. A case study of "A (Art)" as a human activity (2): Alberti's "Ex ludis rerum mathematicarum"

What was Renaissance science, particularly mathematics? Considering this question, particularly the "A (Art)" in the STEAM education, we briefly introduced the relationship between artists and mathematics at the time and provided an example of Alberti's mathematical works.

5.1. Relationship between artists and mathematics (geometry) in the Renaissance period

The mathematics of Renaissance artists is a typical example of the concrete and practical development of mathematics at the time. Mathematics (geometry) had a special meaning for artists in two following respects: (1) to give the works a rationale to enhance their value and (2) useful practical knowledge directly linked to actual production. Indeed, during the Renaissance, many mathematical books and treatises on mathematical art have been written by artists or related theorists. For example, the first one was a study on Perspective by Filippo Brunelleschi (1377–1446). This study was later theorized by Leon Battista Alberti (1404–1472), who published a treatise on Painting, "De pictura (Della Pittura)." Later, Piero della Francesca (c.1412–1492) wrote "De Prospectiva pingendi" on the subject of perspective for painters, to provide a theoretical direction to this field. Their research did not necessarily mature a mathematical theory on this subject; however, at least their exploration of perspective led to the establishment of the basic concept of projective geometry by Girard Desargues (1591–1661) in the 17th century.

In contrast, Piero della Francesca also wrote mathematical books, such as "Trattato d'abbaco" (Arithmetic Treatise) and "De quinque corporibus regularibus" (On the five regular polyhedrons). Moreover, Leonardo da Vinci had a keen interest in mathematics, and several traces of his efforts remain in his manuscripts. In 1525, German painter Albrecht Dürer (1471–1528) also wrote a practical geometry book, titled "Underweysung der Messung" [1525], which presents the measurement methods at that time. Dürer also published "Vier Bücher von menschlicher Proportion," a compilation of many years of research on the Theory of Human Proportion. These works of Dürer had educational implications intended to provide German craftsmen and artists with knowledge of geometry and to provide an academic basis for their work.

What is noteworthy here is that the research of the artists is linked to mathematics theory and practice. At that time, many artists did not receive a high level of education. However, during the Renaissance, against the background of the spread of ancient scholarship and the development of practical mathematics, they themselves could come into contact with the classics and mathematics and fuse that knowledge with their techniques and craftsmanship traditions. Some of them, who came from the upper class, such as Alberti, were actively involved in the world of craftsmen and practitioners and had a major

influence on its development. Such an action of the artists can be regarded as part of “A (Art)” both in terms of practical skill in art and in terms of cultural knowledge.

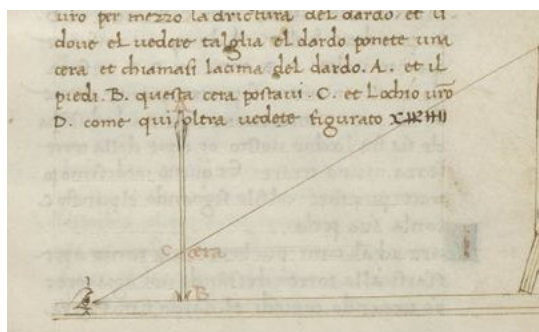
5.2. Alberti’s “Ex ludis rerum mathematicarum”

As a concrete example of the Renaissance mathematics, we mentioned the book “Ex ludis rerum mathematicarum” (Mathematical Amusements) by Leon Battista Alberti, a humanist representative of the early Renaissance. He is truly one of the representatives of the universal intelligence of the Renaissance. Although he was an elite clerk of the Holy See, Leon Battista Alberti appreciated the work of craftsmen and artists and maintained a keen interest in mathematics and science throughout his life. His book “Ex ludis rerum mathematicarum” is a collection of the so-called mathematical puzzles, but is known as a practical mathematics book. The book deals with various practical methods of measurement, such as the height of towers, the depth of water, the measurement of time, and the surveying of a land. It is based on his knowledge of sciences and mathematics and his experience in archaeological research.

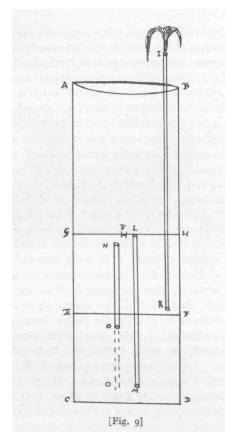
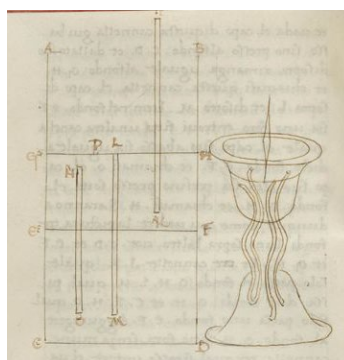
Alberti himself seemed to have been well versed in classical science and mathematics, for example, Euclid’s geometry and Heron’s pneumatics.

In the problem of determining the height of a tower, placing an appropriate rod between the viewpoint and the tower, he obtained the height of the tower from the ratio of similar triangles formed by connecting the rod and the tower to the viewpoint, respectively (Fig. 2). In the problem of measuring time, he introduced a fountain known today as “Heron's Fountain” (Fig. 3). It is a fountain that uses the principles of the weight of water and air pressure. He never explained the underlying theory. Rather, he numerically and practically presented the obtained results with simple explanations.

[Fig. 2] Measurement of the height of towers⁶.



[Fig. 3] Heron’s Fountain⁷.



As mentioned above, it has been highlighted that Alberti possessed vast knowledge of scientific culture, including ancient mathematics and science, and even the practical mathematics of medieval Italy

⁶ Manuscript conserved in Houghton Library, Harvard University, Cambridge (Ms. Typ 316, Carta: [3r]). See the Bibliography at the end of the paper.

(<https://bibdig.museogalileo.it/tecanew/opera?bid=1059516&seq=11>)

⁷ Left: manuscript conserved in Houghton Library, Harvard University, Cambridge.

(<https://bibdig.museogalileo.it/tecanew/opera?bid=1059516&seq=30>)

Right: quoted Grayson edition, p.148. (<https://archive.org/details/254AlbertiTrattati3Si003/page/n149/mode/1up>)

[D'amore (2005), Zerlenga (2020)]. Furthermore, Ludovico Gaymonat (1908–1991), an Italian leading historian of philosophy and science in 20th-century states in the Rinaldi edition of this Alberti's book, said:

“...the purpose of *Ludi Matematici* was to “illustrate to the largest number of educated people, the very interesting tasks that mathematics can perform as well as the ingenious tricks that it is able to suggest to us in the most varied concrete situations” [Rinaldi 1980, p.9]. (Zerlenga, p.235)

After all, it can be said that the book expresses the new spirit of the Renaissance. This is because, based on a wealth of classical and traditional knowledge, this book grasps mathematics as practical knowledge that functions in various ways not only in the philosophical world but also in reality and vividly presents its concrete applications.

Given the style of Alberti's book, it is clear that he presented these examples as the result of applying the principles of science and mathematics he for himself had mastered. In contrast, from the viewpoint of the reader, the structure was quite different. The reader should understand what it takes to solve a specific problem. In other words, the problem leads the readers to deriving the necessary theoretical principles from the concrete problem. Such a structure seemed to represent the practical characteristic of science and mathematics at the time. It differs from today's deductive science and science education, and this point is related to the STEAM education, which is the subject of this article.

6. Tentative conclusion and observation for the future

This study was designed to examine the STEAM education, particularly the meaning and significance of “A (Art).” Moreover, this study also introduced Renaissance mathematics (science) as an example. Through the aforementioned discussions, the following two points were obtained as current conclusions: (1) “A (Art)” in the STEAM education is not necessarily strictly defined and (2) rather, it is a totality that includes human technology, value consciousness, and wisdom that connects the knowledge of science and technology. In that sense, the aspect of mathematics in the Renaissance period provides one suggestion to modern mathematics education because it encourages us to comprehend the historical aspects of the formation of mathematics up to the present day and to reaffirm the concrete relationships between various human activities and culture.

The importance of “A (Art)” in the STEAM education signifies a warning against the fact that each of the four STEM disciplines is discussed only with theoretical principles that are separate from human beings. Just as Renaissance mathematics developed along with artists' intentions, scientific and mathematical knowledge inherently possesses complexity and synthesis. For that reason, it is closely related to the social and cultural trends of the times. Understanding that science and technology develops in harmony with human activities can serve as a guidepost for discovering the true nature of science and technology of today. In fact, modern science and technology is mixed with various elements and exists with cultural meanings and human value consciousness, and that is why science and technology can be considered fundamental to the society where we are living.

Integrating “A (Art)” into the STEM education leads to fostering qualities and abilities (practical

abilities) to discover and solve problems and to create value. In addition to the abilities required by the STEM education, such education also leads to the development of a broad perspective and the ability to integrate knowledge.

In his article on Alberti's "Ex ludis rerum mathematicarum," D'Amore questioned the "joy of mathematics" of the work: "Mathematics has never been the most beloved field in the world of learning" [D'Amore (2005), p.3]. Surely, mathematics is a quite difficult subject since the ancient times, and historically, various devices and attractive games have been devised to encourage the learning of mathematics. It is justly what D'Amore highlighted. Alberti's book should also be interpreted in this historical context, for the problems in this book lead to a literal joy of mathematics, rather than being presented in a dry and cold way. The joy of mathematics is the first step of learning mathematics, and it is also important in terms of promoting further learning. The "A (Art)" integrated to the STEAM education means the restoration of humanity in science and mathematics.

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REFERENCE

- Alberti, L. B., *Ex ludis rerum mathematicarum*. In Bibliothèque municipale de Rouen, Ms. Leber 1158., 1401-1500. <https://gallica.bnf.fr/ark:/12148/btv1b10101783k/fl.item> (accessed on Feb. 18, 2023)
- Alberti, L. B., *Ex ludis rerum mathematicarum*. In Houghton Library, Harvard University Cambridge, Ms. Typ 316., 1450-1452. <<https://bibdig.museogalileo.it/tecanew/opera?bid=1059516&seq=1>> (accessed on Feb. 18, 2023).
- D'Amore, B. (2005), Leon Battista Alberti ed i suoi Ludi rerum mathematicarum. In: *Il Carobbio*, XXX, pp. 61-66.
- Grendler, P. F. (1995), "What Piero learned in school: Fifteenth-Century Vernacular Education", In: M. A. Lavin (ed.), *Piero della Francesca and His Legacy*, University Press of New England, pp.161-176.
- Grendler, P. F. (1989), *Schooling in Renaissance Italy –Literacy and Learning, 1300-1600*, The Johns Hopkins University Press.
- Grendler, P. F. (2002), *The Universities of the Italian Renaissance*, The Johns Hopkins University Press.
- Grayson, C. (ed.) (1973), *Leon Battista Alberti. Opere volgari*. Bari: Laterza.
<<https://archive.org/details/254AlbertiTrattati3Si003/page/n132/mode/1up>> (accessed on Feb. 18, 2023)
- Katz, J. V. (1998), *A history of mathematics: an introduction* (2nd ed.). Addison-Wesley Educational Publishers. (上野健爾・三浦伸夫監訳, 『数学の歴史』, 共立出版, 2005.)
- Katz, J. V. (2014), *History of mathematics* (3rd ed.), Pearson Educational Limited.
- Kline, M. (1953), *Mathematics in Western Culture*, Oxford University Press, 1953. (中山茂訳, 『数学文化史』上・下, 河出書房新社, 1962.)
- Merzbach, U. C. and Boyer, C. B. (2011), *A History of Mathematics* (3rd ed.), John Wiley & Sons, Inc. (三浦伸夫・三宅克哉監訳, 『数学の歴史』 I・II, 朝倉書店, 2018.)
- Nakamura, T. and Hirano, Y. (2022), "A Consideration of Mathematics in the Renaissance: In the Terms of Modern Science and Bricolage", In: *Civilization*, No.29, Special Issue of Resilience, pp.49-58.
- Rinaldi, R. (ed.) (1980), Leon Battista Alberti. *Ludi Rerum Mathematicarum*. Milano: Ugo Guanda.

- Rossi, P. (1971), *I filosofi e le machine 1400-1700*, seconda edizione, Milano, 1971. (伊東和行訳, 『哲学者と機械—近代初期における科学・技術・哲学—』, 学術書房, 1989.)
- Souffrin. P. (trans.)(2002), Leon Battista Alberti. *Divertissements Mathématiques*, Éditions du Seuil.
- Tsujiai, H. and Hasegawa, H. (2020), “A Study of the Concept of “A” in STEAM Education,” *Journal of Science Education in Japan*, Japan Society for Science Education, 44 (2), 93-103, (in Japanese). (辻合華子, 長谷川春生, 「STEAM 教育における“A”の概念について」、『科学教育研究』、日本科学教育学会).
- Van Egmond, W. (1976), *The commercial revolution and the beginnings of Western mathematics in Renaissance Florence, 1300-1500.*, Thesis (Ph. D), Indiana University. (1989 printing, UMI Dissertation Information Service).
- Van Egmond, W. (1980), *Practical mathematics in the Italian Renaissance: a catalog of the Italian abacus manuscripts and printed books to 1600*. Firenze: Istituto e Museo di Storia della Scienza.
- Yamamoto, Y. (2007), *Cultural Revolution in the 16th Century*, (in Japanese), Misuzu shobo. (山本義隆, 『一六世紀文化革命』1-2, みすず書房).
- Yakman, G. (2008), “STΣ@M Education: STΣ@M Education: an overview of creating a model of integrative education.” (<http://steamedu.com/wp-content/uploads/2014/12/2008-PATT-Publication-STEAM.pdf>)
- Zerlenga, O., Ludi Matematici by Leon Battista Alberti. In: *diségno*, no. 7, pp. 233–239, 2020.