

Supporting a Well-being Society that Integrates the Digital and Real Worlds

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Abstract

After reviewing the spread of digital technology in society that has accompanied the development of information and communication technology, this article introduces a well-being digital-real fusion society that is necessary today, and the efforts being made by NTT laboratories to achieve it.

Keywords: well-being, digitization, interdisciplinary research

1. Well-being and digital society

1.1 Well-being as an integral subjective measure

The concept of well-being has been attracting much attention, but why? Let me start by first discussing what is actually meant by well-being. Well-being refers to a state of being in which people are satisfied both physically and mentally [1]. The novel coronavirus (COVID-19) pandemic has adversely affected the well-being of people and is one of the main reasons well-being is considered so important today.

The graph in **Fig. 1** shows how a person's contentment can change over time. We all experience good times and bad times. We believe that well-being is not something that can remedy a bad situation by simply crossing a threshold nor something that is felt only in passing moments but an integral subjective state of mind that takes into account a person's hardships and troubles from the past to the present.

1.2 Well-being in a digital society

To determine what should be done in the information and communication field to promote well-being, we should first examine the current situation regarding the impact that the digitalization of society has had on well-being. Let us look back on the evolution of this digital society in Japan, starting with the founding of NTT's predecessor, Nippon Telegraph and Telephone Public Corporation, in 1952, as shown

in **Fig. 2**.

During NTT's early years, from the 1950s to 1980s, fixed-line telephones gradually became widespread. When people wanted to talk to someone far away, they would have to go to the house or room where the phone was, and had to be mindful of the call charges that accumulated as they made their call. It is thought that telephones contributed greatly to the high economic growth of this period in terms of increased productivity.

With the launch of Internet access services in 1996 and the availability of broadband fixed-line networks due to the introduction of optical fiber technology in 2001, coupled with the launch of cellphone services in 1987 and i-mode (NTT DOCOMO's mobile internet service) in 1999, the period from the mid-1990s through the 2000s saw the development of a network environment that was available anytime, anywhere. However, due to the lack of content, this period was recognized as an era when people connected to a network anytime, anywhere whenever necessary.

With the release of the iPhone in 2007 and Android devices in 2008, smartphones and social networking services became widespread, and now, everyone is always connected to a network. Another major change was the widespread switchover to teleworking that was prompted by the COVID-19 pandemic in 2020.

It is important to note that the current era of

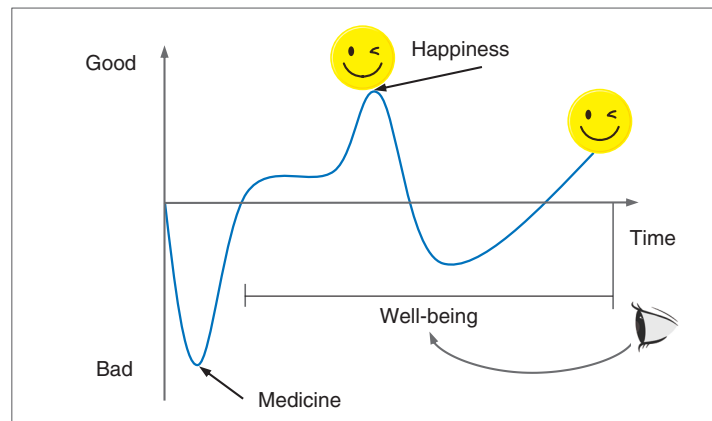
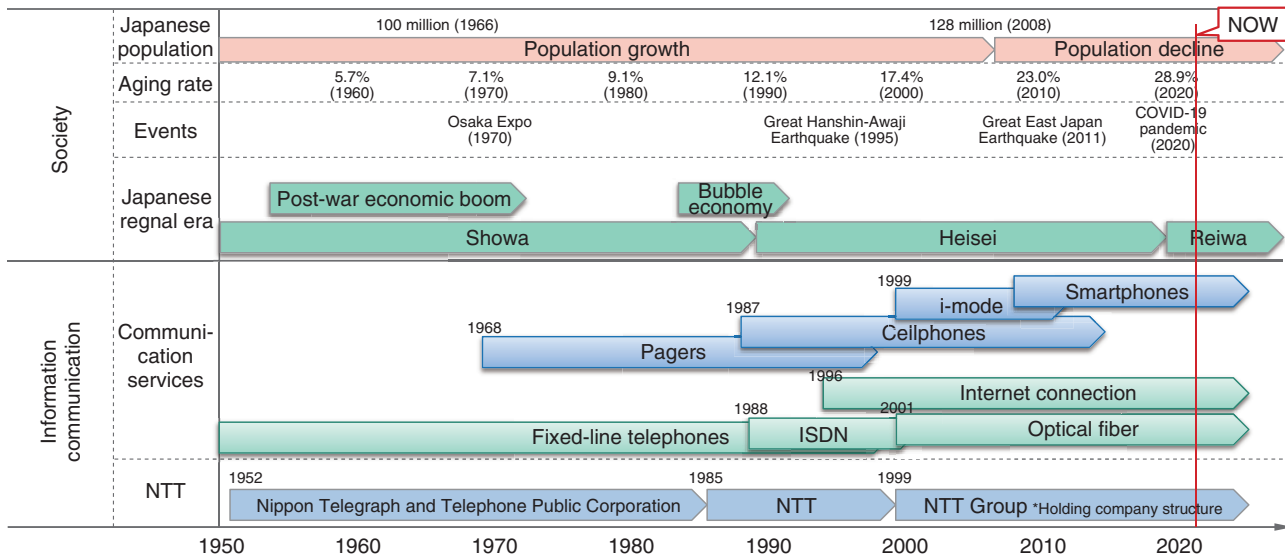


Fig. 1. Well-being as an integral subjective measure.



Aging rate: ratio of the population aged 65 years and older to total population
 ISDN: integrated services digital network

Fig. 2. The evolution of digital society in Japan.

constant connection to digital space is only about 10 years old, which is just a fleeting moment in the long history of humankind. It is thought that this state of being constantly connected to digital space for long periods of time could have a significant impact on people’s well-being, which is an integral subjective measure based on long-term experience.

Another important factor is Japan’s population, which had been increasing after a period of high economic growth, but peaked in 2008 and has since been decreasing due to the declining birth rate and aging

population. Against this background, the structure of Japanese society has changed. People now demand new, flourishing lifestyles rather than ever-increasing economic prosperity, and well-being is attracting attention as a result.

1.3 What is required for well-being research

Based on this situation, the requirements our research on well-being should focus on can be summarized with the following three points.

- (1) An interdisciplinary approach

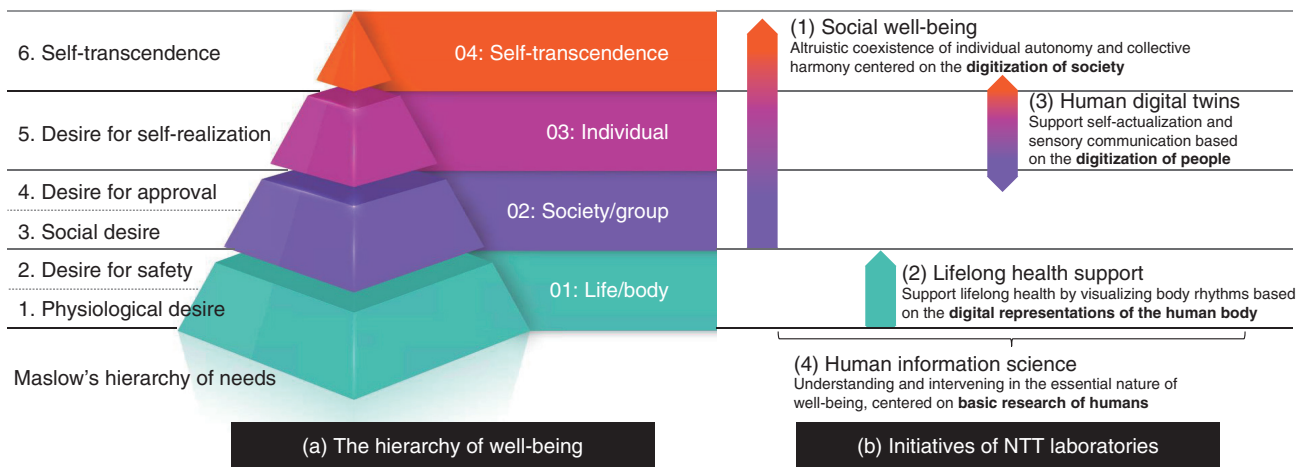


Fig. 3. The hierarchy of well-being and efforts being made by NTT laboratories.

The research must be interdisciplinary. The study of well-being requires not only an engineering approach based on measurement, analysis, and intervention in some form but also an academic approach that includes diverse fields such as psychology, philosophy, ethics, law, and medicine. To achieve this, it is essential to work with experts from universities in addition to collaborating with NTT laboratories personnel having expertise in a wide range of fields.

(2) The pursuit of possibilities through digitalization

Given that digitization has a major impact on well-being, research should be conducted to explore its possibilities. Information and communication technology allows people to establish personalized connections in diverse ways over any distance and can be expected to lead to the creation of new ways of living, working, and learning.

(3) The elimination of obstacles with digital technology

Research is also needed to identify factors that inhibit well-being due to digitization and to suppress these factors. We should respect people's privacy and avoid creating a surveillance society. We should also avoid fueling disparities and divisions through fake news and slander. It is important to bear in mind the negative aspects of digitalization and consider countermeasures.

2. The hierarchy of well-being

Before describing our research into well-being at NTT laboratories, we will first explain the hierarchi-

cal structure of well-being since it is a very broad concept (Fig. 3(a)). This hierarchy is an extension of what Hiroi [2] described as a hierarchy of well-being based on the hierarchy of needs proposed by the American psychologist Abraham Maslow. Hiroi is mainly concerned with the role of public policies and private companies and the younger generation's awareness of social contribution, whereas in this article, we specifically describe the hierarchy of well-being and its relation to information and communication.

Although we are aware that various taxonomies of well-being have been proposed, and that Maslow's hierarchy of needs theory has its critics, we will use this taxonomy with priority given to ease of understanding and the ability to obtain an overall view of various approaches to well-being, even for newcomers to the subject.

2.1 Life/body

The most fundamental aspect of well-being is the life and body aspect, i.e., being physically healthy and free from life-threatening conditions. Services have been developed that use devices such as smart watches to sense, analyze, and provide feedback on the basis of vital data such as the wearer's heart rate and number of steps taken. Devices that can provide more detailed information on the wearer's physical condition are expected to become more widespread. The characteristics of the human body are universal and do not depend on individuals.

2.2 Society/group

The next layer is the achievement of well-being through face-to-face interaction with groups and social interactions with any number of other people. The development of information and communication technology has made it possible for more people to interact anytime, anywhere, even when they are physically distant from each other. It can also have adverse effects such as social-networking fatigue caused by prolonged connection and social fragmentation caused by slander and fake news.

2.3 Individual

The third layer is the well-being of individuals, whereby people with diverse values can act freely and autonomously in the pursuit of their own goals. Information and communication technology has expanded the possibilities of individual well-being by providing individuals with a variety of choices and means of transmitting information. Well-being in this layer is diverse and subjective.

2.4 Self-transcendence

In his later years, Maslow claimed that there is a self-transcendence layer after the layer of self-actualization that he had previously stated to be the final layer in the hierarchy of needs. The previous three layers basically relate to individual well-being, but this last layer transcends the self and relates to well-being gained by thinking of and acting for the benefit of others apart from oneself (which may include not only people but also things such as specific natural locations and the broader Earth). In a digital society, it is said that centralized platforms can create disparities and divisions by controlling information to suit their own business interests. To go beyond this, it might be worth incorporating a philosophy that values self-transcendence into the governance of platforms.

3. NTT laboratories' approach to well-being

The four approaches to well-being at NTT laboratories introduced in the Feature Articles in this issue are explained in terms of the direction they aim to take and their position in the hierarchy of well-being (Fig. 3(b)).

3.1 Social well-being

In our view, social connections constitute the factor with the greatest impact on well-being. However, especially in Japan, doing well within a group of

peers (e.g., in a company or at school) can involve sacrificing one's individual goals, so there could be a tendency for groups and individuals to become diametrically opposed. To solve this problem, we are researching social well-being by defining it as a state in which individual autonomy and collective harmony can coexist altruistically [3].

This field is centered on the advancement of digital society, and in the well-being hierarchy, our main focus is on (2) the society/group layer, (3) individual layer, and (4) society/group layer.

3.2 Lifelong health support

With the aim of creating a society where people can spend their entire lives in good health, which is the most basic part of well-being, we are studying how to visualize individual daily data on basic lifestyles (diet, exercise, sleep) so that users can self-adjust their mind/body rhythms in their own way [4].

This field is centered on digital representations of the human body and exists in the life/body layer of the well-being hierarchy.

3.3 Human digital twins

We are studying human digital twin technology that reproduces not only people's external aspects but also their internal aspects, such as their values and thoughts [5]. From an interdisciplinary perspective, we are looking at how this technology can contribute to well-being in the future and not to a dystopia where humans are threatened by artificial intelligence and robots that imitate humans. We are also researching sensory communication that allows people to convey their feelings in digital space.

This field is centered on the digital representation of humans, and in the well-being hierarchy, our main focus is on (3) the individual, (2) society/group, and (4) self-transcendence layers.

3.4 Human information science

Human well-being is diverse and shaped by many factors, including a person's physical and mental conditions, values, and relationships with others. We aim to obtain a comprehensive grasp of these diverse aspects of well-being, understand the human information-processing mechanisms behind it, and study intervention methods that operate on these mechanisms [6].

This field is centered on basic research of humans and positioned as an area that comprehensively supports each layer of the well-being hierarchy.

4. Future outlook

Ever since the Stone Age, humankind has developed by creating tools to make life more convenient. However, it is important to note that the tools we make for our individual needs may, in turn, define and shape our lives. Information and communication technology provides us with important tools that are indispensable in today's world, and since it has become an indispensable infrastructure for daily life, it has a significant impact on our well-being, for better or for worse. We will keep this in mind as we continue our research on well-being, and by conducting research and development and outputting results geared toward delivering a well-being society, we will promote imaginative solutions that actively improve people's well-being rather than simply trying to eliminate things that make people unhappy.

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