

## Environment of Intellect—What we need to think about for the future

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### Abstract

“Environment of intellect” is a new concept that I believe is necessary to the development of future technology. It underlines the fact that we need a macroscopic view of our total environment and that the environment needs to embrace us and our society intellectually. This paper introduces this concept and some research themes related to it.

### 1. Introduction

The environment in which we live these days is full of high-technology tools such as broadband Internet, mobile phones, digital cameras, high-performance personal computers, and digital televisions. Many people believe that this is very convenient and beneficial. However, various issues have arisen recently that suggest the possibility of serious trouble in the future. For example, we cannot keep up with the rapid changes in our environment and its underlying technologies, cyberspace poses unexpected risks, and we are being buried in unwanted information. I believe that these phenomena are the result of the conventional industry-and-economy-oriented approach to developing technology, where we emphasize functionality and ease of use. We may have lost the perspective of providing important benefits to individuals and society in general. The widespread use in the media of words such as safe and secure reflects these kinds of issues.

Recently, there has been much discussion of the dark side of technology. However, we should now move on from simply judging a technology as good or bad based on results to considering how to develop technology and from what perspective to develop it with our eye on the future. In this paper, I present the concept of “environment of intellect” as the basis for a proposal. When developing technology, we should

take a macroscopic view of the total environment including information and communication technology (ICT) to provide us with an appropriate perspective of the future. We need to design ICT in such a way that the environment embraces us and our society through its use of human intellect. There is already a research area called “ambient intelligence” [1], which we think is rather interface-oriented, that might be referred to in a complementary manner in our scheme. Below, I provide a rough outline of research projects being undertaken at NTT Communication Science Laboratories (NTT CS Labs.) from the viewpoint of the environment of intellect and based on our mission of pursuing the communication technology of the future.

### 2. Environment of intellect

#### (1) Macroscopic view

We tend to develop technology in a rather microscopic manner to achieve targeted functions with the hope of bringing great benefits. However, we are now living in an environment where there are complex and dynamic relationships between various factors. Unexpected events sometimes occur in unexpected ways that have significant effects on society. We need a macroscopic view of our environment that will allow us to take these things into consideration when developing technologies (**Fig. 1**).

ICT has become an important element in today’s environment. Our environment can be roughly considered to comprise nature, human artifacts, and ICT (**Fig. 2**). Each of these appeared at completely differ-

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ent times in the Earth's history: nature 3.8 billion years ago, human beings 150 thousand years ago, human artifacts a few thousand years ago, and ICT just 20 years ago. Although artificial constructions including artifacts and ICT have a very short history compared with that of nature, they have been changing too rapidly to become adjusted to the environment. The global environmental problem, which has become a serious issue lately, is said to be caused by the destruction of nature, which is no longer capable of remaining a balanced circulatory system. This is because, in the industry-and-economy-oriented approach to developing technology, we have ignored nature too much and have lacked a broad, long-range view of the effects and consequences of technology. Biologically speaking, we have evolved and reached today's state over a long period that has allowed us cope with the natural environment. Although humans

can adapt to some extent to unfamiliar situations encountered in ICT, we cannot evolve in such a short time. This leads to gaps between what ICT offers and what we can actually accomplish.

We typically encounter ICT on a desktop computer, which connects us to global sources of information. ICT is now deeply penetrating the economic and industrial worlds. The global and complex world of ICT may present us with unpredictable and unexpected effects and risks. It is also important to remember that ICT has greater potential to affect our perception, and consequently our minds, than any other man-made creation.

## (2) Intellect

The above discussion suggests that there are many things to consider: we need to be more intellectual in designing technologies so that the environment can intellectually embrace us and our society. To achieve this, the environment requires various kinds of wisdom and knowledge. For example, we may be able to utilize the ancient wisdom that has been passed down over many generations to keep our daily life and society safe and sound. It is also important to make use of knowledge in the fields of biology, neurology, psychology, and ergonomics, the knowledge of society in sociology, and the knowledge of our environmental system. Understanding the relationship between the current situation and the past is a fundamental requirement. Forecasting methods, such as simulations with a large historical database, would also be

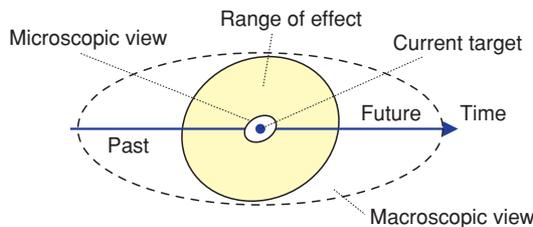


Fig. 1. Expanding the view: a macroscopic view of the environment.

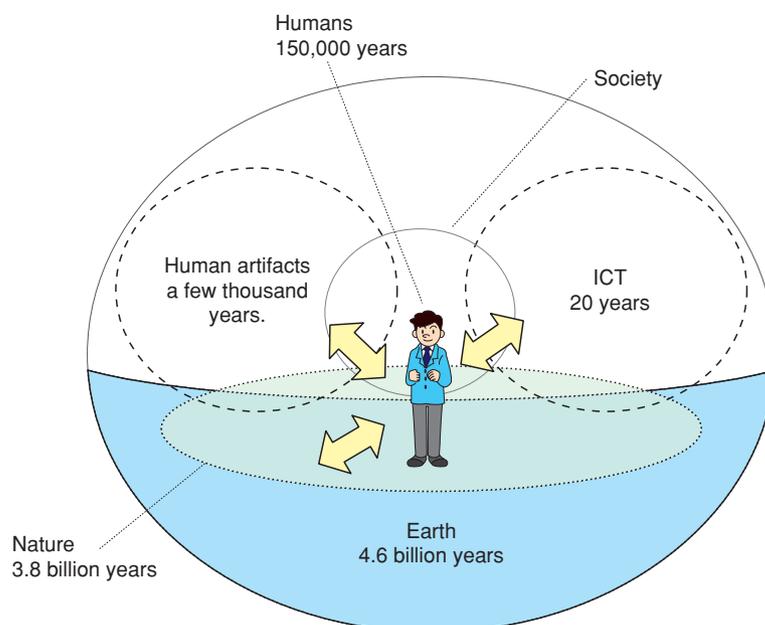


Fig. 2. Elements of our environment.

helpful.

**Figure 3** shows a rough diagram of the environmental factors surrounding us to help us picture what is needed in what situation. For example, we use good manners to converse with a person when hoping to gain his/her trust. As shown in this diagram, fairies and goblins, which are referred to in the following paper, can be understood as symbolic rules that allowed us to coexist with nature in earlier times, and they worked very well in a spiritual manner. This is one non-technical way of utilizing past wisdom to maintain the order of nature. I hope we can find a new technique for utilizing wisdom that replaces fairies and goblins and appeals to our modern way of thinking. We also need to consider which human resources are used and how they are used based on the knowledge found in human information science.

Another important aspect is the way in which the environment essentially matches a given situation or purpose. For example, when we want to perform a

calculation, if the purpose is simply to obtain the result, an electronic calculator is convenient and our brains are not burdened. However, if one wants to exercise the brain's calculation ability, a *soroban*, (Japanese abacus), which assists mental arithmetic, is surely more suitable.

If we take the above into consideration, the ideal environment should be able to understand the current situation, know what should be done, maintain and respect our humanity, utilize implicit human capabilities, expand human creativity, and keep society well balanced. The concept also indicates the way that we should think when developing technology.

In this article, the environment of intellect is explained mainly from an ICT-oriented point of view, but it is also applicable to other fields. For example, the redevelopment of a city by designing its landscape and taking into account a wide range of macroscopic factors is also a topic related to the environment of intellect.

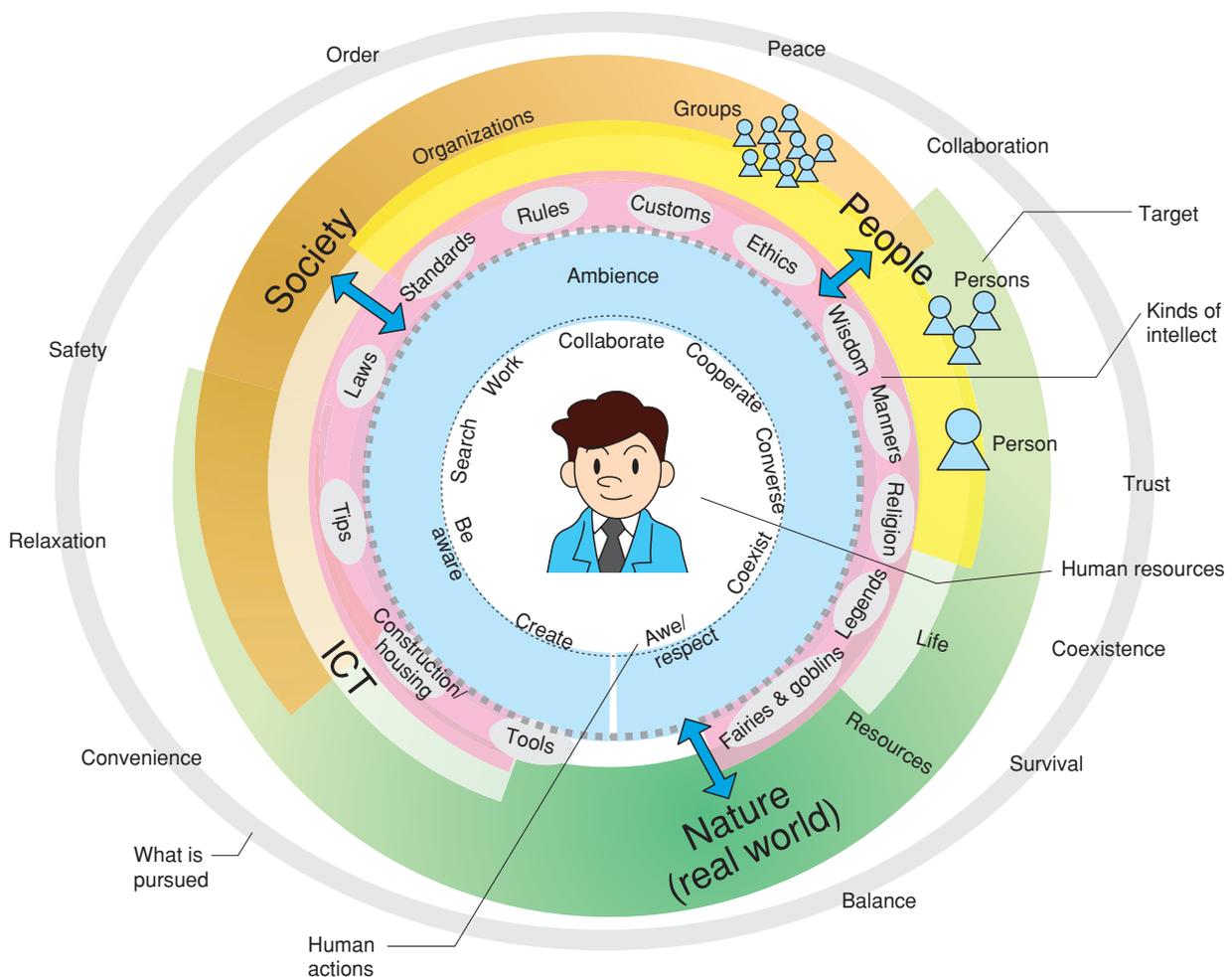


Fig. 3. Environmental factors surrounding us.

### 3. Research for future communications

While the environment of intellect is applicable to various areas, the factors and required technologies depend on the target area. In this section, I outline, from the standpoint of the environment of intellect, our research themes at NTT CS Labs., whose mission is to pursue the communication style of the future.

A simple reference model of the communication environment is shown in Fig. 4. It comprises a stage on which human activities are performed, an interface for human interaction, an ambience that surrounds us but is not necessarily visible or audible, and channels to other worlds.

The scope of our communication is rather wide—not only through bilateral communication by telephone, e-mail, and the Internet, but also unilaterally through books, which allow their authors to communicate with us. When we conjure up a memory by looking at a family memento, this is also communication with the past.

We believe that research in the human sciences such as biology, neurology, and psychology is very important in communication science because these fields relate to how we feel and act and how the environment affects us either immediately or gradually over a long period. In particular, we are undertaking

research on brain science, namely, perception, recognition, motion, learning, and language acquisition. We are also trying to invent interaction devices as interfaces based on human sensory organs.

In our laboratories, we are carrying out three research projects based on the “environment of intellect” concept. They are called the t-Room, s-room, and Mushroom. The following three papers explain them in more detail. Here, I provide just a rough idea of each type of research.

The t-Room is a kind of stage on which we can experience a sense of sharing space/time even though the other participants are not in the same location and/or time. We can naturally feel a sense of distance, direction, and size, corresponding to the presence of others sharing the same virtual space. Utilizing a person’s own senses is very important here. In a t-Room, anything that occurs in the space is recorded by video and sound recorders, allowing us to retrieve a specific recorded scene from any time. This makes it possible to share time by overlapping the retrieved scene with the current one. The t-Room is described in the third paper in this issue [2]. To make use of this system more intelligently, anything that occurs in the space should be recorded not only in video and sound but also using various kinds of sensor data that might be useful in later intelligent processing. This is

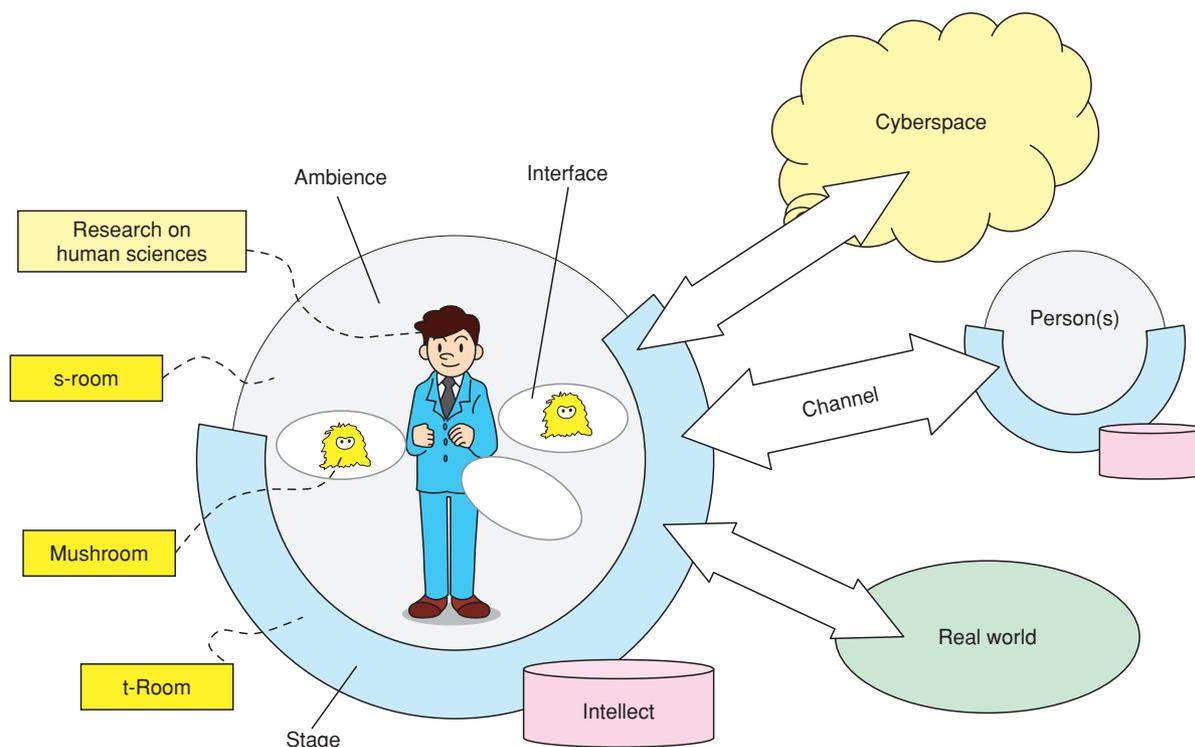


Fig. 4. Reference model of communication environment.

achieved by the s-room, which is a platform for recording and scripting events in the real world through various types of sensors. The s-room allows us to retrieve specific events that occurred in the real world. An important aspect of this approach is that what happens in the space is manipulated with natural language, which matches the way our brains operate and the way we gain wisdom and knowledge. An event that is described in words is decomposed into a set of scripts that bridge the event to the actual recorded data. A key component of the s-room, its human-centric system for searching for events that occurred in the world, is described in the fourth paper [3].

In the project called “Mushroom”, various species of interface agents mediate a peaceful daily life, helping us in the right place, at the right time, and in the right manner. This project is based on a concept of ambient intelligence, which is the origin of the environment of intellect. With ambient intelligence, first we focus on how we feel. If we are comfortable in doing something, we may feel that the ambience is intelligent. With mushrooms, the main idea is to create beings like fairies and goblins from previous ages that were virtual beings used in storytelling and that worked to keep us safe and sound. We are trying to create modern equivalents of fairies and goblins through ICT. In the Mushroom project, we need highly intelligent technology related to interaction, information handling, knowledge-base computing, and information retrieval. Therefore, this project is being undertaken using an interdisciplinary approach of integrating technologies from many of the areas of expertise in our laboratories. This topic is described in the second paper in this issue [4].

#### 4. Conclusion

In this article, I presented the concept of the “environment of intellect” in a rather general way, hoping that it will be applicable in many areas as we develop technology for the future. I stressed the need to adopt an environmental viewpoint to provide us with a macroscopic perspective with regard to developing technology. We also need various kinds of intellect. I also introduced our research approaches for dealing with issues in communication technology.

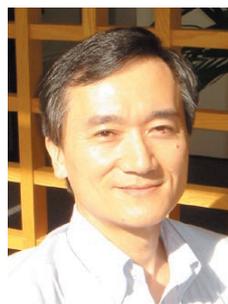
I believe that in the current age, where technology has a great impact on people and society and consequently on the future, it is the duty of scientists and engineers to think deeply about the environment of intellect.

The above discussion suggests that lifestyles in the

future may not be very different from those of today. We can say at least that conventional future images just underline the scenes full of convenient and functional technology will not be what we want from our viewpoint. I believe that for our ambience we will need an environment that matches an ordinary and natural way of life, as long as we can keep our Earth as it is.

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