Aim at promotion of a vision disabled people's Personal Digital Assistant use.

-The possibility of addition of the information on vibration-

Satoshi KAWAMURA*, Masayoshi KUBO*
* Kyoto Institute of Technology

By the progress of the technology in a Personal Digital Assistant, people's life became more convenient. On the other hand, many vision disabled people have not fully received the convenience. The Personal Digital Assistant should be convenient for more people including vision disabled people.

In this research, its attention was paid to the tactile sense when a vision disabled person uses a Personal Digital Assistant, it is considered as reliance. Specifically, it is a vibration function. If the information of the state of emergency and a reply required can be added to the pattern of the vibration, many vision disabled people can use a Personal Digital Assistant more conveniently. Furthermore, if the information on feeling can be added to the pattern of vibration, vibration may be made into a new communication tool and they can use it. In order to realize these themes, in this research, I investigate whether or not the compatibility is seen between a vibration pattern and emotional information, functional information, and state of emergency. Moreover, I show clearly that a vision disabled person wants to identify what kind of information.

As a result of investigation, compatibilities were seen between the pattern in which only a short vibration is repeated and the information of “state of emergency” and “urgent”. In addition, compatibility was seen between the pattern in which only a long vibration is repeated and the information of usual. Moreover, it turned out that many vision disabled people want to discriminate the information of “state of emergency”,” urgent” and “reply required” from vibration.

As a view of the future of this research, it is thought that it is also necessary to investigate other patterns and information because compatibility has been investigated only about 5 kinds of patterns, and 26 items of information in this time. Moreover, same investigation toward a person with normal eyesight should be conducted since only the vision disabled person has been targeted in this research.

Key words: ***Vision Disabled Person , Personal Digital Assistant , Vibration***

1. Introduction

1.1. Background

With digitization of information, the use of environmental becomes different around visual disabled people. To focus on cell phone, consider now diffusion ratio is over 100% in 2012, many people receive the convenience. Moreover, it came to be dealt with as a more useful tool by the appearance of the smart phone which is spreading in recent years. On the other hand, it is difficult for a vision disabled person or elderly people to master and receive the benefit of a smart phone fully. That has induced digital divide. In addition, spread of cell phones which targeted a mobile phone beginner and elderly people enabled it to use a mobile phone, in the point of a vision disabled people smart phone use, an action is insufficient.

Also, the Internet is indispensable for a vision disabled people, and it is used in various scenes, such as a life, working, and study. However, the Internet is increasingly more complicated by maintenance of a high-speed network infrastructure, raising high-capacity of a memory means, and evolution of a display. Although many healthy persons' life is convenient, the vision disabled person cannot say that the convenience is fully received.

Furthermore, with contents increasing in size of display and capacity, device which has new user interface, such as touch panel is spreading. The service on condition of touch-panels-oriented GUI is also increasing. However, it is difficult for a vision disabled people to use a touch panel, still less it is insufficient to make the GUI operation system for which it depended on vision strongly correspond to a vision disabled people, such as a sound or vibration.

It was always next to the appearance of digital divide that IT developed, but it could be said that those gaps are small by development of the device for elderly people due to low-pricing of apparatus and service and maintenance of a network infrastructure. However, it is prospected that the gap becomes large by developing information and telecommunications technology, because the personal digital assistant for vision disabled people cannot keep up with the development speed. Today environmental of cell phone for handicapped people, many products in which not only elderly people but visually impaired people use was taken easy exist. For example, the cell phone has the function in which text-to-speech-reading and a partner’s voice can be easily heard in noisy environment and slowly. As the result, the vision disabled people using cell phone is increasing. On the other hand, smart phone is not used by them easily because operation in a flat screen is very difficult. Moreover, as common in both, since it is difficult for vision disabled people to read a screen, a button visually, it becomes important interfacing them using hearing or a tactile sense. Specifically, they are the voice information at the time of e-mail or voice arrival, text-to-speech reading of a function, and vibration.

2. Experimental

2.1. Preparation

2.1.1. The setting conditions of the vibration patterns

It referred to the standard of the Morse code which transmits information by long and short in the pattern setup of the vibration in this research. Moreover, by the previous work, on the conditions of 250 ms of dots, and 750 ms of dashes, since the recognition rate was the highest, this condition was adopted. Moreover, 5 patterns were set up since 5 was a mode when the number of built-in of the vibration of the existing cell phone unit was investigated.

- The length of a dot and a dash is set to 250 ms and 750 ms, respectively.
- 5 kinds of patterns are set up.

2.1.2. The setting of the vibration patterns

The vibration patterns set up based on these conditions are the next. In addition, these set the vibration pattern built in the existing mobile phone as reference.

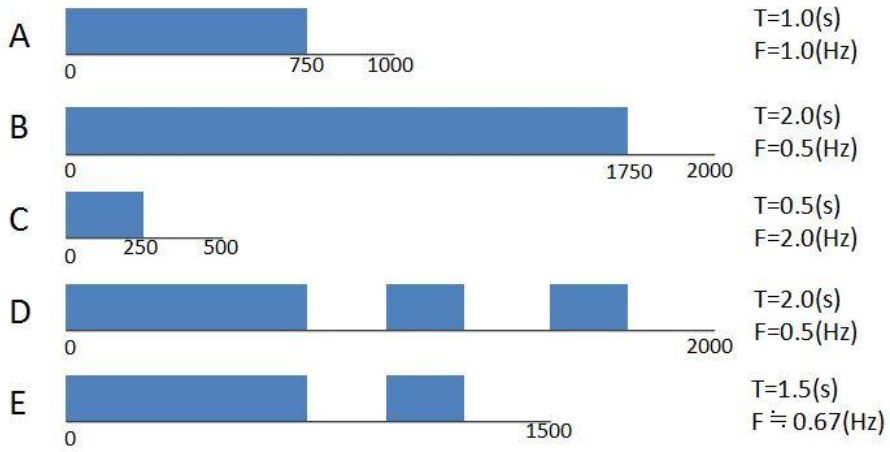

Fig.1. vibration patterns treated by this research

2.1.3. The presentation method of the vibration patterns

In the previous work, when showing information sound by vibration, it is shown that a significant difference was not seen about frequency and volume, and I thought the same way that a difference was not seen by the apparatus which presents the pattern of the vibration in this research from there. So, in this research, vibration was shown using the iPhone terminal.

2.1.4. The setting of the information

Information was classified into three with urgent, function, and feeling, and the information item was prepared in each. In addition, these set the previous work as reference.

Table 1. Information treated by this research

Urgent	Function	Feeling	
・State of emergency	・Caution ・Completion ・Connection for business ・A reply required ・Urgently ・Unsolicited junk e-mail ・Guidance ・Usual	・Joy ・Anger ・Pathos ・Pleasure ・Surprise ・Safe ・Uneasy ・Embarrassment ・Gratitude	・Apology ・Fear ・Pain ・Impatience ・Happiness ・Love ・Like ・Dislike

2.2. Investigation

In addition, in implementation of this investigation, pre investigation was conducted and the hypothesis was set up.

2.2.1. Investigation outline

Enforcement period: From December 18, 2012 to December 29

Enforcement place:

・Kyoto (vision disabled person synthesis welfare facilities Kyoto lighthouse)

・Tokyo (central ward-facilities Trade Center ,Others)

Universe person: 28 vision disabled persons

2.2.2. Investigation items

・Whether compatibility is seen between a vibration pattern and information.

・What information they would like to discriminate from a vibration pattern.

・The hearing investigation about a Personal Digital Terminal.

2.2.3. Investigation method

It investigated in the hearing form which advances along with a questionnaire. In addition, the investigator read out all question sentences since a subject was a person of total blindness or weak eyesight.

3. Results and Discussion

3.1. Compatibility of a vibration pattern and information

・Pattern A

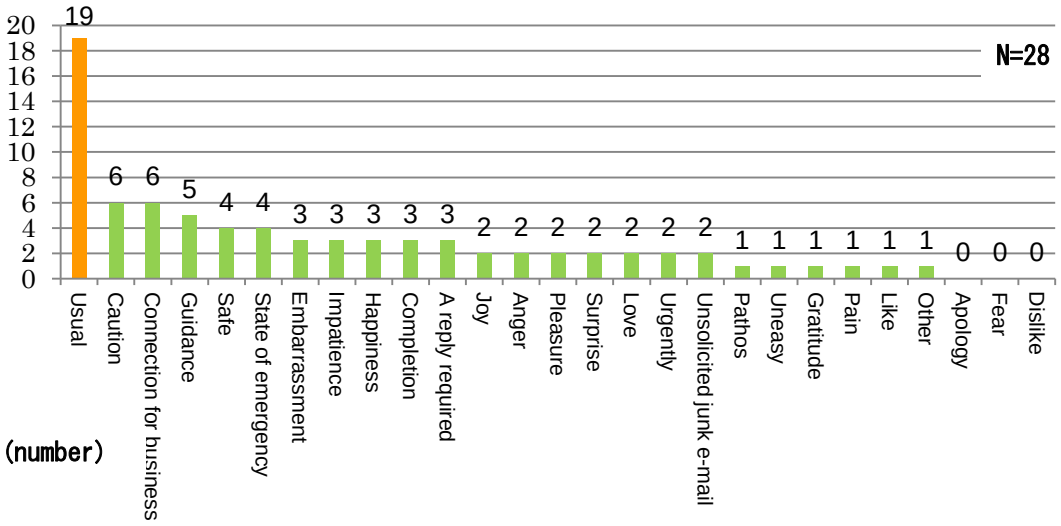

Fig.2. Image of the pattern A [Multiple answers]

・Compatibility was seen in the pattern A and a "Usual" combination. ($p<0.1$)

・Pattern B

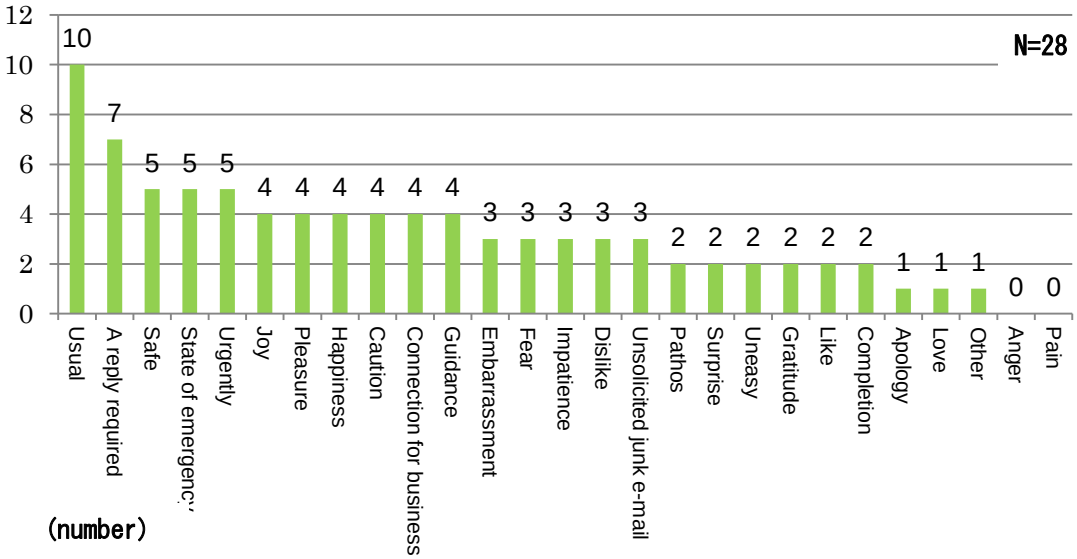

Fig.3. Image of the pattern B [Multiple answers]

・Compatibility was not seen in the pattern B and all information combination.

・Pattern C

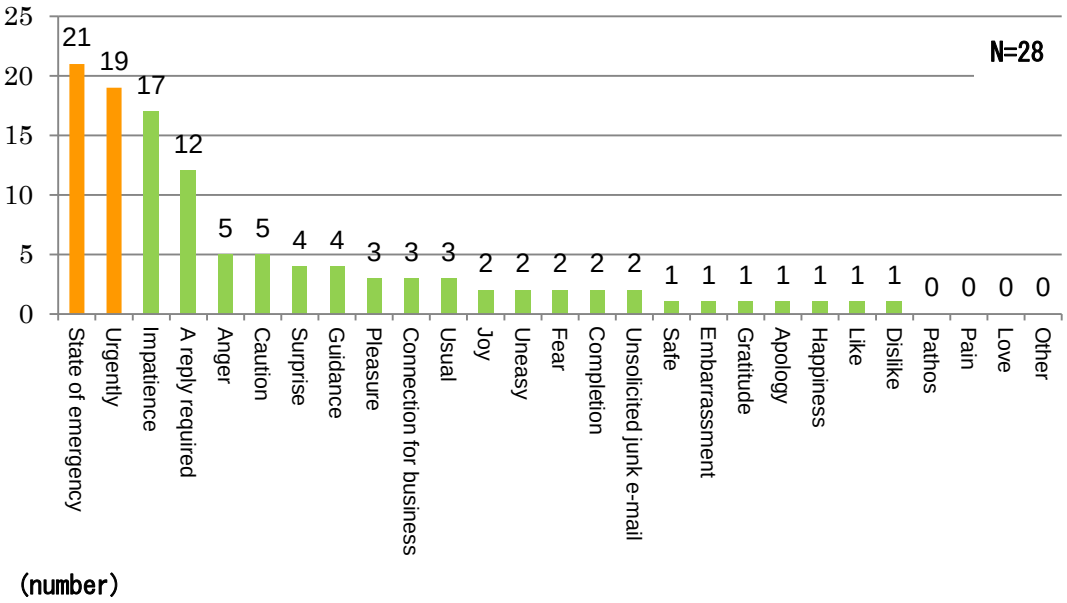

Fig.4. Image of the pattern C [Multiple answers]

・Compatibility was seen in the pattern C and a "State of emergency" combination. ($p<0.01$)

・Compatibility was seen in the pattern C and a "Urgently" combination. ($p<0.1$)

・Pattern D

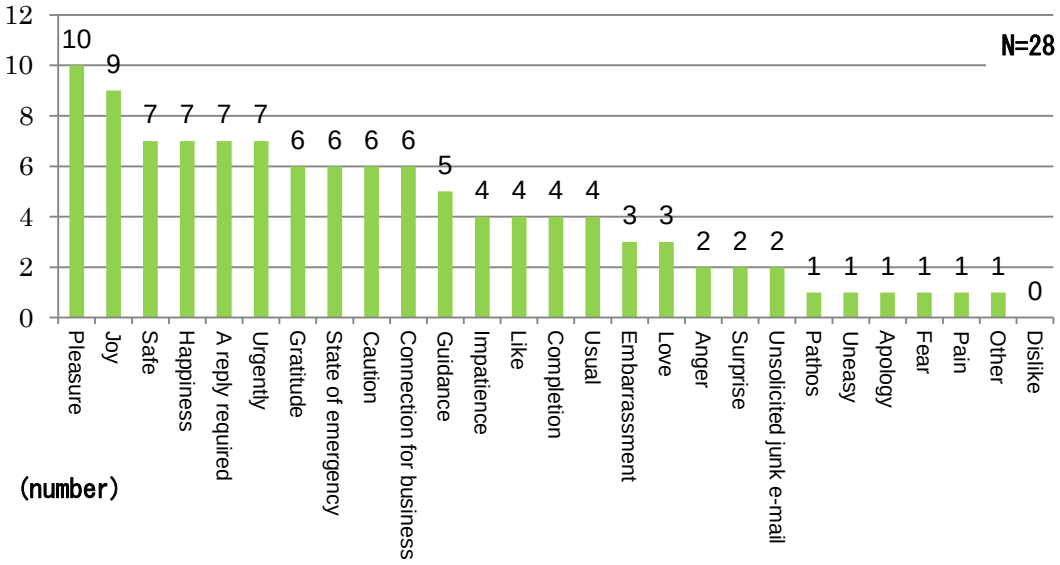

Fig.5. Image of the pattern D [Multiple answers]

・Compatibility was not seen in the pattern D and all information combination.

・Pattern E

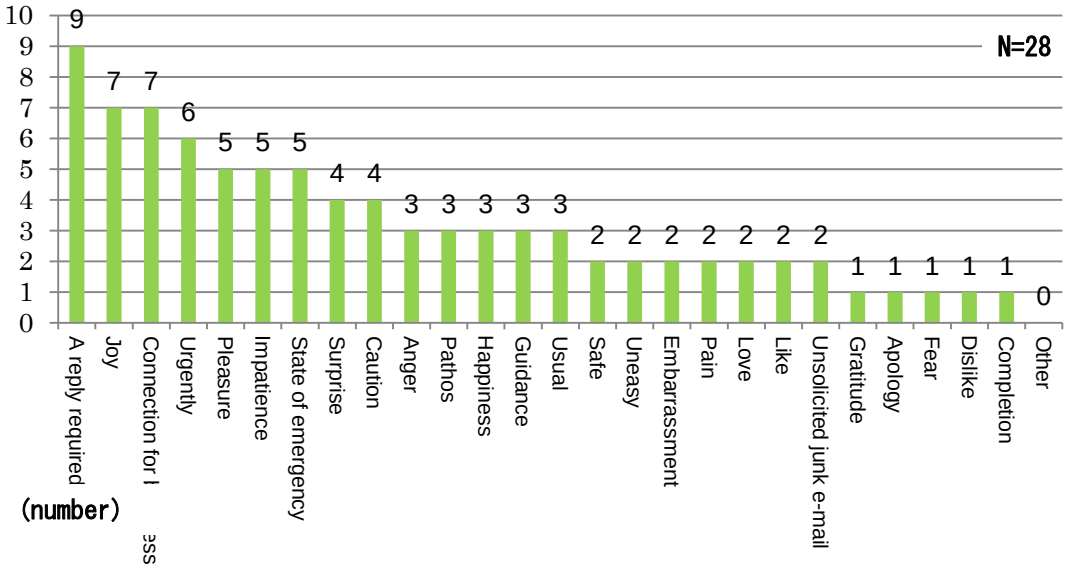

Fig.6. Image of the pattern E [Multiple answers]

・Compatibility was not seen in the pattern E and all information combination.

Compatibility was seen in the pattern A and a "Usual" combination. Moreover, compatibilities were seen in the pattern C and "Urgently", "State of emergency" combinations. In addition, about the patterns D and E, by combining long vibration and short vibration, a difference appears in how to hold an image and it is considered that it is a factor opinions have been divided that compatibility with information was not seen.

3.2. Information to discriminate from a vibration pattern

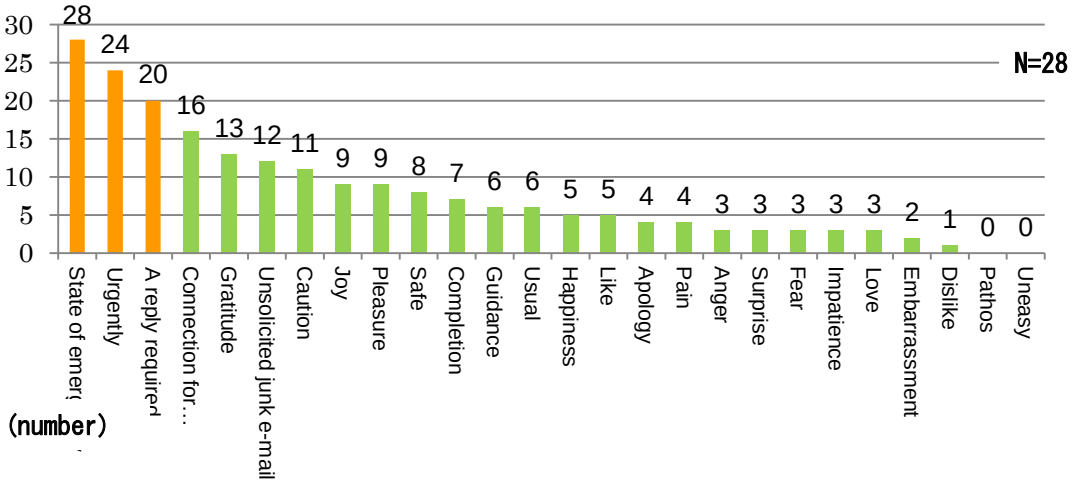

Fig.7. Information to discriminate from a vibration pattern [Multiple answers]

・They would like to identify the information of "State of emergency." (100%)
・They would like to identify the information of " Urgently." ($p<0.01$)
・They would like to identify the information of " A reply required." ($p<0.05$)

Since it became clear that many people want to discriminate that it is "urgent", "state of emergency", "a reply required", it is thought that discernment of these pieces of information is very important. In addition, "state of emergency" is considered that especially discernment is important from having answered that all subjects wanted to identify.

3.3. From hearing investigation

・The person of weak eyesight is seldom dependent on sound or vibration in use of a mobile phone.
・Although a vision disabled person makes sound reliance and is living, the places from which sound cannot be taken out are increasing in number.
・Since the vibration of the existing mobile phone is weak, I want Mobile phone maker to prepare the mode which strengthens vibration.
・Although they would like to carry out proper use of the pattern of vibration, a setup is difficult and trouble.
・There are many unnecessary functions, and in order to cause operation, I want you to select a function carefully.
・It is better to have been able to choose not only the pattern of vibration but strength.
・Vibration is very effective at the place with which sound cannot be sounded like a public transportation facility.
・It may be able to use as deaf blind persons' communication tool which communication can take in tactile sign language, finger Braille points, etc.

and so on.

Fig.8. The situation of investigation

4. Conclusions

4.1. From results of an investigation

- Compatibility was seen in the pattern A and a "Usual" combination. ($p<0.1$)
- Compatibility was not seen in the pattern B and all information combination.
- Compatibility was seen in the pattern C and a "State of emergency" combination. ($p<0.01$)
- Compatibility was seen in the pattern C and a "Urgently" combination. ($p<0.1$)
- Compatibility was not seen in the pattern D and all information combination.
- Compatibility was not seen in the pattern E and all information combination.

- They would like to identify the information of "State of emergency." (100%)
- They would like to identify the information of " Urgently." ($p<0.01$)
- They would like to identify the information of " A reply required." ($p<0.05$)

Something vision disabled people think and wish are

- Validity of the vibration in a public place
- Mode which strengthens vibration
- Make a mobile phone briefer.

4.2. Future view and subject

This time, we investigated only 5 vibration patterns and 26 information. Therefore, other patterns and information are also considered that it is necessary to investigate similarly. Moreover, it will be necessary to investigate a person with normal eyesight similarly, since only a vision disabled person is written with a universe this time. Furthermore, if the combination etc. of the information and vibration pattern in which compatibility was seen by this research are used how, it is necessary to think of whether a vision disabled person can use a Personal Digital Assistant more conveniently. If these are realizable, as many people's as possible life will be changeable into a more convenient.

5. Examples Citations

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