Personalization of multi-modal interface for mobile phone

- Adaptation to "noticeable", "understandable" and "memorable" for each user -

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Abstract

"Every extremity is a vice."
"Much information, much confusion."

Authors aim to provide each user with intelligible information. Intelligible information is that an information provider means that it is important information for a certain user whose private data was protected. And actually, a user can be recognized its information as "noticeable", "understandable", and "memorable". We propose to control modality on the multi-modal interface of mobile phone. In our experiments, we have modeled subjective criteria of each user. Authors mean subjective criteria as visual-, hearing-, and tactile-information which is provided by authors is whether "noticeable", "memorable" and "considerable" for each user or not. Authors say subjective criteria as *KANSEI* model. Authors think that we can provide each user with intelligible information by using this model.

In first experiment, authors gave information of a simple pattern, which is simple combination of visual-, hearing-, and tactile-information. Authors found out that 90 percent of user can "noticeable" our presentation without being dependent on the contents in our experiment result. However, authors found out that 50 percent of user cannot "memorable" the contents of our presentation. Moreover, authors found out that each user depended on the contents whether he can "memorable" what information provider provides is or not.

Authors expect three effects by controlling modality on the multi-modal interface of mobile phone.

(1) Improvement of notice, understanding, and memory level to information

Authors found out that each user misunderstood our information presentation, if information provider provided information for each user without taking how to combine modality into consideration. Consequently, information provider and user cannot communicate intention of information provider to each user. That is, communication of a system and each user is not completed. Moreover, authors found out that this misunderstanding is caused by differences among subjective criteria of each person. Therefore, authors propose the information presentation using the control of modality. Simultaneously, we propose that control of modality do take differences among subjective criteria of each person into consideration.

(2) Improvement of reception environment corresponding to each user's behavior and their environment

Each user who has the mobile phone is behaving at various times and the place. In a certain environment, user might not be able to receive important information of his own. Even if each user is in any environment, he is able to understand what this information meaning is.

(3) Improvement of interface of mobile phone

Authors think that general user cannot be effective communication on the mobile interface. Mobile interface has small display and buttons. According to this, users are restricted their expression method for communication. However authors think that small display can be effective device for information presentation. Because of small display, information provider can present messages compactly for each user. Moreover, the mobile phone has already mounted three stimulation of sight, hearing, and sense of touch stimulation, and it is needless to say that it is stimulation that becomes familiar with usual life.

1 Control of modality

We receive and are sending a variety of multimedia information in the life of every day. However, it can be paraphrased that they exchange the person's stimulation of five feelings. The stimu lation of five feelings is a sight, a hearing, a sense of touch, sense of smell, a taste, and man can obtain multimedia information from the life of every day by exchanging these stimulations. However, there is a lot of one that it is incomprehensible what you want to tell in multimedia information that sight stimulation and aural stimulation are combined with the complexity. In the information presentation by sense of touch stimulation, there is no something with the local meaning, and the user misunderstands it under the present situation occasionally. Contents that the volume of information presented by each stimulation requests excess and the consumer one by one are not only different but also because a point to which it attaches importance depending on the person and a noteworthy method are different. Moreover, when sight stimulation is too strong, and too weak, it is understood to disturb attention to the contents and the memories of the content.

In this paper, the information presentation necessary so that the focus may be applied to three stimulation of the sight, aural, and the sense of touch that is the stimulation generally used for the presentation at present with the portable terminal among five feelings, and the user may live by a comfortable information society method is examined. It is called as the presentation of information the modal on multi-to combine these stimulation, and to use it for the information presentation at the same time. In this research, the information presentation in the portable terminal is especially assumed in the scene of a variety of information presentations.

Moreover, the usages of any stimulation are found, and the focus is applied to three actions support to user's information.

(1)noticeable：Authors think that each user have two situations when he gets information of his own. First, it is scattering of attention situation. Second, it is situation that he has focused about picture, text or audio of his information. In this paper, authors think the latter one. Authors suggest that if informer gives stimulus by his intention, each user can focus information. Doing so, authors think that we can support information life.

(2)understandable：Authors aim to design multi-modal interface for each user. Each user can understand that information which he got has what means for him if he use this interface We aim at a certain contents and it aims at the design of the interface for the user to understand what meaning the contents have for the user when information is presented. For example, each user can understand importance, emergency, danger, and reliability and profitable feeling, etc.

(3)memorable：Promotion we think that it is preferable to memorize the presented content after the fixed time passes in the information presentation including the promotion. Then, it is effective to the promotion of the memory that what stimulation ties to contents is examined.

In this research, wh at you achieved is verified to three supports of the above-mentioned. Moreover, when a modal multi presents it, how to which stimulation to feel it verifies "Domination" that indicates whether a noteworthy level is high for the user.

The stimulation treated this time indicates the one that one that "Sight and sense of touch" was combined and "Sight and aural" were combined, examines "Individual how to feel it" in these stimulation, and proposes the method of the information presentation matched to individual how to feel it. Sight information in this research indicates "Text, image, and image" presented on the screen of the portable terminal, and indicates "Music and voice" by aural information. Moreover, sense of touch information indicates stimulation by the vibration of the portable terminal.

We think that stimulation is used properly, information is presented, and there are two advantages. The first is to be able to receive information under various environments. Secondarily, it is thought that it is possible to present it by the presentation method of each user's understanding the content of information easily. In this text, it proposes the method for the achievement of the above-mentioned needs by the interface.

2 Model of multi-modal *KANSEI* in sight and aural

We have all time usually and the chance to touch multimedia information in the place. The typical example is a television, a movie, and the Internet, etc. Multimedia information is composed of various combinations of "Music and voice" that "Text, image, and image" that is sight stimulation and is aural stimulation. This chapter describes to model the multi-modal KANSEI that combines sight stimulation with aural stimulation. Aural stimulation was defined as music and the voice, and it experimented on psychology in of each in this research though aural stimulation included various stimulations from music and the voice to the life sound and the effect sound.

2.1 Sight and music

This chapter describes to model the multi-modal sensibility that combines sight stimulation with music. In the research of the past, even if the given sight stimulation is good impression, it is understood to change viewer's impression because of aural stimulation like the height etc. of the sound. [2] In the example of television CM, music in CM might be revolted for a certain viewer, an unpleasant impression and the commodity tie, and it remember. Thus, information that the donor intended under the present situation seems not to be passed on accurately the user one by one. Because information is presented without understanding be good if sight stimulation and aural stimulation are very combined. It is necessary to consider the combination of the stimulation of sight information and aural information to pass on information intended to an individual user. And, it is necessary to achieve the dissemination the multi-modal. As a result, the viewer comes to be able to receive the dissemination felt pleasant. As a result, remembering the commodity with a good impression for the informer becomes possible.

Then, music not to be able to lack especially in daily life like the television and the movie, etc. in aural stimulation in this chapter is paid to attention. In one of the features of multimedia information, it is enumerated that it is information that changes in the time limit. In a word, stimulation has changed into sight stimulation and aural stimulation with the change in time, too. Then, the contrast caused in both sight stimulation and aural stimulation is paid to attention, and the contrasts are compared mutually. To model each user's multi-modal sensibility is tried from the comparison.

2.1.1 Reserve experiment and result

First of all, it experimented on the reserve to examine "Whether aural stimulation goes mad the sight judgment of it or not?"

The experimental environment presents white-black background image on the PC screen. The image made the index that divided brightness into 14 beforehand, and prepared the one sight stimulation with different brightness of the background. These indices of division into 14 applied the result of investigating the difficulty of the brightness judgment beforehand. In addition, it presented it adding harmony (consonance and discord) at the same time as presenting not only sight stimulation but also sight stimulation. The presentation method presents three kinds in of the interval constant. And, the evaluation experiment that made three images the order putting by the subject in bright the order was done. In a word, it experimented whether music (harmony) that was aural stimulation might drive the brightness judgment of the image mad. In addition, whether it was unpleasant or pleasantness was evaluated overall including the presented harmony with the image simultaneously. In a word, whether the combination of aural stimulation was a pleasant one for the subject also verified to stimulate the sight.

As a result, the following results of two points were obtained.

- It was not possible to concentrate regardless of unpleasant or pleasantness, to the presented harmony, and there was something into which the evaluation by the sight fell
- Going mad and mistaking and the order putting have understood the sight judgment according to the presented harmony

Harmony that might not drive the judgment of the sight mad because it disturbs the concentration will be used for the following experiments.

2.1.2 Contrast

This chapter introduces the experiment and the result that pays attention to the contrast based on the result of a preliminary experiment. It was thought that multimedia information was information that had depended at time, and the change from point with sight stimulation and aural stimulation influenced how to feel the user. When information changes in the time limit, the contrast is generated respectively of sight stimulation and aural stimulation. Two kinds of contrasts were paid to attention in this research. Eyes are the one contrast in sight stimulation. Sight stimulation includes the text, the image, and the image, etc. All those information need not be thoroughly presented, and some contrasts are generated without fail. In this research, the contrast in sight stimulation indicates the difference between white and black of the object and brightness in the background image. Moreover, music is defined to consist of three attributes (height of the sound, strength of the A sound, and B tone), and the kind of the sound like music, the single sound, and harmony, etc. uses harmony especially as a sample sound in this research. And, the contrast in our music indicates the volume difference of two kinds of sounds that ring

continuously. How a big and small degree of this contrast influences sight and aural how to feel the user is examined. Each individual examined how to feel it for the contrast of sight stimulation and aural stimulation at the following. Moreover, can show the contrast in this research by the following expressions.

$$Vc = \frac{|Va - Vb|}{Va + Vb} \qquad Sc = \frac{|Sa - Sb|}{Sa + Sb}$$

V : luminosity (black-white:0-100)

S : The volume (42.2dB-60.9dB)

Fig1. Fig2. An equation of contrast (a vision and a sound)

2.1.3 Comparison experiment of contrast

It experimented by using the still picture where T-shirt was reflected in this research. The contrast is generated by change brightness of the background image and brightness of the T-shirt image. Moreover, the contrast is generated by changing the volume among three attributes of music between two harmonies. In the actual experiment, is the brightness of the background a black-white prepared it by ten stages by the one that it made between white into ten. The volume prepared the sample sound in ten stages that used software "text and music Sakura", and divided at equal intervals between 30-120 of indices 0-127 of the volume in this software. Table 1 showed how much actually volume it was when these sounds output it.

The image with two sounds projected onto the personal computer screen is presented to one person for two seconds as 12 subjects (eight man women 4 in her twenties). The first piece is presented in the background image simultaneously with harmony (do-mi-so)(the first piece of Fig.2). The one that T-shirt of a white is reflected in the same background is presented in the second piece based on this (the second piece of Fig.2). The same harmony as what presented to the first piece about the sound is presented with the image. The sound by the second piece prepares two kinds, and presents the one of the same volume as the first piece and the one of a different volume alternately for three times of total and six seconds (Fig.2). This was presented and 48 kinds of in total sample image and music were presented by the one that brightness and the volume of the background were changed. Moreover, when this experiment was conducted, an environmental volume before it experimented was about 40dB. The subject compares the contrast of the brightness generated between the background and T-shirt and the contrast of the volume generated by two kinds of harmonies with different volume (Fig.3). Choices of these two contrasts of having felt that the sight (aural) was larger (It was small) or having felt it in this extent were prepared and evaluated.

2.1.4 Experiment result and consideration

How many times it had answered respectively of 48 kinds of samples 12 subjects had evaluated total (Table 2).

As for common result to 12 subjects, when the contrast of sight stimulation is small, the nearer the difference of the contrast between aural stimulation the contrast between sight stimulation is, the more sensitive the subject is (Figure 4), saying that "This level". Moreover, the contrast between sight stimulation is and there is "It is felt to the experience that it is large" tendency from numerical changes into the contrast between aural stimulation for the subject when it is large (Fig.5). In a word, 12 subjects have understood what the contrast between aural stimulation feels exaggerated sensitively to the change than the contrast between sight stimulation.

Moreover, when the results are considered more individually than Table 2, the following seven tendencies are enumerated.

(a) Person with dominant sight: Subject C and subject E
(b) Person with dominant aural: Subject A and subject G
(c) Person who has a lot of level: Subject D and subject F
(d) Person with all is average: Subject B and subject L
(e) Person who feels sight or this level: Subject I
(f) Person who feels aural or this level: Subject J and subject K
(g) Person with few patterns felt this level: Subject H

The (a) takes account from sight stimulation, and indicates the person who biases to the evaluation by the sight in the range of this experiment data. In a word, when sight stimulation and aural stimulation are presented at the same time, the person who interprets and evaluates it from the sight is indicated. The (b) peels off and the person who interprets and evaluates it from aural is indicated by the pattern in contrast to the (a). Thus, it is understood that the individual variation is large in this case respectively though this experiment data used the pattern thought to be not

uneven to distribution from can the classification into (a)-(g), and dividing of 12 people into seven patterns. It thinks whether the information presentation felt pleasant can be achieved by presenting the pattern evaluated, "This level". Moreover, the method of presenting each user can be controlled by understanding how of each one of the user to feel it. For instance, subjects (a) enlarges the contrast between sight stimulation from aural dominant more than the contrast between aural stimulation, and the dissemination with which both the sight and aural stimulation harmonizes becomes possible. It is thought that important information for Moreover, when the dissemination that uses data similar to this experiment data is done, it is subjects a important information is presented by aural stimulation) can be presented. Therefore, information can be presented by controlling not the information presentation biased to only sight stimulation or aural stimulation but the modality. Moreover, the informer comes to be able to present important contents for the user in consideration of domination to the user's stimulation.

Table1. The aural stimulus in experiment

index of software	volume30	40	50	60	70
actual volume(dB)	42.2	43.8	46.7	49.2	51.5
index of software	volume80	90	100	110	120
actual volume(dB)	53.8	55.4	57.6	58.9	60.9

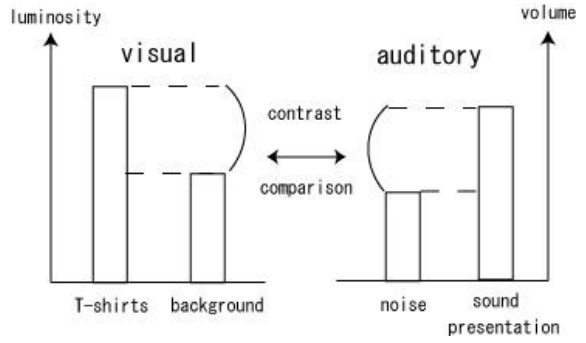

Fig3. Comparison of contrast

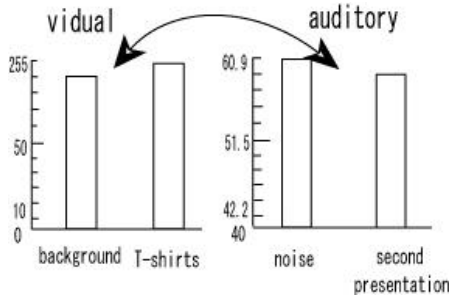

Fig4. The small contrast

Table2. Results of experiment

examinee	A	B	C	D	E	F
visual contrast is large	13	14	23	13	27	12
auditory contrast is large	20	15	16	15	11	14
visual and auditory contrast is same	15	19	9	20	10	22
examinee	G	H	I	J	K	L
visual contrast is large	7	20	19	9	4	14
auditory contrast is large	36	21	12	22	23	18
visual and auditory contrast is same	5	7	17	17	21	16

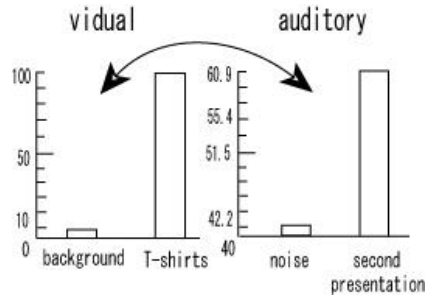

Fig5. The large contrast

2.2 Sight and voice

This chapter describes to model the multi-modal sensibility that combines sight stimulation with the voice of aural stimulation. It was verified whether effective information that there was an influence also in the memory of the content depending on the method of the presentation because it contained the meaning and the content in the voice, and is an influence in the memory was able to be presented.

It is thought that there are two kinds of voices when the originated voice is heard directly from the person and when the voice is heard through the machine. Moreover, it thinks the latter for two kinds when the voice artificially made is heard in case of the case to hear person's voice from the television and the machine such as cellular phones to exist. A latter voice is called a voice in this research. Moreover, the usage for a single direction and the few people is assumed though it is thought that there is a voice according to the usage for a single direction, interactive,

and for the large number of people and the few people etc. when uttering it. The combination of what stimulation remains in the impression or information that combines the text and the image that is sight stimulation with the voice that is aural stimulation is presented, and it searches for domination in stimulation from the user's reaction though it doesn't know. At the same time, the content presented by sight stimulation uses the attribute (price and material, etc.) in which the commodity is shown. It searches for the impression to those content. And, this information that is combined and presented is presented by using the change in time to examine the time limit change that is the feature of multimedia information, and it searches for the difference of the impression before it changes and after it changes.

2.2.1 Preliminary experiment and result

A preliminary experiment was done two times in total.

First of all, it was examined whether the difference of the character of the voice influenced how to feel the user in a preliminary of first time experiment. In this research, the character of the voice is indicated and three of the voices of the speed, height, and the man and woman of the voice are indicated. The image and the text were presented on the screen, the voice that related to the image, and it presented it to the subjects at the same time (Fig.2). Moreover, the question of each sample "How much did you feel that it was told that the computer was important?" was installed by the questionnaire after it had presented it. The evaluation method used the SD method as six total subjects three men and women in the first half in one's twenties the subjects. As a result, the woman's voice is used in the following experiments because it tended to feel important that the evaluation to the woman's voice is high.

Hereafter, a preliminary of second times experiment experimented on three patterns including the question concerning the question and the attribute concerning the memory (Fig.3).

(a) Pattern image of T-shirt and four attributes are presented by text, and without voice presentation

(b) The image of T-shirt and four attributes are presented by the text, and the pattern of the our one attribute that presents the voice

(c) The image of T-shirt and 3 of four attributes are presented by the text, and the pattern of one attribute in which the text is not presented that presents the voice

When it was made to answer in order of remembering four attributes immediately after presenting it, it was higher than the correct answer rate when there was no correct answer rate when there was a voice presentation. Moreover, the tendency appeared in order of the attribute answered each person. For instance, a certain subjects tended to fill in the price first.

2.2.2 Memory

Which stimulation of the voice can be left for the person's memory especially by the dissemination including the voice in sight stimulation and aural stimulation in the actual experiment was examined. Moreover, whether it remembers at time when which combination is longer when the content of the attribute is presented by using sight stimulation and the voice is verified. If the presentation method that can be memorized at longer time is achieved, it becomes an indicator that decides how to present the hope of the consumer like the advertisement etc. the memory. Moreover, it referred to Ebbinghaus's forgetting curve as an index that showed how much the person memorized after the fixed time had passed in this research. The memory after 20 minutes information presentations decided to be asked to the subjects according to this.

2.2.3 Experiment on memory to voice information

The voice sample of the actual experiment was made by the voice synthesis soft " Speech 2 of voice text". It adjusted to the standard dialect by author's subjectivity to hear it, and the parameter of the software was used about the meter of the narration about height, earliness, the intonation, and the volume.

Subjects were 12 people of total six men and women in the first half in his/her twenties.., and three kinds of screens where the commodity image (shirt), text information, and voice information had been combined were presented (Fig.4).

Voice information presents one time of the combination (the image and text information) twice, and the interval is 3 that adopted about 1.5 seconds that are the lengths of best "Among".

Authors use the attribute about the color, the price, and the material concerning the shirt that was the commodity. When it finishes seeing three kinds of presentations, the commodity that entered the first nature is chosen from among three commodities. Because a sight element was strong, the expression concerning the color answered the

color of T-shirt from the result of a preliminary experiment about the commodity image in attribute information. The price and the material were alternately applied and text information and voice information were answered respectively.

In addition, it experimented on the memory when the fixed time passed in the actual experiment after a sight and aural information presentation. First of all, in the memory by this research

a) The storage after the fixed time passes than the memory immediately after information the presentation is more important

b) Storage of remembering without intending it is more important than the memory of remembering intentionally

Whether the attribute presented by being use which stimulation in 20 minutes was memorized was examined. As for time of 20 minutes, it is four quoted from Ebbinghaus's forgetting curve (curve that showed how much memory remains after the fixed time).

In the actual experiment, it was made to fix about the voice attributes (height, speed, volume, intonation, and woman's voice), the presentation time, and the presentation image that was the factor in the experiment. The change factor was assumed to be a color of the shirt of the presentation image and an attribute value of the price and the material.

2.2.4 Experiment result and consideration

The one that the correct answer rate according to the presentation method according to the attribute of the total was summarized in Table 1 and Table 2. The result of obtaining by 2.2.1 is compared with the result of the actual experiment. When the memories (actual experiment) after 20 minutes memory (2.2.1) immediately after information the presentation and the information presentation were compared according to the attribute, the correct answer rate was higher than Table 1 in the order of the color, the price, and the material. Moreover, when the attribute to which it attached importance when purchasing it for the subjects was heard, there were a lot of answers, and the correct answer rate was corresponding to the high order in the order of the color, the price, and the material. It is thought that the attribute to which it attaches importance because of this is memorized though passes compared with other attributes time.

The correct answer rate was higher than Table 2 in the order of the image, the text, and the voice when comparing it by the presented stimulation. In a word, the memorized stimulation has understood the image of sight stimulation remains most in the memories. In preliminary experiment (2.2.1) that had been answered immediately after the screen was seen, the correct answer rate where it compared by the presence of the voice and there was a voice was high. It can be said that it is also early to forget as time passes though information by the voice presentation can strongly leave the impression by comparing these two experiment results. Moreover, none of groups with a low correct answer rate tended to be able to answer the voice presentation correctly though the correct answer rate concerning the image was the same when four people with a high correct answer rate and four low people were considered to be a group and it compared it. In a word, it is possible that there is a considerable individual variation in the voice presentation.

2.2.5 Experiment that controls timing of voice presentation

It thinks about the correct answer rate of the voice presentation from the experiment result of 2.2.4 and the timing of the voice presentation is thought as a factor that was low (Table 2). After the hoop and the voice presentation including the voice presentation ended at the same time as presenting the sight, the sample of the actual experiment had time only by the sight presentation. It thought whether the presentation only of this sight had influenced the result. Then, the timing of the voice presentation was changed and the presented experiment was tried.

The timing of the voice presentation prepared three patterns (Fig.5). Pattern A presents the voice first, and presents the sight on the way. Pattern B presents the sight first, and does only the voice presentation at the end. Pattern C presents the voice while presenting the sight. Three patterns were prepared above. The one that the correct answer rate of each presentation method and each pattern of total was summarized in Table 3 and Table 4 as a result. The memory of the content of the attribute that presented the voice was urged when the timing of the voice presentation was changed from Table 2 and Table 3 when comparing it according to the presentation method, and the correct answer rate went up. However, the correct answer rate of the content of the attribute that did the text presentation oppositely has fallen. It has been understood that there is an influence in the memory from changing timing in which the voice is thrown.

Table3. The percentage of correct answers

	The percentage of correct answers (%)
color	66.7
price	55.6
material	52.8

Table4. The percentage of correct answers

	The percentage of correct answers (%)
sound presentation	44.4
text presentation	63.9
picture presentation	66.7

Table5. The percentage of correct answers

	The percentage of correct answers (%)
sound presentation	53.3
text presentation	53.3
picture presentation	63.3

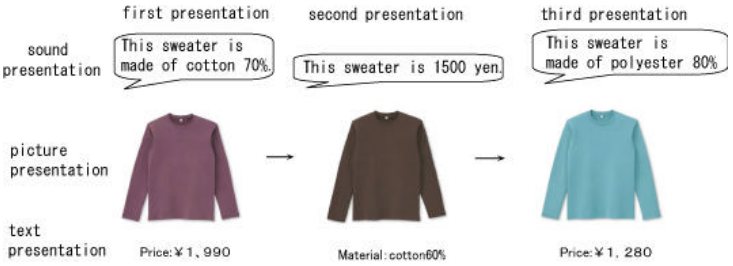

Fig6. Flow of experiment

Fig7. Samples of experiment

Table6. The percentage of correct answers

	The percentage of correct answers (%)
Pattern A	53.3
Pattern B	60
Pattern C	56.6

3 To model of multi-modal sensibility in sight and sense of touch

3.1 Sight and sense of touch

This chapter describes to model the multi-modal sensibility that combines sight stimulation with sense of touch stimulation. We are always receiving sense of touch stimulation in daily life. It has the one to feel the one to touch voluntarily and the one to feel an external factor. Surface sense [5] that the person feels has four following classifications.

a) Tactile senses; touch-pressuosense, flutter-vibration
b) Pain senses
c) Thermoreceptive senses, warm sense, cold sense
d) Itch sensation; tickle sensation

In this research, the focus is applied to a), the role that sense of touch Satoru plays in the information presentation is examined, and support that urges "Attention" to user's information, "Understanding", and "Memory" is tried.

3.2 Role of sense of touch stimulation

In the sense of touch stimulation that we are experiencing in daily life, there are various roles. The sense of touch stimulation experienced most typically and daily is a function that the cellular phone vibrates to inform the user of the notification now. Sense of touch stimulation that makes "Rouse of attention" that informs of the notification a purpose is presented, and it what meaning has by the stimulation, how is important or there no purpose to urge "Understanding" such as how the emergency is high under the present situation. Furthermore, "Memory" is not urged according to the importance degree.

Moreover, the one to receive sense of touch stimulation from the one to touch voluntarily includes the controller etc. of an electric toothbrush, the doll, and the game machine besides the notification function of the cellular phone.

These are presented in the purpose to increase the enjoyment by experiencing the event in the vibration and the game to accomplish the purpose easily. And, it is a research stage, and the attempt to vibrate the steering wheel of the car to tell danger is performed. Moreover, the sound such as the vibrations of the drum of a live hall and the combined stimulation exist in the sense of touch stimulation received from an external factor, too and they are big factors to produce power. However, neither "Understanding" nor "Memory" is urged though it is when these also similarly fill it with "Rouse of attention". It is thought that sense of touch stimulation should combine three of the timing of the sense of touch presentation of interval (3) between the vibrations time (2) that (1) vibrates to give vibrate the meaning, and to urge "Understanding" to user's information and "Memory" and we use it properly.

3.3 Experiment on information presentation that uses sense of touch stimulation

3.3.1 Relation between sense of touch stimulation and attention

It experimented to examine "What vibration rouses attention?" in this research. The subjects had the portable terminal, and the terminal was vibrated. And, it questioned whether attention turned to beginning or the end of the vibration by the questionnaire. In addition, modal multi that combined sight stimulation with sense of touch stimulation presentation was given, and it questioned whether attention similarly turned to beginning or the end of stimulation. The subjects was six people (five men and one woman) subjects in his/her twenties, and experimented the experience of having already carried about the portable terminal in daily life, and receiving the notification because of the vibration in the origin of the confirmation.

As a result of the experiment, attention to the stimulation of the vibration turned when all members began stimulating. And, attention turned when five people in six people began stimulating when sight stimulation and sense of touch stimulation were presented at the same time. A certain subjects obtained the answer result "It became a trouble because two or more stimulation was presented at the same time, and attention was not turned to modal multi presentation" though both sight stimulation and sense of touch stimulation simple presentations were done in the sample that had been used this time.

3.3.2 Relation between sense of touch stimulation and memory

It experimented to examine "Whether does the vibration urge the memory or not?" in this research. It presented adding the vibration to sight information by using the vibration pattern answered as turning one's mind by 3.3.1, and it was examined whether to memorize sight information. As a result, the correct answer rate of the memory was 50 percent.

4 Conclusions

It is necessary to consider the individual variation to rouse attention by using the interface that combines three kinds of stimulation of a sight, aural, and sense of touch stimulation, and to urge understanding and the memory. As for the individual variation, it has been understood that aural stimulation is the largest, and sight stimulation is smallest.

When the contrast of sight stimulation is small, the nearer the difference of the contrast between aural stimulation the contrast between sight stimulation is, the more sensitive the subjects is , saying that "This level". What the contrast between aural stimulation feels exaggerated sensitively to the change has been understood than the contrast between sight stimulation. A domination tendency to the stimulation of the individual could discover.

The attribute to which it attached importance discovered the tendency to memorize though passed compared with other attributes time. It has been understood that the image of sight stimulation remains most in the memories in the voice that it is an image, a text, and is aural stimulation that is sight stimulation. Moreover, it was also early to forget as time passed, and after the fixed time had passed, understood the memory of the content that presented the image from the voice presentation remained though information by the voice presentation was able to leave the impression strongly. The group with a low correct answer rate discovered the tendency for nobody to memorize the voice presentation though the correct answer rate concerning the image was the same in the experiment result of presenting sight stimulation and aural stimulation at the same time when one group and four low people were considered to be one group and each group compared four people with a high correct answer rate. In a word, how to

the voice presentation to feel it can expect a considerable influence for a considerable individual variation to exist, and to exist also in the memory.

Attention to the stimulation of the vibration turned when all members began stimulating. And, attention turned when five people in six people began stimulating when sight stimulation and sense of touch stimulation were presented at the same time. As for modal multi presentation including stimulation where the experience is insufficient, two or more stimulation is presented at the same time. The presentation becomes a trouble therefore, and it has been understood might do the scattering of attention the user. Even if it is sense of touch stimulation of the pattern to which attention is roused, it has been understood not to memorize the content of the sight stimulation presented at that time. As for it, the user is thought to be a sense of touch dominant. Or, it can be expected to be interested in the content of different information, and to be memorized.

5 Next steps

In this research, how each user felt sight stimulation, aural stimulation, and sense of touch stimulation was examined. This time, when sight stimulation and music (three harmonies) were combined, how to feel the user was examined about the contrast generated each stimulus. And, when sight stimulation was combined with the voice, the relation between attention and the memory in each stimulus to user's information was examined. Similarly, the relation between attention and the memory when sight stimulation was combined with sense of touch stimulation was examined. One of next steps is the contrast in the voice examines what characteristic you exist. Moreover, it aims to find the common feature concerning the contrast. In addition, it gropes for timing in which stimulus is used properly. In that case, it aims to find the difference of the evaluation by the difference of the presence of the experience, and to construct the technique of the information presentation matched to each user.

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References

[1]Takahiro Iijima, Isao Shinohara, Toshikazu Kato : Multi-modal interface for mobile information service The 6th Japanese Society of Kansei Engineering 2004 H71

[2] Written by Shinichiro Iwamiya: Multi-modal communications of music and audio-visual

[3]Written by Toshie Nakamura, Chika Nagaoka, and Maria Raluca Draguna: Human interface related to sensibility information transmission in voice conversation - Role of "*MA*" that forms smooth communications-

[4] Ebbinghaus's forgetting curve: http://www.naracom.co.jp/diary/kobore3.html

[5] Surface sense: http://www.tmd.ac.jp/med/phy1/ptext/somat_1.html