

L-050

The evaluation to information presentation and recognition on a wearable computer

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1. Introduction

At present, They reserch widely wearable computer which is equipped with Head Mounted Display. As the technology advances, They must need to study the new interface that is called real-world oriented interface, the purpose of which is to support workers by using computers. However, few papers have been published on the related information. Accordingly, we focus on the evaluation of the best information presentation for a wearable computer, through experiments, which is the main objective of this study.

2. Important points about an information presentation

(1) Sensuous aspect

We think of three senses, for which are visual, auditory and tactile sensation.

- Visual : color, size, form, arrangement, etc.
- Auditory : direction, pitch, volume, etc.
- Tactile : temperature, feel, size, etc.

(2) Cognitive aspect

We think two points, which are composition and media about information presentation.

- Composition : arrangement of the information, presentation sequence, etc.
- Media : character, sound, picture, etc.

In the points mentioned above, we focus on a visual and auditory sensation concerning sensuous aspect because it is difficult to do the presentation that raises the task efficiency by the tactile information. Moreover, We pay attention to the media in regard to cognitive aspect because there is no change in the presentation method even if the composition is changed.

3. Information presentation method

We categorize four information presentation methods.

(1) Basic media(Character)

First, we use the media, whose name is "Character", which presents only characters when helper gives an information.

(2) Static media(Color)

Secondly, we use the static media, whose name is "Color", which presents characters and the background color of a HMD, the color of which is red.

(3) Dynamic media(Flash)

Thirdly, we use the dynamic media, whose name is "Flash", which presents characters. Moreover, this media has the feature that flashes blinkingly in the background color of a HMD, the color of which is blue and pink.

(4) Auditory media(Sound)

Lastly, we use the auditory media, whose name is "Sound", which reads the presented contents.

We use 60pt as the font size presented on a HMD[1]

4. Experimental

In order to study what reaction subjects show to four presentation methods, we made two experiments.

4.1 Task for real world

This is a task of assembling the solid block drawn on the card. The shape of all blocks is different. We named this task "Block Task".

(1) Features of the task

- Intermittent work : There was no need for subjects to work all the time, and sometimes they can stop working.
- Wide work area : Subjects need to gather the blocks which are on the table, and they must arrange them as showed on the card.

(2) The content of information presentation

- Arrangement place : Subjects get the information about hint of the block structure.
- Blocks used this time : Both necessary and unnecessary blocks information, which is in relation to the structure, are given.

4.2 Task for display

This is a puzzle game that piles up "Atom" below well, and makes "Molecule". It's like a tetris. We named this task "Puzzle Task".

(1) Features of the task

- Continuous work : Subjects should always gaze at the display. Moreover, it is necessary to keyboard at the same time.
- Small work area : Because of the task on the display, Subjects have to see only the screen

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basically for the task accomplishment. In addition, only the right hand is used for the operation of the keyboard.

- (2) The content of information presentation
- Arrangement place: The content, which is the hint of the task, concerning the "atom" that should be dropped, is presented.
 - Molecular composition: In order to show what kind of "molecule" has to be made, the content concerning the molecule that should be made next is presented.

5. Evaluation

The number of testees is 15 people in both tasks.

5.1 Evaluation by the NASA-TLX

NASA-TLX is a technique for requesting the load index of the task based on a multi-dimensional average of a subjective evaluation.

5.2 Evaluation concerning awareness

Each item is evaluated by five stages.

- Degree of the awareness: How much are they aware of the presented information while carrying out the task.
- Degree of the confidence: How much are they irritated or annoying for each presentation.

6. Results and Discussion

6.1 Workload

Table 1 the comparison of the workload

Information Presentaion	Block Task	Puzzle Task
Charecter	68.2	58.6
Color	69.3	62.4
Flash	73.2	67.3
Sound	49.5	44.5

This result shows that the workload of "Block Task" is larger than that of "Puzzle Task". Therefore, the noticeable difference in the workload is considered to be due to the work area and the range of the glance movement.

6.2 The awareness

Table 2 the comparison of the awareness

Information Presentaion	Block Task	Puzzle Task
Charecter	3.1	3.0
Color	3.6	4.8
Flash	3.7	4.0
Sound	4.9	4.9

Table2 shows that it is easier to have awared the "Color" than "Character" in both tasks. Moreover, according to our observation, subjects sometimes don't aware the "Character" while carrying out the experi-

ment. Therefore, we think that it is suitable to emphasize by the background color when we present an information on HMD.

In static media, we can find out that it is easier to aware in "Puzzle Task". As for the "Puzzle Task", the glance movement is smaller and the work area is narrower than "Block Task". Therefore, it is thought that the awareness level rises because subjects can take account to HMD.

6.3 The confidence

Table 3 the comparison of the confidence

Information Presentaion	Block Task	Puzzle Task
Charecter	3.6	3.8
Color	2.6	3.1
Flash	2.1	2.7
Sound	4.7	4.9

According to this result, the visual media, especially "Flash" media, gives unpleasantness in proportion to background color strength. Actually, it is possible to take a long time in the working with being equipped with a wearable computer. Therefore, we consider that the information presentation only by the "Flash" is not suitable in long time tasks.

The "Sound" has high comfortable degrees because of no sight influence. Namely, according to the experiment, we consider that the cause of giving a psychological load is due to a sight influence.

7. Conclusion

In this paper, we aimed to obtain the data concerning the best information presenting method which is suitable for a wearable computer. In order to study what reaction people showed to a variety of presentation methods, we made two experiments.

As the result about the value of the workload, we found out that there was a proportion between the amount of the work area and the glance movement, and the workload. In addition, we discovered that there was the relation of the trade-off in the sight media between the awareness level and the comfortable degree.

At the end, When the message by text information was presented, auditory media were the most suitable under a static environment.

Reference

- [1]Naohiko Kotaka, Atsushi Hiyama:Analysis of relationship between visual information volume and walking. In *Proceeding of the Human Interface Society*, pages 61-64.