THE EFFECTIVENESS AND CHARACTERISTICS OF 3 POINT TASK ANALYSIS AS A NEW ERGONOMIC AND KANSEI DESIGN METHOD

Toshiki Yamaoka, Takuo Matsunobe

Faculty of System Engineering, Wakayama University

This paper describes effectiveness and characteristics of 3 P(point) task analysis as a new Ergonomic and Kansei design method for extracting user demand especially. The key point in 3 P task analysis is to describe the flow of tasks and extract any problems in each task. A solution of a problem means a user demand. 3 P task analysis can eliminate an oversight of check items by examining the users' information processing level. The users' information processing level was divided into the following three stages for problem extraction : acquirement of information ---> understanding and judgment ---> operation. Three stages has fourteenth cues such as difficulty of seeing, no emphasis, mapping for extracting problems.
To link analysis results to the formulation of a product concept, I added a column on the right side of the table for writing the requirements (user demand) to resolve the problems extracted from each task.
The requirements are extracted by using seventh cues. Finally 3 P task analysis was compared with group interview to make the characteristics of 3 P task analysis, especially extracting user demand, clear.

Keyword: 3P task analysis, Group interview, User demand

1. Introduction

Every product is designed based on hard requirements and user requirements changed from user demand. User requirement becomes important item in order to make products attractive and user friendly and due to ISO 13407 (user centered design).

Extracting user demand is very important as Ergonomic and Kansei design are constructed based on user demand. 3P task analysis is very useful and low cost method to extract user demand without target user. On the contrary group interview is used with about seven target users and in marketing research widely. In this paper effectiveness and characteristics of 3P(point) task analysis are described by comparing with group interview regarding extracting user demand

2. Conventional task analysis

The key point in task analysis is to describe the flow of tasks and extract the interface-related problems in each task. This analytical method originated from the work analysis conducted by F.W. Taylor and L.G. Gilbreth. And a variety of methods were developed in the 1950s.[1] As most interface problems in those days were related to physical characteristics, sequential task analysis methods were commonly used to extract device-related problems.[2]

When the application of electronic technology spread in products produced after 1980, task analysis for the examination of cognitive aspects was proposed and used.[3]

In addition to sequential task analysis, hierarchical task analysis (HTA)[4] was also adopted. In this method, tasks are broken down into subtasks, which are then arranged in hierarchical layers. The resulting hierarchical chart was used as a base in extracting problems. Another common method used was cognitive task analysis. This analysis method was an extension of the then-conventional task analysis method, and was designed to obtain information of the structure of a target as well as users' thinking patterns and knowledge which could affect task performing results.[5]

There are many other types of task analysis methods, but sequential task analysis has been used most commonly. HTA is also based on the sequential task analysis method.

3.3P task analysis[6]

As mentioned previously, conventional sequential task analysis is used to examine the input/output sections of devices and extract device-related problems. In this method, the cognitive level is included as an examination item perfunctorily, and it rarely serves the purpose of evaluating the users' information processing level.

The reasons for examining the users' information processing level are to eliminate evaluation item oversights and to incorporate users' viewpoints in the evaluation. This is because users receive external information as input and follow the information processing procedures of understanding, judging and operating.

The users' information processing level was thus divided into the following three stages for problem extraction: acquirement of information ---> understanding and judgment ---> operation. In the previous methods, analysis ended when problems were extracted. To link analysis results to the formulation of a product concept, I added a column on the right side of the table for writing the requirements to resolve the problems extracted from each task. This column is further divided into two sections: one section is for items that can be resolved immediately in a practical manner and the other is for items which cannot be solved at the present time due to cost and technical factors but which are expected to be solved in the near future. Solution ideas described in this column are reusable in the future. Then, there is a seventh cue for designing solutions (Fig. 1). User can produce solutions taking seven cues in account.

Norman[7] focused on seven stages of user activities in task execution. However, application of his concept to task analysis requires a great deal of descriptive work. In addition, since the purpose is to extract problems, I concluded that dividing user activities in three stages would not cause much difference as far as problem extraction is concerned.

In the "acquirement of information" step, users obtain information, and this step is equivalent to the "sensory" and "perceptual" levels in humans' information processing flow. The key point in this step is ease of information acquirement.

The "understanding and judgment" step is a stage for recognizing perceived information — that is, a level in which information is understood and a judgment is made.

In the "operation" step, the user's intention is conveyed to the machine. This means that the judgment of information is converted to an instruction to be given to a machine by means of humans' effective devices (hands, legs, etc.).

The following shows the most frequent evaluation items in the task analyses I conducted for 30 electronic products. In other words, using these items allow easy discovery of problems.

(1)Acquirement of information:
  1) poor layout (position),
  2) difficulty of seeing
  3) no emphasis
  4) lack of information
  5) mapping
(2)Understanding and judgment:
  1) indecipherable,

2) no affordance
3) confusing, easy to mistake
4) no feedback
5) procedural problems
6) inconsistency
7) problems in mental model

(3)Operation:
1) incongruity with humans' physical characteristics (three important items: posture, fitness and torque (force necessary for operation))
2) cumbersomeness

4.3P task analysis procedure

The following describes the 3P task analysis procedures.

(1) Consider a typical scenario for the use of the product being surveyed.
(2) Determine a general flow of tasks in the selected scenario.
(3) In each task or subtask, extract problems in each of the users' steps —"information acquirement," "understanding and judgment" and "operation" —by referring to the cues.
(4) Design the requirements for resolving the extracted problems by referring to the seven cues. In the right most column, write memos or draw illustrations to indicate whether the requirements can be solved at the present or in the future
(5) The requirements are grouped.

5.Compared with group interview

Vacuum cleaner and bicycle were selected to compare 3P task analysis with group interview.

5.1. Test 1

Group interview about bicycle was done.

(1)Participants:
6 university students (3 males and 3 females)

(2)Test design and procedure
Participants talked each other about bicycle freely. Especially merit and demerit of bicycle, the when and the where of riding bicycle were asked.

5.2.Test 2

Group interview about vacuum cleaner was done.

(1)Participants:
7 university students (3 males and 4 females)

(2)Test design and procedure
Participants talked each other about vacuum cleaner freely. Especially complaints about vacuum cleaner, frequency in use were asked.

5.3.Test 3

Two students who have specialized in ergonomics did 3P task analysis of a bicycle and a vacuum cleaner in order to extract user needs. They extract the problems of the bicycle and vacuum cleaner talking each other. The extracted problems were changed to idea that means user demands.

5.4.Results of Test 1,2 and 3

The results are as follows.

5.4.1. 3P task analysis

(1) time to execute
a) bicycle: 80 minutes
b) vacuum cleaner: 110 minutes

(2) number of problem extracted
a) bicycle: 59
b) vacuum cleaner: 50

(3) number of idea
a) bicycle: 28
b) vacuum cleaner: 38

(4) quality of idea
The quality of idea were classified into three group from the point of view of practical idea: good, so-so, bad.
Number in three groups (good, so-so, bad)
a) bicycle: 6(good), 15(so-so), 7(bad)
b) vacuum cleaner: 10(good), 26(so-so), 2(bad)

5.4.2. group interview

(1) time to execute
a) bicycle: 105 minutes
b) vacuum cleaner: 85 minutes

(2) number of problem extracted
a) bicycle: 35
b) vacuum cleaner: 43

(3) number of idea
a) bicycle: 22
b) vacuum cleaner: 44

(4) quality of idea
Number in three groups (good, so-so, bad)
a) bicycle: 3(good), 9(so-so), 10(bad)
b) vacuum cleaner: 10(good), 27(so-so), 7(bad)

6. Discussion

Number and quality of extracting ideas of 3P task analysis and group interview are nearly same according to results. And time to execute is almost same. These results lead to the conclusion that 3P task analysis like group interview can extract a lot of ideas. We see 3P task analysis can get ideas as well as group interview.

As stated above conventional task analysis extract only device-related problems. However 3P task analysis can extract not only problems but also user requirement (user demands) using seventh cue for designing solutions.

As 3P task analysis is done without target user, it' s inexpensive than group interview with target user.

So, 3P task analysis is useful and low cost method to extract ideas of new products without target users. If product development term is short or the schedule is tight , 3P task analysis is available without using group interview.

References

[1] Annet J.: Theoretical and Pragmatic Influences on Task Analysis Method; Cognitive task analysis, pp25-27, Lawrence Erlbaum Associates, Inc. (2000)

[2] Burgess J.H.: Human Factors in Industrial Design; pp95-114, TAB BOOKS Inc. (1989)

[3] Cushman W.H., Rosenberg D.J.: Human Factors in Product Design; pp36-39, Elsevier (1991)

[4] Preece J., et al: Human-Computer Interaction; pp404-429, Addison-Wesley (1994)

[5] Chipman S.F., et al: Introduction to Cognitive Task Analysis; Cognitive Task Analysis, pp3-5 (2000)

[6] Toshiki Yamaoka: Human Design Technology, Primer of Design Information Science, Japanese Standards Association, Chapter 16 (2000)

[7] Norman D.A.: Cognitive Engineering; User Centered System Design, pp41-43, Lawrence Erlbaum Associates, Inc. (2000)

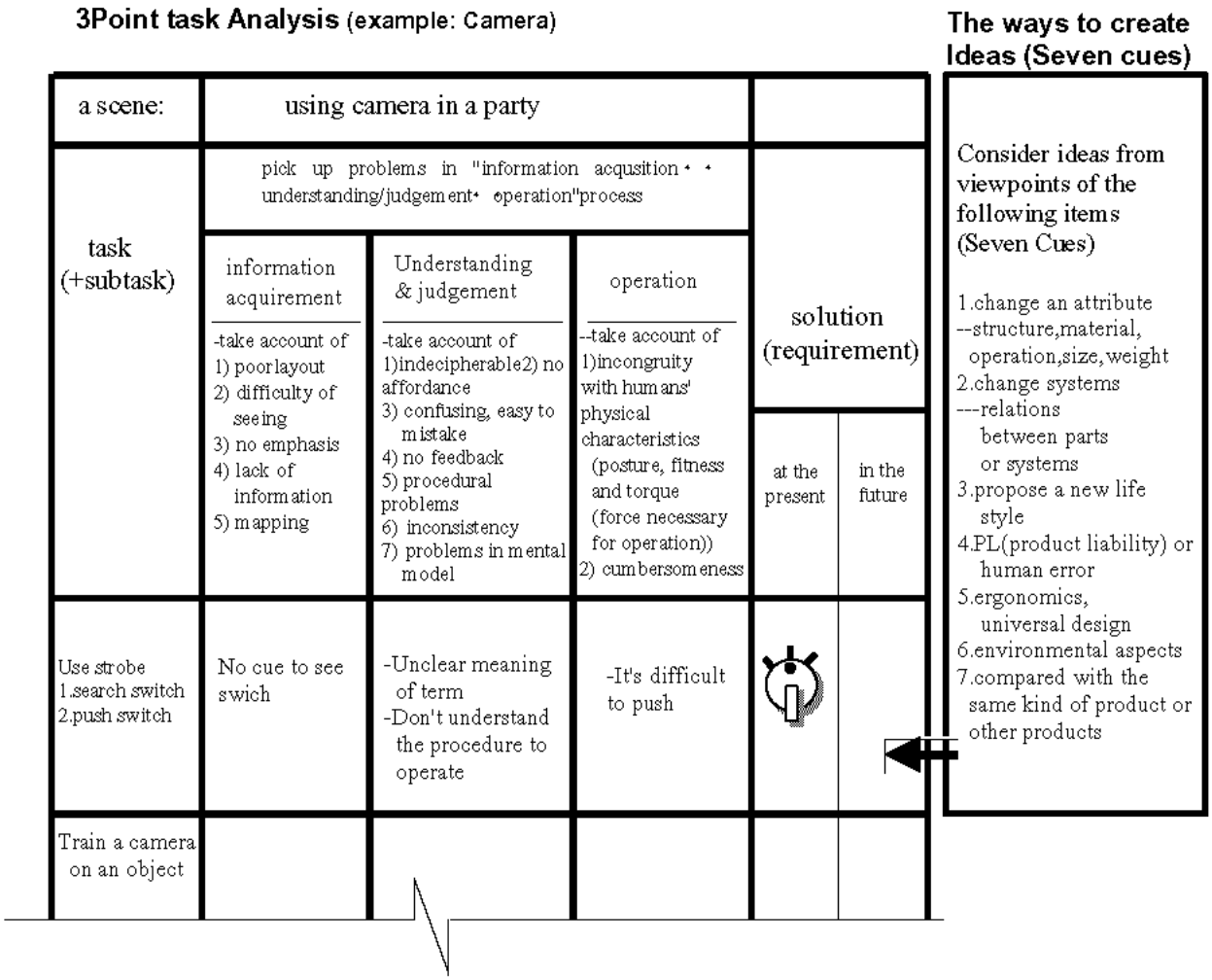

fig1 3P task analysis