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A PROPOSAL OF THE USABILITY CHECKLIST CORRESPONDING TO TASK FLOWS

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ABSTRACT

Quantifying usability is important in Human-Centered Design. Checklist methods are one of the methods of quantifying usability method by usability inspection. Checklists so often used for quantifying usability in design development at present. However, checklist methods have some problems regarding quantifying usability. First problem, the differences of the results come up by the difference of usability evaluator. Second problem, the right evaluation by checklists is hard if the checklist doesn't coincide with the tasks of evaluated products. Then, we aimed at proposing the usability checklist corresponding to task flows as a way of solution of current problems. The proposed method is versatile and easy quantifying usability method by checklist. This paper shows our proposed method.

Keywords: user centred design, design methods, quantifying usability, checklist method

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1 INTRODUCTION

1.1 Background

Recently, Human-Centered Design (HCD) has attracted industry attention. Regarding the HCD process, ISO13407, and ISO9241-210 as a revised from of ISO13407, were established as an international standard. According to ISO 9241-210, HCD is defined as follows: "Human-Centered Design is an approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques".

In HCD, both evaluating usability in downstream and examining holistic usability upstream are important. Usability evaluation via checklists is frequently used from the upstream to the downstream stage by various development actors, including non-designers, non-usability engineers, and development engineers. Upstream, the easy checklists as design guidelines are used for examining the design and usability. The checklists are easy to use in design development. However, the interpretation of the checklist items is difficult by non-designers and non-usability engineers because the different evaluators may have different preference systems regarding usability. In other words, there are differences in the evaluation results among evaluators. Downstream, the detailed checklists corresponding to each product are used for grasping the level of usability. These checklists require a testable and high-quality finished product or mass products. Additionally, the interpretation of checklist items is comparatively easy because each item is finely established corresponding to each product. In other words, there are few differences in evaluation results among evaluators but a correct evaluation by this checklist is difficult if the checklist doesn't coincide with the tasks of the evaluated products. However, it may be difficult that this type checklist for the specified products use the similar products because the checklist items corresponds each product.

1.2 Objective and Approach

For those reasons, it is difficult to use current checklists sufficiently in design development. In this study, a usability checklist corresponding to task flows is proposed as a way of solving current problems. We believe this approach makes it possible to evaluate the operation flow of various products in the design development phase. Additionally, we aim to improve accuracy by using narrow evaluation scopes with rating on a task/subtask level. We also assume that the checklist will be used by usability practitioners and product developers who don't have much experience in usability evaluation.

2 THE PROPOSED METHOD

In the proposed method, flow design patterns were used to examine task flows (Wada, 2011). Flow design patterns are design patterns that are developed as a reference for designing an operation flow for users. Fourteen patterns in general user-interfaces were reported by Wada. An example of flow design patterns appears in Figure 1. Fourteen flow design patterns appear in Table 1. In this method, a checklist was provided for each flow design pattern. In this way, we believe it is possible to evaluate an operation flow in various products. Moreover, the checklist can evaluate usability including the previous or next operation flow. We also aim to improve accuracy by using narrow evaluation scopes with rating on a task/subtask level. Therefore, we used flow design patterns for checklists corresponding to task flows.

2.1 Selecting Tasks from an Evaluation Object

Frequently used tasks are selected as tasks of an evaluation object. If evaluators think that the tasks are not enough, they can arbitrarily add tasks.

2.2 Selecting Flow Design Patterns Corresponding to the Task Flow of the Object

Flow design patterns corresponding to each task are selected from 13 patterns excluding an auxiliary pattern. If the tasks consist of multiple patterns, multiple patterns are selected.

2.3 Evaluation Using a Checklist for each Pattern Corresponding to a Task Flow

An evaluation of the object task flows is conducted using the checklist for each flow design pattern. A 5- or 7-point scale rating in a checklist has differences in the results due to the differences among

usability evaluators (Kato et al., 1995). Therefore, a 2-point scale rating (yes/no) is adopted in the proposed checklist.
An outline of the proposed checklist appears in Figure 2.

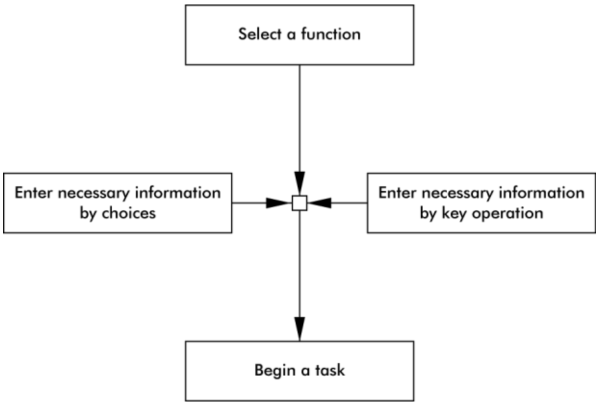

Figure 1. An example of the flow design patterns (Pattern 1)

Table 1. 14 flow design patterns

1	Procedure with parameter adjustment
2	1 step execution of a task by function selection
3	2 step execution of a task by function selection and parameter adjustment
4	Parameter adjustment during operation
5	Procedure with input-output of media
6	Procedure centering on input of media
7	Procedure by input of information regarding users
8	Procedure by users' request
9	Search in special terminals to search and view information
10	Access to information in a screen of a shallow hierarchy
11	Access and search to information in a screen of a deep hierarchy
12	Search in an information-intensive system
13	Access and edit to stored information
14	Reiteration of entry and confirmation

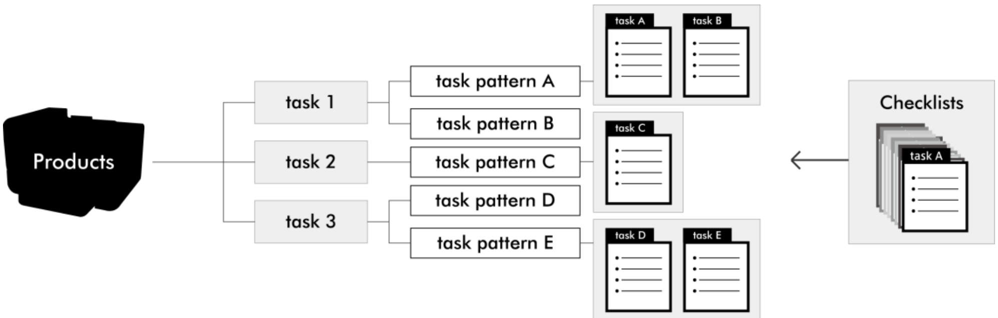

Figure 2. An outline of the proposed checklist

In this proposal, an investigation and experiments were conducted to examine the checklist corresponding to task flows. First, an investigation was conducted to construct the checklist. This investigation was aimed at constructing the checklist items in each flow design pattern. Second, an experiment was conducted to examine the effect of the method. Differences in evaluation among usability evaluators were examined in the checklist.

3 AN INVESTIGATION TO CONSTRUCT THE CHECKLIST

3.1 Methods

In this investigation, the checklist items were examined from tasks of products applied to each flow design pattern. Five tasks were selected per pattern and 65 tasks were used in 13 patterns. A part of the selected tasks and products in each pattern appears in Table 2. The user-interfaces of systems to operate the information which have the touch display, the operation buttons, or some input devices were evaluated.

Then, items to be considered in user-interface design were grasped in each task using 3-point task analysis (Yamaoka et al., 2002) and the UI design items in SIDE: Structured user-Interface Design and Evaluation (Yamaoka et al., 2000). The 3-point task analysis was used to examine the tasks in each pattern. The UI design items in SIDE were used as the items. SIDE is a UI design and evaluation method. UI design items in SIDE consist of 32 items in terms of human information processing. These items are used for evaluation. In this investigation, UI design items in SIDE were used because UI design items consist from the same points as the 3-point task analysis. Therefore, UI design items were applied to the format of the 3-point task analysis. In this way, the items to be considered in user-interface design were grasped in each task.

Next, the items found in five tasks per pattern were summarized as the items in each flow design pattern. Finally, the checklist items in each pattern were made based on the summarized items or characters mentioned in the flow design patterns. The procedure of this investigation appears in Figure 3.

Table 2. An example of selected tasks and products (Pattern 1, Pattern 2, Pattern 3, and Pattern 4)

No.	Flow design patterns	Case	Product type	Tasks
1	Procedure with parameter adjustment	ATM of Bank of Kiyo	ATM	Withdraw deposit
2	Procedure with parameter adjustment	loppi	Ticketing device	Receive goods from Amazon
3	Procedure with parameter adjustment	Information terminal of Wakayama University	Information terminal	View the map of Wakayama Univ.
4	Procedure with parameter adjustment	IS03	Smartphone	Call on the phone
5	Procedure with parameter adjustment	it's	Rice cooker	Cook rice by subscription
6	1 step execution of a task by function selection	CanoScanLiDE90	Scanner	Copy a document
7	1 step execution of a task by function selection	FinePix Z10fd	Digital camera	Do the shooting
8	1 step execution of a task by function selection	IS03	Smartphone	On/Off control of GPS
9	1 step execution of a task by function selection	ThinkPadT420	Laptop PC	Mute volume
10	1 step execution of a task by function selection	IC RECODER	Voice recorder	Record sounds
11	2 step execution of a task by function selection and parameter adjustment	FinePix Z10fd	Digital camera	Change the shooting mode
12	2 step execution of a task by function selection and parameter adjustment	CD player of Tower Record	CD player	Play music
13	2 step execution of a task by function selection and parameter adjustment	wave captor	Alarm clock	Set an alarm time
14	2 step execution of a task by function selection and parameter adjustment	National	Air conditioner	Put on a heater
15	2 step execution of a task by function selection and parameter adjustment	NF032JD	TV remote control	Watch a program
16	Parameter adjustment during operation	National	Air conditioner	Change the temperature setting
17	Parameter adjustment during operation	NF032JD	TV remote control	Change the volume
18	Parameter adjustment during operation	IS03	Smartphone	Change to manner mode
19	Parameter adjustment during operation	iPod nano	Portable music player	Change the volume
20	Parameter adjustment during operation	FinePix Z10fd	Digital camera	Zoom in

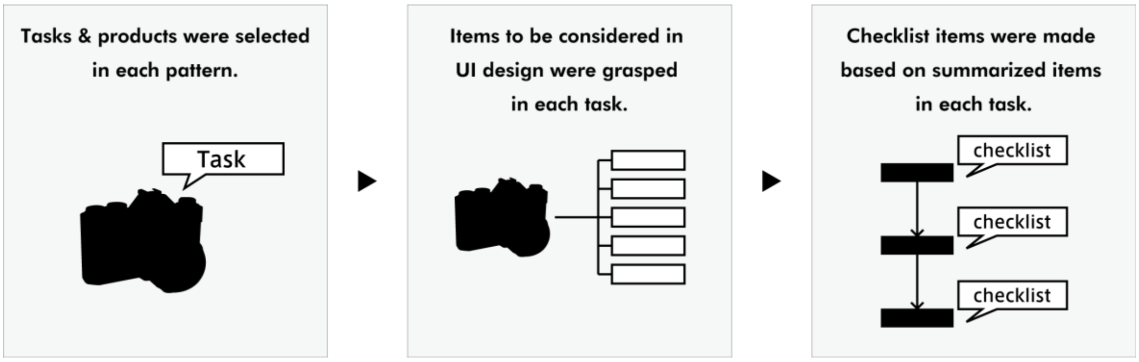

Figure 3. The procedure of this investigation

3.2 Results

The items to be considered in user-interface design were grasped in the 65 tasks. UI design items were grasped along with the format of 3-point task analysis. As an example of this investigation, one of the results appears in Figure 4.

Then, items found in five tasks per pattern were summarized as items in 13 flow design patterns. As an example, the items in Pattern 1 appear in Figure 5.

Task: Cook rice by subscription

Sub-tasks	Effective information acquisition	Ease of understanding and judgment	Comfortable operation
Select the subscription button	Clues	Appropriate vocabulary	Operational feeling
	Mapping		Appropriate feed back
	Discrimination		
	Emphasis		
Set the time	Clues	User’s mental model	Operational feeling
	Mapping	Appropriate vocabulary	Appropriate feed back
	Discrimination		Operation efficiency
	User’s mental model		
Select the cooking start button	Clues	Appropriate vocabulary	Operational feeling
	Mapping		Appropriate feed back
	Discrimination		
	Emphasis		

Figure 4. Results of this investigation in Pattern 1 (rice cooker)

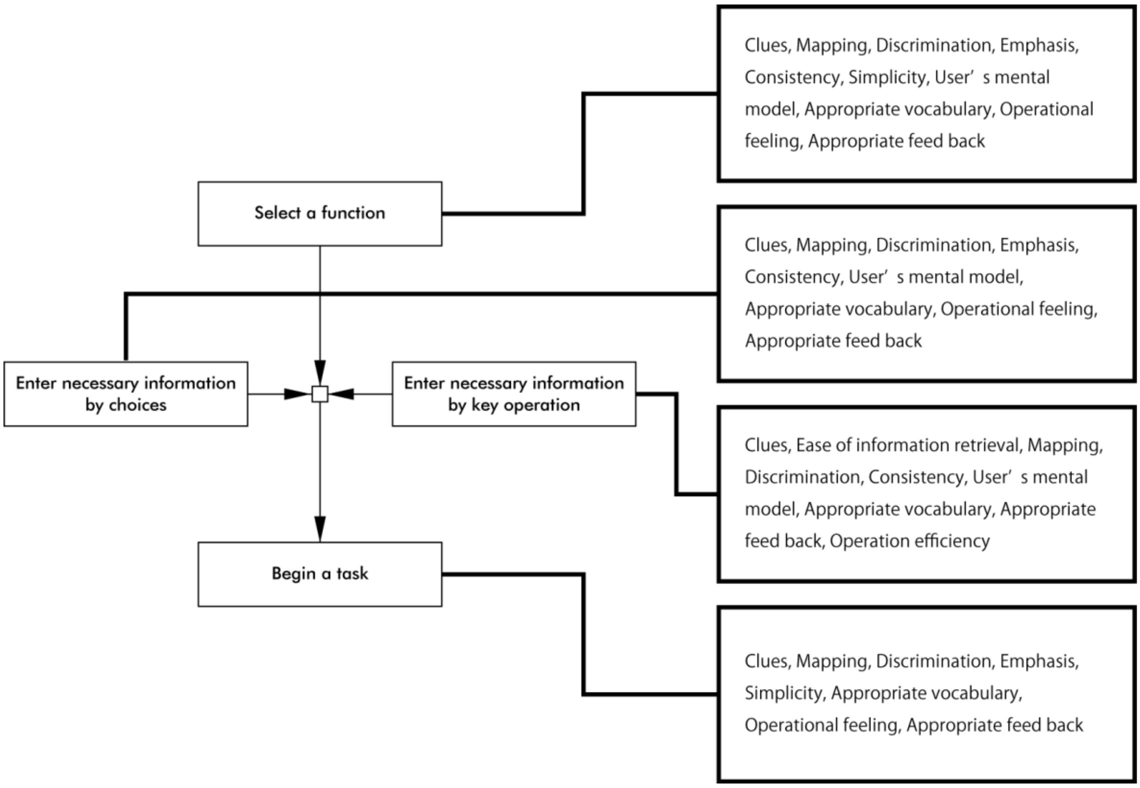

Figure 5. The summarized items in Pattern 1

4.3 Constructed Checklists

The checklist items were made for each flow design pattern. The checklists consisted of items examining the entirety of a task and items examining each sub-task in a task. A part of the items in each pattern are as follows:

The checklist in Pattern 1

Items examining the entirety of a task

- Are there any clues for supposing the following operation?
- Can users easily understand the vocabulary or the icons?
- Are there any friendly and smooth forms of feedback for the operation?
- Can users easily suppose the operation method?

- Can users understand immediately the relationship among UI parts?
- Are the layouts of operation panels or screens standardized?
- Is there consistency in the operation method?

Items examining each sub-task in a task

Select the function

- Can users easily understand where the choices are?
- Is the operation panel or screen simple?
- Can users easily grasp the entirety of the selecting functions?

Enter necessary information by choice

- Can users easily understand where the choices are?
- Can users easily grasp an entirety of the choices?

Enter necessary information by key operation

- Can users operate UI with few and efficient operation procedures?
- Can users easily understand the operation portion?
- Can users easily grasp the entirety of the operation portion?

Begin a task

- Can users easily understand the operation portion?

5 AN EXPERIMENT TO EXAMINE DIFFERENCES AMONG USABILITY EVALUATORS

5.1 Methods

Differences in the checklist ratings were examined. In this experiment, evaluations using a part of the proposed checklists were conducted by participants. Then, the degree of coincidence and the disposition of the ratings were examined among the participants. A kappa coefficient was calculated to examine the degree of coincidence. Fisher's exact test was conducted to examine the disposition of the ratings between participants in the checklist items.

In this experiments, two random checklists were used as investigation objects. The selected tasks and checklists appear in Table 3. Participants evaluated the two tasks using the checklists corresponding to the tasks. There were six participants. The participants were students majoring in usability or design (Average age = 24, SD = 0.63). We assumed that the participants are equivalent to the evaluators who will use the checklist.

Table 3. Selected tasks and checklists

Products	Tasks	Checklists
Smartphone	View incoming mails	The checklist in pattern 10
Digital camera	Change the volume setting regarding the operation	The checklist in pattern 11

5.2 Results

Kappa coefficients among six participants were calculated for two checklists to examine the degree of coincidence of results among evaluators. The kappa coefficients appear in Table 4. As a result, moderate or strong and significant coefficients were seen in the two checklists.

In addition, kappa coefficients in task level and sub-task level items were calculated for each checklist. The kappa coefficients appear in Table 5. As a result, moderate or strong and significant coefficients were seen in each item. Especially, the kappa coefficients in the sub-task level items were stronger than the coefficients in task level items in the two tasks.

5.3 Discussion

Moderate or strong kappa coefficients were seen in the two checklists. This result shows that the degree of coincidence in the two checklists was high. Therefore, we think that the checklist corresponding to task flows is effective for decreasing differences in evaluation among evaluators. Moreover, the kappa coefficients in sub-task level items were stronger than the coefficients in task level items. In other words, the degree of coincidence was high in narrower evaluation scopes of the sub-task level than that in the scopes of the task level. We think the results shows that the checklist is not difficult to define the rating for any evaluators because we can obtain similar result among difference evaluators.

Table 4. Kappa coefficients in two checklists

	The checklist in pattern 10	The checklist in pattern 11
Kappa	.585	.652

Table 5. Kappa coefficients in task and sub-task levels

	The checklist in pattern 10	The checklist in pattern 11
Task level	.557	.608
Sub-task level	.631	.701

We had confirmed the usability evaluation result of the evaluated systems in this experiment by the 2 specialists. Then, the results were similar. So, we think this experiment could focus the rating among the difference evaluators. However, we think the result doesn't show that some evaluators have same rating by this checklist. We can accept the evaluators obtain different result by this checklist. This could be a good starting point for a reflective discussion regarding the usability of the systems they are designing.

6 CONCLUSION

In this study, a usability checklist corresponding to task flows was proposed as a means of solving current problems. In this method, a checklist in each flow design pattern was provided. Checklist items corresponding to 13 types of flow design patterns were created based on an investigation of products or systems. Then, differences in evaluation among usability evaluators were examined for this checklist to improve accuracy by narrowing evaluation scopes with ratings on task/subtask levels. As a result, the effectiveness of this approach for decreasing differences was shown. For that reason, we think that the proposed checklist method is effective for decreasing differences among evaluators. Additionally, this checklist method can be used for the evaluation of various products based on task flows upstream in design development.

This is a versatile and easily quantified usability method using a checklist upstream. It is assumed that method will be used along with flow design patterns in an iterative design process such as an HCD process. We think that the results of this checklist are easy to use for redesigning. Additionally, it is assumed that the checklist will be used by usability practitioners and product developers who don't have much experience in usability evaluation, just like current checklist methods.

Besides, proposed checklist items are formulated as "Can users …?". If the designers and usability evaluators want to know what the users can or cannot do, the designers have to ask the users. Their perception of what users can or cannot do could be wrong, which results in an invalid evaluation.

This method is used in an HCD process as shown in the following Figure 6. Prototypes or mock-ups upstream are evaluated just like they are in other inspection methods to find usability problems. Then, the rating results and problematic items are fed back by this checklist and used to grasp the degree of usability, identify problematic places, improve prototypes, and compare products before-and-after.

We assume that the method in this study will contribute to HCD-based design development by manufacturers. An iterative design process in HCD can be smoothly conducted by this easy usability evaluation. Specifically, this checklist is assumed to contribute due to the following advantages.

- There are few differences in evaluation results among evaluators.
- The checklist can correspond to various products.
- The checklist can be used in the design development phase without a testable and a high-quality finished product.
- The checklist can evaluate usability including the previous or next operation flow.

Hereafter, the feasibility and effectiveness of this checklist must be examined in actual design development by manufacturers.

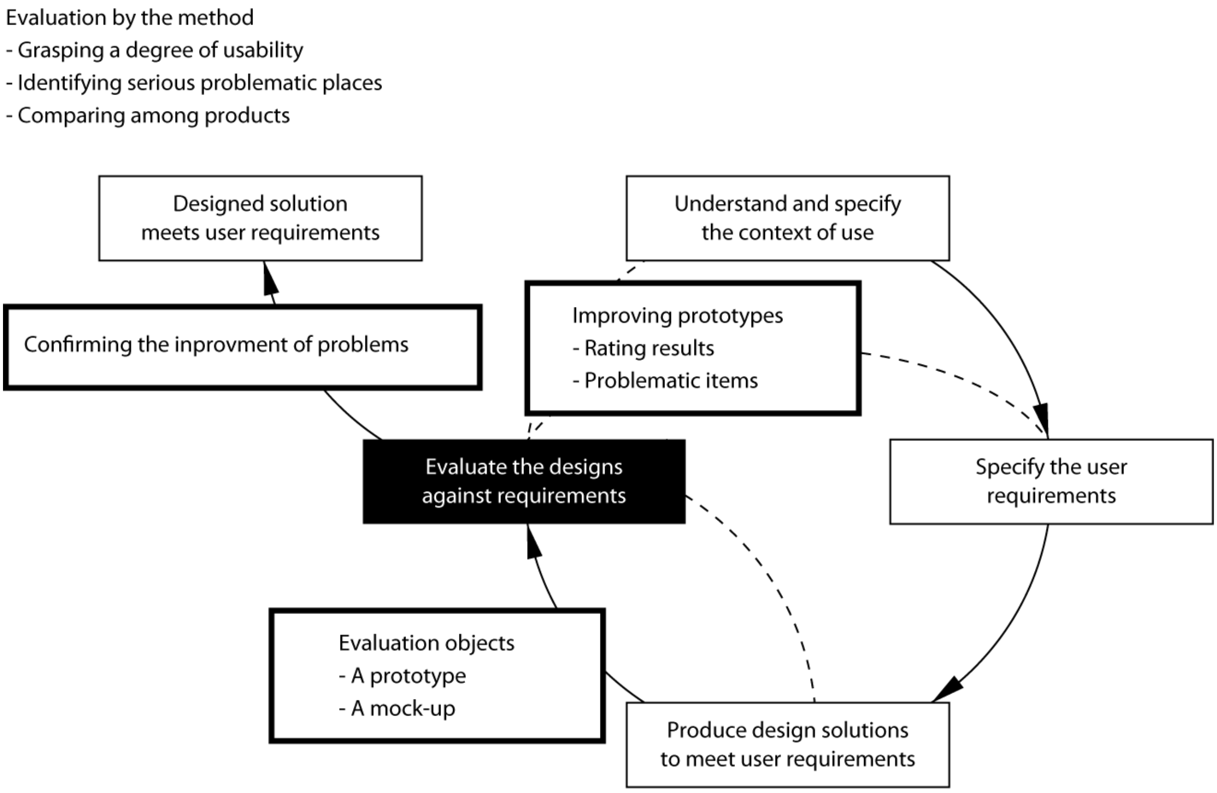

Figure 6 . The position of the proposed method in an iterative design process

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