The Layout for the User-Friendly Manual: Case Study on an Internet Set-Up Manual

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Abstract. We propose two design concepts for the user-friendly manual and compare them in an experiment. The first concept, which focuses on user comprehension, is to use one picture of the completed wiring. The second concept is to uses a series of steps from left to right with the goal of making the user follow the order. Trials show that participants presented with material based on the first concept tend to follow their own mental-model rather than the manual. Material based on the second concept also failed to make users follow the order. Some implications for the refinement of manual design are derived based on the results.

Keywords: Usability, manuals, documentation, technical communication.

1 Introduction

Developing an effective design concept for the user-friendly manual is crucial given the extremely large, are growing, number of home appliances. Consumers are well known to seldom read or follow the instructions in the manner intended by the designer, resulting in a lot of frustration [1],[2].

While software configuration can be automated, users still have to manually perform the wiring task. As the home-network is now entering the home, the action of wiring the devices has become more complicated, and the importance of developing user-friendly manuals for the wiring task is increasing. Service providers often provide a one-sheet manual that places all crucial information on a single piece of paper to moderate the users' resistance to reading. Our challenge is to construct a method for designing user-friendly lucid one-sheet-paper manuals for the reluctant user.

In this paper, we propose two design concepts for wiring manuals. The concepts and details of the experiment are described in the following section. Results are then introduced and discussed.

2 Design Concepts

As the test case, this paper, considers the replacement of a home router; its connection diagram is shown in Fig.1. The user is expected to replace the old router, which has

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failed, with the new router. The procedures for unplugging and reconnection are shown in Fig.2.

Many of the wiring tasks of recent home appliances contain steps that must be done in a sequence. In the test case, the user must "(5) Take off the stand" before "(6) Opening the lid" to "(7) Unplug the optical fiber". Step "(11) Plug the optical fiber in" cannot be done before step "(9) Take the cap off the connector".

We devised two design concepts: "Duplicate Layout (DL)" and "Ordered Layout (OL)". The concept of the DL is to make users understand the overall wiring layout.

Unplugging Procedure	Plugging Procedure
(1) Unplug power cord from the wall	(8) Open the lid of the new router
(2) Unplug optical fiber from the wall	(9) Take the cap off the connector
(3) Unplug LAN cable from the old router	(10) Move the part
(4) Unplug telephone line from the old router	(11) Plug the optical fiber
(5) Take off the stand of the old router	(12) Close the lid of the new router
(6) Open the lid from the old router	(13) Plug the optical fiber into the wall
(7) Unplug the optical fiber	(14) Plug the lan cable into the new router
	(15) Plug the telephone line into the new router
	(16) Plug the power cord into the new router
	(17) Plug the power cord to the wall

Fig. 1. This shows the procedures for replacing a broken router. (1)-(7) is the procedure for unplugging the cables from the old router and (8)-(15) is for plugging the cables into the new router.

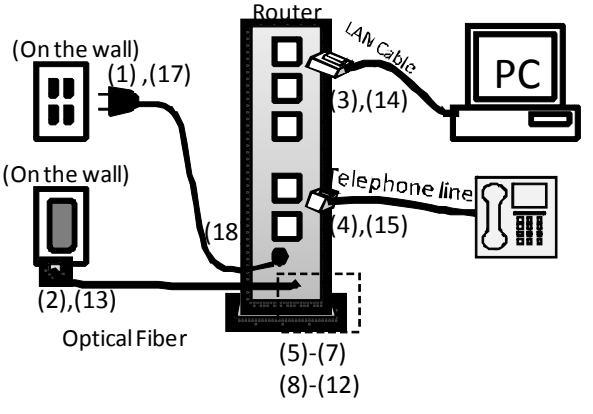

Fig. 2. This shows the wiring diagram. (1)-(15) that corresponds to the unplugging and unplugging procedures which is described in Fig.1.

Pictures of two devices that should be connected or disconnected should be placed next to each other so that the users can easily understand what devices should be connected or disconnected. The OL, on the other hand, places the procedures in order to encourage the users to follow the order.

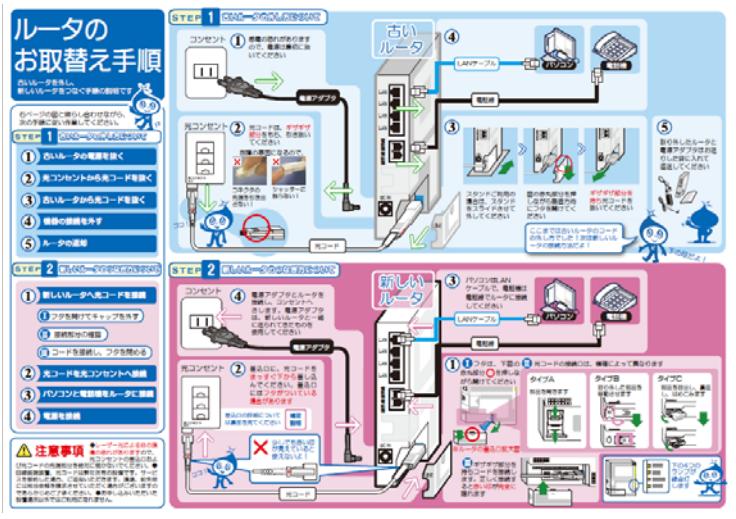

Fig. 3. Duplicate Layout manual (DL). The spatial locations of the upper components are copied by the lower components.

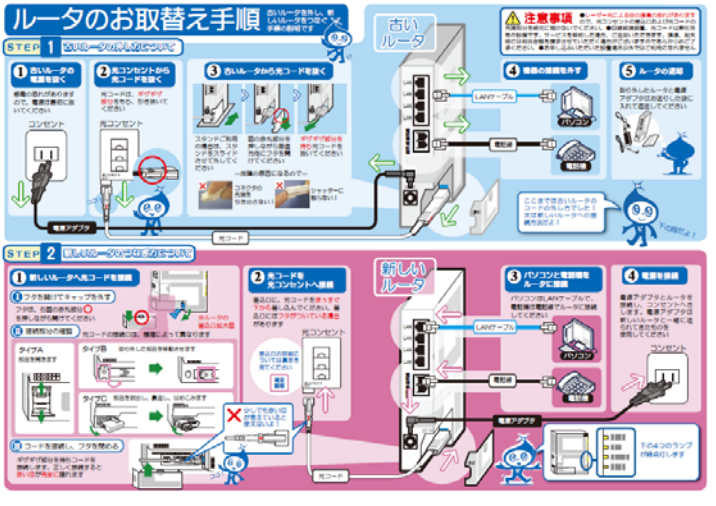

Fig. 4. Ordered Layout manual (OL) where both unplugging and reconnection actions run from left to right. However, the lower pane reverses the spatial locations of components.

We used these design concepts to design the two manuals shown in Fig. 3 and 4. The upper pane explains the unplugging steps and the lower pane the reconnection steps. For example, the power connector occupies the top left corner in both manuals. In the DL (Fig.3), the pictures of the outlet on the wall, PC, and the telephone are placed next to the router. The DL also copies the spatial locations of the components so that user can understand the overall wiring layout. However, reconnection actions

run from right to left. OL (Fig.4) reverses the spatial locations of components, and the picture of the outlet is not placed next to the picture of the router, but both unplugging and reconnection actions run from left to right.

3 Experiment

3.1 Method

To find out how users actually execute the procedures after being provided with these two manuals, we conducted an experiment. We hired 15 novice Internet users (30-50 years old) and divided them into two groups, DL (7 subjects who used the Duplicate Layout manual) and OL (8 subjects who used the Ordered Layout manual. Each subject was told to replace the broken router.

3.2 Results

(1) Success rate
85.7% (6 out of 7) of DL subjects, and 87.5% (7 out of 8) of OL subjects succeeded in replacing the device without anybody's help, and there were no significant differences between the two groups.

(2) Order of the action
Average number of times that users went back one or more steps is shown in Table 1(a). If the user performed step(2) and then step(1), for example, the number was incremented. DL subjects demonstrated more step reverses than OL subjects, but the difference was not significant ($p>0.05$).

Average number of times they switched between unplugging and reconnection actions is shown in Table1(b). If the users performed all the procedures in order, the number was counted as "1"; reconnection follows unplugging. The DL subject with the highest switch number first unplugged the LAN cable from the old router, and then plugged it into the new router, and then unplugged the telephone line from the old router, and plugged it into the new router. Overall, DL subjects tended to move between the old/new router more often than OL subjects.

Table 1. Number of the times the participants reversed a step and switched between unplugging and reconnection actions

Heading level	Condition	Average	Min	Max
(a)Number of times they reversed a step	DL	4.57(SD=2.22)	1	8
	OL	3.25(SD=1.28)	1	5
(b)Number of times they switched between unplugging and reconnection actions	DL	5.57(SD=3.95)	1	12
	OL	2.86(SD=1.84)	1	5

(3) Order of the action in "strictly ordered procedures"
The test case included two strictly ordered procedures. First, step "(7) Unplug the optical fiber" cannot be done unless step "(5) Take off the stand of the old router", and step "(6) Open the lid of the old router" have been performed. Second, step "(11) Plug the optical fiber in" cannot be done before step "(9) Take the cap off the connector".

Most DL participants didn't follow the order required; 3 out of 8 participants didn't order steps (6) and (7) correctly, and 4 out of 8 misordered steps (9) and (11). OL participants were guilty of the same errors; 2 out of 7 participants misordered steps (6) and(7) and 6 participants misordered steps (9) and (11). These participants wasted time and energy in order to get the order right.

4 Discussion

With reference to the results in Table1(b), the DL switched frequently between the old router and the new router; unplug this and immediately reconnect it to the new device. It is known that constructing appropriate mental model leads users to execute the procedures faster by simplifying inefficient procedures [3][4]. So we assume that participants who used DL constructed their mental-model and relied on it rather than following the procedures written in the manual. If the procedures are not required to be followed in order, this DL approach is efficient for the faster execution and the flexible error recovery.

However, if the order is strictly defined, the user may encounter some trouble. DL participants actually didn't follow the strictly ordered procedures (steps (6),(7) and steps (9), (11)), which led to extra effort to go over the procedure again.

One-page manuals should, therefore, be designed to clearly indicate step sequencing requirements. If the order is inflexible, the manual layout should focus the user on one step at a time. Otherwise, layouts that enhance the user's understanding of the whole picture are suitable [4].

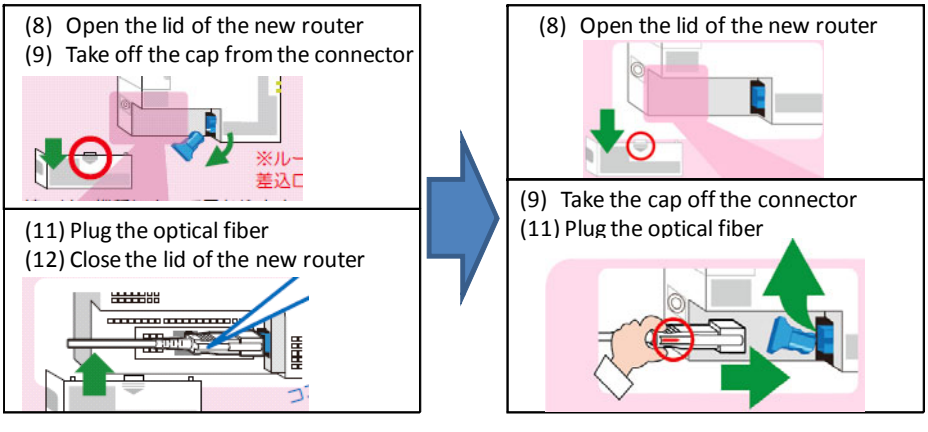

Fig. 5. Left side pane shows part of the original manual: steps (8)-(11) (steps (8) and (9) are shown in one picture). Right side pane shows the refined version: steps (9) and (11) are combined.

While the design concept of the OL was intended to enforce the step order, it was not really effective in doing so as shown in Table1(a). Our solution is to elaborate the design in two ways. First is to eliminate redundant explanations (e.g. title of each step, names of each cable) so as to emphasize the order information (step number). The second idea is to change the way of grouping the pictures to emphasize the inflexible step sequences. Fig.5 shows an example of a refined manual for steps (9)-(11). The left pane shows the manual used in the experiment; steps (8) and (9) were combined in one picture and step(11) was presented separately. However, combining steps (9) and (11), in the right pane, is expected to ensure that the user follows the order.

We assume that this enhanced design will improve the efficiency of users' actions. We intend to validate the effectiveness of these design refinements.

5 Conclusion

We have described two design concepts to develop the user-friendly manual. By comparing two design layouts, the DL which focuses on helping the user to understand the overall wiring arrangement, tends to let the user follow his/her own mental-model rather than the manual. Past research suggests that if the order of steps is flexible, the manual layout that enhances the user's understanding of the overall arrangement is most suitable. On the other hand, if step order is inflexible, the manual layout should focus the user on performing one step at a time in the correct order.

Because the original OL was not as effective as hoped, we proposed two enhancements and intend to confirm their efficiency in subsequent research.

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