Design and Evaluation of a Medication Application for People with Parkinson's Disease

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Abstract. Smartphones may allow disease self-management, which is relevant for people with Parkinson's Disease (PD) in need of frequent medication adjustments. Yet, there is little data on the interaction of people with PD with smartphones. We describe the processes of the design and usability evaluation of a smartphone medication application for PD. Results show that participants with PD were generally able to successfully interact with the tailored user interfaces (UI), and grasp navigation and organization principles designed into the application. The paper lists issues for UI improvement and further testing.

Keywords: Smartphone, Usability tests, Parkinson's disease, Gestures.

1 Introduction

Parkinson's Disease (PD) requires frequent medication adjustments, for which medication intake tracking may be useful. Smartphones offer a possibility to act as a mobile medication reminder and manager; however, it is possible that motor and non-motor symptoms of PD [1] affect the way in which people with PD interact with a smartphone. There are reports of solutions targeting people with PD [2] and medication management [3]. However, usability tests with such smartphone applications have not, to our knowledge, been reported in the literature.

This paper briefly presents the process and choices in the design of a medication application specifically tailored to PD—which is part of a larger personal health system for PD management, REMPARK[1]—followed by the results on usability tests with people with PD.

[1] http://rempark.cetpd.upc.edu/

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2 Design and Evaluation

The medication application offers 4 main functionalities through its main menu: Medication list, Intake schedule, Missed intakes and Intake history (Fig. 1). The design options were structured after existing guidelines for older adults, specific PD studies, and user requirements that were gathered in different iterations: interviews with medical doctors, interviews with people with PD and focus groups composed of people with PD and their informal caregivers who provided input on the use cases, layouts, navigation or graphic elements. The application allows adding reminders to the intake hours and to record medication intake, postpone it or to skip it. PD-related medication is fed through the REMPARK server, therefore saving the user from having to input all the data (minimizing effort and chance for error), but users may also add extra medication. A set of patterns was designed, with dimensions previously optimized for PD, combining guidelines for displays for older adults [4] (as PD is more prevalent amongst seniors) and insights from primary and secondary users. These patterns were used throughout the entire application in different combinations, so as to ease the learning curve. Even though literature suggests in breath navigation [5], a trade-off was made when it came to text edit/input: these actions have their own screen so as to avoid confusing the users with keyboard animations and focus users' attention on the task at hand. When navigating in-depth, the user can always rely on the back button which shows on every screen at the same place and which also acts to prevent error when users tap the back button in the course of an unfinished task.

Fig. 1. Medication application sample screens

Usability tests were designed to assess ease of touch interaction, accuracy, and navigation. These were not meant to test the entire application's mechanics, as this is but one of many applications on the REMPARK project. Furthermore, the use of identical patterns throughout the applications eliminates the need to test everything in each application. The usability tests sessions were conducted at Teknon Parkinson's Unit, from where participants were recruited. Participants were brought to a quiet room, apart from distracting stimuli, and tests were led by one researcher. The sample was composed of 12 participants, 7 male and 5 female, with ages ranging from 48 to 80 (average: 71.2, SD 9.3). The exclusion criterion was the presence of dementia.

All participants signed an informed consent prior to test onset. The medication application was running on Android in a Samsung Galaxy Nexus with a 4.65'' AMOLED display. Tests were recorded in video. Tactile interaction with the touch screen was also recorded for later analysis.

Errors in tasks were considered to be low, generally recoverable and non-severe. Task performance, as shown in Table 1, was high across tasks.

Table 1. Task performance, number of errors and time (E=Errors; TP=Task Performance)

	Interact with medication reminder (2 sub-tasks)		Check medication schedule (2 sub-tasks)		Check & edit medication details (6 sub-tasks)		Check missed intakes (1 sub-tasks)	
Participant	E	TP	E	TP	E	TP	E	TP
1	0	Yes	0	Yes	1	Yes	0	Yes
2	1	Yes	1	Yes	3	No	2	No
3	0	Yes	1	Yes	1	Yes	0	Yes
4	1	No	2	Yes	3	Yes	2	No
6	-	-	0	Yes	0	Yes	1	Yes
7	-	-	1	Yes	1	Yes	0	Yes
8	0	Yes	1	Yes	2	Yes	0	Yes
9	1	Yes	0	Yes	0	Yes	0	Yes
10	-	-	1	Yes	2	Yes	1	Yes
11	0	Yes	0	Yes	1	Yes	0	Yes
12	0	Yes	0	Yes	1	Yes	0	Yes

Despite large tapping areas for all buttons (the wide buttons were 10.5cm high and the square shaped buttons had 14.0cm sides) some participants with less than good accuracy still had problems tapping them. Either in menu or list buttons, participants generally aimed at the icon, which may induce errors if icons are placed too close to button borders. We observed some particularities regarding taps on the user interface (UI) back button: participants generally tapped to the right side of the button and the interaction was often not a tap, but a swipe gesture from right to left (Fig. 2).

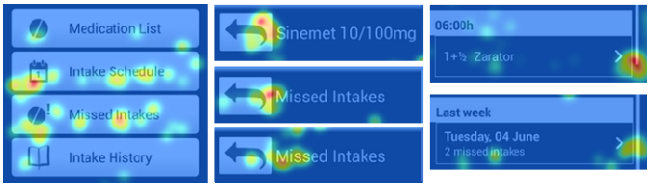

Fig. 2. Tactile interaction with menu (left), back button (middle) and list elements (right)

The back button concept was already known to the majority of participants: 66% had a smartphone and most of the times used the native back button. Nevertheless, the

remaining also quickly grasped the concept and quickly learned how to use it, either by themselves or after a hint from the facilitator. Participants were also generally able to: 1) use a navigation widget with arrows to go back and forth on consecutive days (Fig. 1d); 2) understand and use pickers to change hours (Fig. 1c); 3) read and understand the list of intakes (Fig. 1d) and missed intakes; 4) find and navigate through medication schedules (Fig. 1b); 5) understand how to edit a medication/intake; and 6) understand and interact with a medication reminder pop-up (Fig. 1e). In the last item some participants were not very accurate in tapping the checkboxes, nor did some understand that they were required to tap "Taken" for confirmation (as soon as one checkbox is ticked, the label on the button changes from "All taken" to "Taken").

3 Discussion and Conclusion

Users were able to make sense out of the structure and content, understand groups and categories and understand how to edit. One challenge was the tap interaction with buttons: in future iterations, icons should be displaced farther away from the edge of the clickable area. Despite interaction issues, the success rates of task accomplishment and the reduced number of errors suggest a general positive assessment, and that the elements' dimension seems appropriate for the interaction of PwP with smartphone UIs. Even though 66% of participants owned a smartphone, none used a medication management application. There were two participants who used sound alarms to remember to take medication, but which did not do any digital tracking of medication intake. Even with this low familiarity with medication management applications, users were able to grasp the main concepts and the errors being recorded were not considered to be severe or blocking task performance, thus suggesting that people with PD would indeed be generally able to use this medication application.

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