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ORIGINAL RESEARCH

Measure It Super Simple (MISS) activity tracker: (re)design of a user-friendly interface and evaluation of experiences in daily life

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ABSTRACT

Purpose: The purposes of this study were, first, to (re)design the user-interface of the activity tracker known as the MOX with the help of input from elderly individuals living independently and, second, to assess the use of and experiences with the adapted Measure It Super Simple (MISS) activity tracker in daily life.

Methods: The double diamond method, which was used to (re)design the user-interface, consists of four phases: discover, define, develop, and deliver. As a departure point, this study used a list of general design requirements that facilitate the development of technology for the elderly. Usage and experiences were assessed through interviews after elderly individuals had used the activity tracker for 2 weeks.

Results: In co-creation with thirty-five elderly individuals (65 to 89-years-old) the design, feedback system, and application were further developed into a user-friendly interface: the Measure It Super Simple (MISS) activity. Twenty-eight elderly individuals (65 to 78-years-old) reported that they found the MISS activity easy to use, needed limited help when setting the tracker up, and required limited assistance when using it during their daily lives.

Conclusions: This study offers a generic structured methodology and a list of design requirements to adapt the interface of an existing activity tracker consistent with the skills and needs of the elderly. The MISS activity seemed to be successfully (re)designed, like the elderly who participated in this pilot study reported that anyone should be able to use it.

➤ IMPLICATIONS FOR REHABILITATION

- This study provides an overview of important characteristics of the activity tracker interface for elderly individuals that can be used when choosing an appropriate activity tracker.
- This study can serve as a model that demonstrates how to adapt other eHealth and mHealth tools to improve the user-centred design.
- The MISS activity seems to be an elderly-friendly activity tracker that can facilitate a meaningful experience.

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Wearable; elderly; interface; experiences; user-centred

Introduction

Smart health has become increasingly popular in recent years as a method of monitoring physical activity, as well as health- and lifestyle-related variables [1]. The term smart health refers to mobile applications (apps), wearables, and smartwatches [1]. Although activity trackers are mainly used by a young and physically fit population, the elderly could also benefit from the use of an activity tracker. In the Netherlands, 53% of elderly individuals (65+) do not meet the Dutch physical activity guideline [2,3] even though there is ample evidence that sufficient physical activity can prevent several chronic diseases, reduce the risk of premature death, and decrease the risk of fractures and falls in the elderly [4,5]. Barriers that inhibit elderly individuals' physical activity noted in the literature include a lack of motivation and self-discipline, the assumption that they are already sufficiently active, limited knowledge about the positive effects of physical activity, and a lack of habits [6,7]. Studies show that incorporating the use of an activity tracker into one's healthcare can motivate elderly individuals to become more physically active. The primary explanations for this phenomenon are that trackers provide insight into an elderly individual's amount of physical activity and increase their awareness of their physical activity [8–13].

The user-friendliness of an activity tracker is an important feature to start and continue using an activity tracker. Several studies concluded that the elderly do not achieve a meaningful user-experience with existing activity trackers because there is a disparity between tracker features and the skills and needs of the

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elderly [10–16]. Frequently mentioned problems include an imbalance between technical skills and the perceived complexity of the activity tracker, the lack of a clear manual, complex interpretation of feedback, excessively high standards for daily activity goals (e.g., 10,000 steps), and reduced wearing comfort [10–16].

Consequently, there is a need for an activity tracker that meets the needs and skills of the elderly. In this study, we wanted to examine whether the user-interface of an existing activity tracker could be adapted in order to facilitate a (more) meaningful experience for the elderly. An example of an activity tracker whose user-interface can be adapted is the MOX Activity Monitor (MOX [17], Box 1).

Box 1. About "MOX Activity Monitor"

- The MOX Activity Monitor contains a tri-axial accelerometer.
- The algorithm of the MOX was recently optimized and the algorithm settings were validated in an elderly population.
- The system can measure and transfer physical activity parameters continuously every second for 14 days.
- Dust & Waterproof IPX8
- CE-certified
- Wireless communication Bluetooth LE
- Battery lifetime 14 days

Since the algorithm settings of the MOX (including the optimized parameter settings of $MOX_{MissActivity}$) have been validated for an elderly population [18], we wanted to examine whether the user-interface of the MOX could be adapted for this target group as well. In this article, the user-interface refers to (1) the design of the tracker's hardware, (2) the feedback system and display of the activity tracker, and (3) the feedback provided by a mobile application.

Based on the recent research of Ummels et al. [10] regarding the experiences of the elderly with eight different activity trackers, 53 important characteristics to create a meaningful user-interface were determined (Appendix 1). For instance, three important characteristics from this list include the wearing location, outcome parameters, and feedback options. Thus, findings from Ummels et al. that have been broadly supported by the literature [11–13,15,19–32] were used as a departure point for the design of the user-interface.

In order to facilitate meaningful user experience and to assess the usage and experiences of the elderly with the activity tracker, this study was conducted with the following objectives:

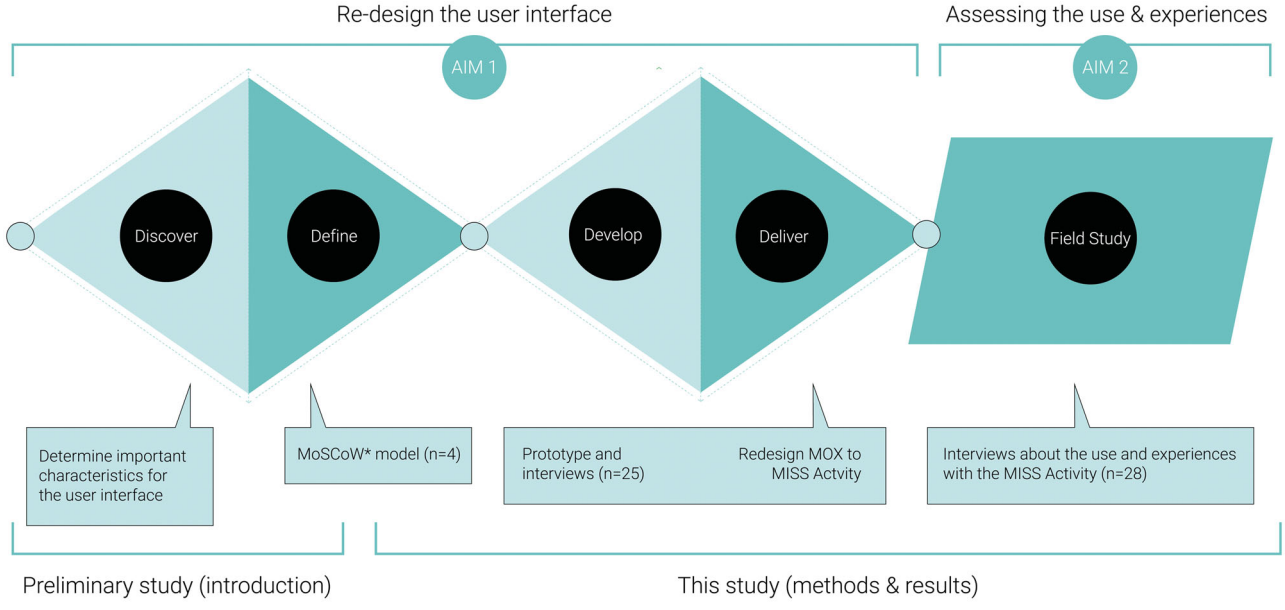
1. to (re)design a user-friendly interface of the MOX, meeting the requirements of the elderly by using the double diamond method.
2. to assess the elderly's use and experiences of the adapted activity tracker in daily life.

Methods

This study consists of two methods that aim to answer the two aforementioned research questions (Figure 1) and were approved by a local ethics board (METC-Z Medical Ethical Committee, METCZ20180012).

Regarding the (re)design of the user-interface, the double diamond method [33] was used. The double diamond method consists of four phases: the discovery, definition, development, and delivery phase. The discovery phase was completed in a preliminary phase (Appendix 1) and served as a departure point for the remaining three phases, which are outlined below.

To assess the use of and experiences with the adapted activity tracker, a sample of elderly individuals using the activity tracker for a period of 2 weeks. Afterward, all participants were interviewed.



** MoSCoW stands for "Must Have, Should Have, Could have and Would have"*

Figure 1. Schematic overview of the two designs used in this study.

(Re)design of the user-interface

Definition phase

To prioritize the 53 characteristics outlined in the discovery phase, the MoSCoW model was used [34]. Four experts in wearables (a professor in the field of smart devices, a physiotherapist, an advisor from the knowledge centre for sports and physical activity, and a clinical operator of a human kinetics lab) were asked to prioritize these characteristics, based on technical complexity and market distinctiveness. When at least two experts rated a characteristic as a "should have" the characteristic was labelled critical.

Development and delivery phase

Based on the definition phase, three key aspects of the activity tracker were included: (1) the design of the activity tracker, (2) the way the activity tracker provides feedback, and (3) an app that provides additional feedback. Consequently, each aspect was designed in co-design, described in a user manual, and tested with the elderly.

Participants

Participants were recruited via several local associations, such as sports clubs and social initiatives for the elderly. Participants were eligible if they were 65-years-old or older and possessed a sufficient understanding of the Dutch language. The following demographic characteristics of the participants were noted: gender, age, knowledge of technology (between 0 and 10), and use of a computer, tablet, smartphone, and activity tracker (Yes/No). All participants provided written informed consent after receiving verbal and written information about the research.

Design of the activity tracker

Three participants were interviewed about their preferences regarding the design of the activity tracker. They were provided with six distinct activity tracker shapes and clips. They were then asked to arrange their preferences for these shapes and clips. Participants were asked to explain why they chose this sequence. The interviews were audio-taped and summarised, and pictures were taken of the final sequences. Finally, based on the interviews, a clip and shape were designed.

Feedback system on the activity tracker

Twelve participants (two focus groups) were interviewed about feedback concepts for battery life, progress to goal, and synchronization status (Figure 2). Furthermore, they were asked about their opinion on how they would like to activate the feedback on the activity tracker (e.g., tapping or shaking). These interviews were audio-taped and summarised. Based on the results, the feedback system on the activity tracker was adapted and implemented.

Additional feedback by an application

Twenty participants were asked to perform several tasks on a designed mock-up app. The performance was documented by a researcher (DU). Afterward, the participants were asked about the user-experience. The first 10 participants were also provided with three alternative designs (Figure 3), from which they could select their preference. After 10 interviews, the app was adjusted based on the feedback of these first ten participants. Based on the last 10 interviews, the app was adapted to its final version.

Evaluating use and experiences in daily life

The adapted user-interface was integrated into the MOX. Together with the developed algorithm [18], the activity tracker is called the Measure It Super Simple (MISS) activity tracker [35]. To evaluate if the Measure It Super Simple (MISS) activity was indeed successfully (re)designed, thirty participants used the MISS activity for 2 weeks. During this time, two personal visits and two check-up calls were organized (Figure 4).

To evaluate the success of the (re)designed MISS activity, thirty participants were asked to use the MISS activity for 2 weeks. During this period, two personal visits and two check-up calls were organized (Figure 4).

Participants

Participants were recruited through convenient sampling via several local associations, such as sports clubs or social initiatives for the elderly. Participants were eligible if they were 65 years or older, had a sufficient understanding of the Dutch language, and

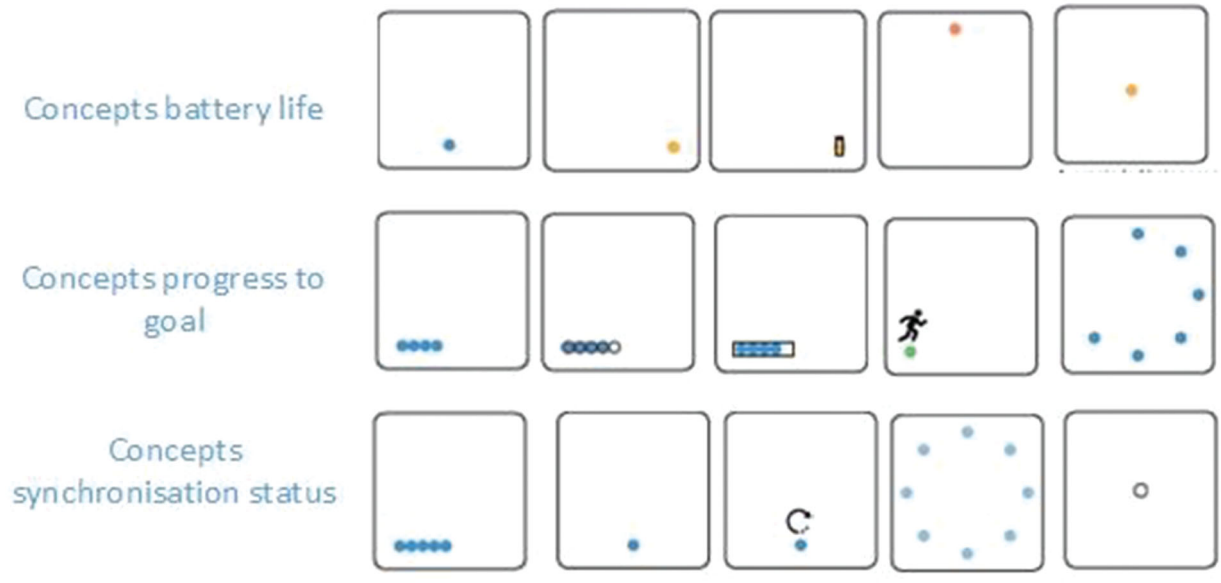


Figure 2. Feedback concepts for battery life, progress to goal, and synchronization status.

Figure 3. Alternative designs for the application.

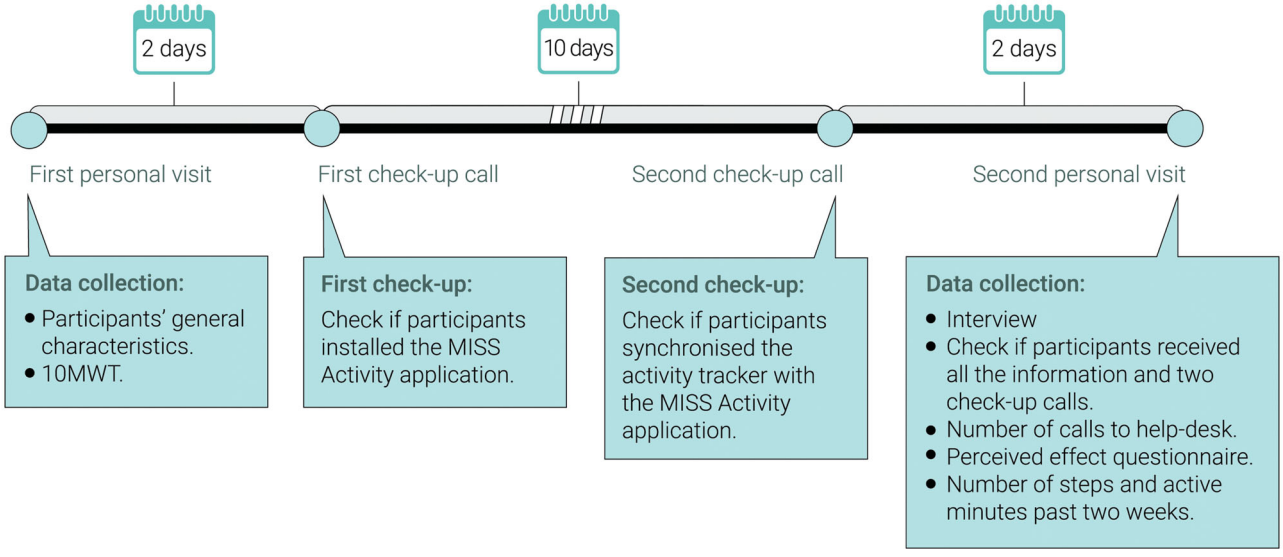


Figure 4. Overview of data collection during the 2 weeks test period. Abbreviation – 10MWT: 10-meter walking test.

possessed a smartphone. Participants were excluded if they had an asymmetrical gait that was observed during the 10-m walking test [36] or used a walking aid.

First personal visit

The first personal visit was located at a convenient location for the participant (e.g., their home). General characteristics were collected: gender, age, the highest level of education, living situation, family composition, use of technology, and their hobbies. Participants received a MISS activity, which they were asked to wear for 2 weeks, and a user manual. No further instructions about the use of the MISS activity were given. Participants were invited to call the helpdesk if they perceived any problems.

Check-up calls

Two days after the first appointment, a researcher called the participant to check if they had installed the app. The researcher pointed out again, that participants could obtain support through the helpdesk if they encountered problems. After ten days the researcher called the second time to ask if participants had

Table 1. Demographics of the included participants of the develop and deliver phase.

Characteristics	Participants shape and wear location ($n = 3$)	Participants feedback ($n = 12$)	Participants app ($n = 20$)
Gender, male, *n* (%)	2 (66)	6 (50)	10 (50)
Age (year), median (range)	66 (66–74)	71 (66–77)	72.5 (65–89)
Knowledge of technology[a], median, (range)	7 (5.5–8)	7 (0–7)	6 (0–8)
Use of technology, *n* (%)			
Smartphone	2 (66)	4 (33)	15 (75)
Computer	3 (100)	11 (92)	15 (75)
Tablet	2 (66)	6 (50)	8 (40)
Activity tracker	1 (33)	3 (25)	5 (25)

[a]Participant could score their knowledge of technology between zero and ten. Zero representing no knowledge and 10 a lot of knowledge.

synchronized the activity tracker with the application in the last 2 weeks. If not, they were asked to do so.

Second personal visit

At the end of the 2 weeks testing period, a second personal visit was scheduled during which the researcher asked whether (1) the participant had received the number of the helpdesk and the user manual, (2) whether the participant had had two check-up calls and (3) how many times the participant had called the helpdesk. The step count and active minutes per day according to the MISS activity app were recorded. Furthermore, one questionnaire was filled out in which the satisfaction with the MISS activity and the effect of their physical activity was queried (Appendix 2).

Semi-structured interviews with all participants about their experiences with the MISS activity were performed. The interview guide was based on a framework of a previous study [10], with the following main categories: purchase, instruction, characteristics, correct functioning, sharing data, privacy, use of the activity tracker, and interest in feedback. The interview lasted between 15-30 min and was recorded on audio.

Data analysis

Descriptive statistics of the participants' characteristics and questionnaires were presented as absolute numbers with medians (range). The interviews were transcribed verbatim. To analyze the interviews deductive and inductive content analysis [37] was used, using NVivo (version 10). The framework [10] of the interview guide was used for the deductive content analysis. Inductive coding was used when a text passage, that was relevant for the research question, did not fit the framework. Therefore, an "other" code was used to include these text passages. The first interview and every fifth interview was coded by two reviewers and an alignment session was held to fine-tune the coding. Differences in interpretation were solved by dialogue to reach consensus.

Results

(Re)design of the user-interface

Definition phase

From the 53 characteristics, 31 were prioritized as critical based on the MoSCoW model. Five of these characteristics were related to the algorithm of the activity tracker. The remaining 26 characteristics were related to the user-interface and used in de development and delivery phases (Appendix 1).

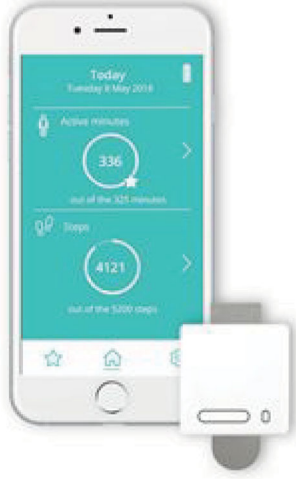
Development and delivery phase

Participants. The participants' demographic characteristics are presented in Table 1.

The main features of the development and delivery phase are presented in Table 2. These findings combined resulted in the MISS activity tracker (Box 2).

Box 2. About the MISS activity tracker

- The square design was worn on the pocket and secured with a clip
- Algorithm outcome parameters: step count and active minutes
- Users can choose whether the standing activity is included as active minutes
- Feedback on battery level and progress to goal with LED lights on the activity tracker itself
- Feedback is activated by shaking the activity tracker
- The app shows total step count and total active minutes
- The app shows a graph with the distribution of step count and active minutes during the day



Evaluating usage and experiences in daily life

Participants

The demographic characteristics of the participants are presented in Table 3. Two participants dropped out ($n = 2$: participant's smartphone was too outdated to run the MISS activity app and one due to illness).

Interviews

All participants received the manual, as well as the number of the helpdesk, and were called twice. Of the 28 participants, 27 (96%) used the manual, and seven (24%) used it more than once. Five (16%) participants called the helpdesk. One participant asked a question about Bluetooth, one asked about the graphs, and one asked if he could swim with the MISS activity. Two participants had a question about installing the app. One participant did not

Table 2. Main finding of the development and delivery phase.

Characteristic	Main findings	Remarks
Design of the activity tracker	• Activity tracker should be round • Activity tracker should be worn on one's pants pocket with a clip • Clip should be long enough • Clip should be sturdy • Clip should be easy to put on	A round shape was technically not possible, therefore a square shape was chosen
Feedback system on the activity tracker	• Colour of the hardware should be neutral • Battery level on activity tracker • Colour of lights on activity tracker is not important • Feedback as simple as possible • No feedback about synchronization • Feedback activation of activity tracker by tapping on tracker	It was technically not possible to activate the activity tracker by tapping, therefore the activity tracker will be activated by shaking
Feedback by an app	• Good user-flow is needed • Original design was preferred • App should work both clicking as well as swiping • Additional information screen is needed	

Table 3. Demographics of the included participants during the 2-week testing period.

Characteristics	Participants ($n = 28$)
Gender, male, *n* (%)	11 (39)
Age (year), median (range)	69 (65–78)
Education, *n* (%)	
Secondary Education	12 (40)
College	14 (50)
University	3 (10)
Living situation, *n* (%)	
Living alone	2 (6)
Living with a partner	23 (81)
Living with partner and child(ren)	4 (13)
Housing situation, *n* (%)	
Single-family dwelling	28 (100)
Hobbies[a], *n* (%)	
Active	48 (47)
Passive	54 (53)
Use of technology, *n* (%)	
Computer	27 (96)
Tablet	24 (86)
Activity tracker	11 (39)
Operating systems smartphone, *n* (%)	
Apple	12 (43)
Android	17 (57)

[a]Each participant was asked to name four hobbies, and each activity was categorised as either active or passive. Based on the MET score, a MET score >3 was considered active [38,39].

use the MISS activity for four days since his step count and active minutes were zero. Fourteen participants chose to include standing as active minutes.

Eleven (42%) participants were absolutely satisfied with the MISS activity, nine (35%) were very satisfied, four (16%) were somewhat satisfied and two (7%) participants were neutral ($n = 26$, 2 missing participants). Eleven (42%) participants gained much more insight into their physical activity level, six (16%) gained a little more insight, and eleven (42%) did not gain any insight. One (3%) participant increased his physical activity level much, three (11%) participants increased their physical activity level a little, and 24 (86%) did not perceive any increase. One participant (3%) noticed that he divided his activities much more over the day, six (22%) participant divided their activities a little more over the day and 21 (75%) participants did not perceive any change. The results of the interviews are shown in Table 4.

Discussion

The aim of this study was twofold. The first aim was to (re)design a user-friendly interface of an existing activity tracker so that it would meet the requirements of elderly individuals. Within the (re)design process of the MOX, three aspects were (re)designed: (1) the shape and clip of the activity tracker, (2) the feedback provided on the activity tracker itself, and (3) the additional feedback provided through the app. Furthermore, a list of general design requirements that facilitate the development of technology for the elderly was developed. The iterative character of the user-centred approach enabled access to a deeper level of user understanding and thereby facilitated the development of a user-friendly activity tracker, which in turn increases the likelihood that elderly individuals will have a meaningful experience with the tracker.

The second aim of this study was to assess the use and experiences of the elderly regarding the adapted activity tracker (MISS activity) in their daily life. The results of this study show that participants found the MISS activity to be easy to use, needed limited help when installing the tracker, and thought that anyone should, in principle, be able to use it. The MISS activity was primarily used to gain insight into participants' physical activity levels, and the data it collected was checked multiple times each day through the app. The most important distinction between this tracker and others is that elderly individuals experienced the MISS activity as easy to use; they perceived practically no imbalance between their technical knowledge and the complexity of the MISS activity. In several other studies in which elderly individuals used commercially available activity trackers, participants experienced the the trackers as technically complex and sensed that they were ill-suited not fitted for them [10–16].

Limitations and strengths

This study contains several strengths and limitations that should be addressed. One strength of this study is its user-centred design. The goal of user-centred design is to create a usable system that contributes to meaningful user experience. To achieve this, (early) involvement of the end-user is indispensable [47], and offers several benefits, such as a swifter acceptance of the user-interface, the capacity for users to identify problems specific to them, and the capacity for users to help define the scope of a project [47]. In this study, several methods have been used – interviews, observations, and usability testing [48] – to achieve a deeper understanding of the specific wishes and requirements of the elderly.

Given that a plethora of commercially available activity trackers already exists, a further strength of this study is the fact that it improved an existing activity tracker for a specific target group rather than design a new activity tracker for an overrun market.

Table 4. Results of the interviews presented in categories based on a previously developed framework.

Category	Main findings	Quote	Icon
Purchase of the activity tracker	• Those who show interest in buying the MISS activity say they want to buy it in a healthcare setting. • Expect that the healthcare setting in question will have expertise in activity trackers. • The app should also work on a tablet.	"I think I would go to a company which is specialised and has sufficient background knowledge about it [the activity tracker] so I would go to a pharmacy". Female, 69 years	 [40]
Instruction and use	• Manual was clear. • Help desk provided a reassuring feeling.	"Yes, I think everybody should be able to install it I think, I can't decide for everyone but, on average, yes". Female, 67 years "I can imagine that it is easy to have a helpdesk if you can't figure it out you would want a helpdesk, right?" Male, 75 years	 [41]
Characteristics of the activity tracker	• Activity tracker was easy to use. • Goal setting was clear. • Lights on the activity tracker were not of additional value. • Step count and active minutes were sufficient as variables. • Preference to read data on the app. • No problems wearing the activity tracker.	"No, no, I just need step count and active minutes every day and that was sufficient for me". Female, 76 years	 [42]
Correct functioning	• Overall, no technical problems. • Experiences with the validity of the activity tracker are variable.	"Yes, sometimes it said it was offline then I had to restart it. No, I had no problems with it". Female, 76 years	 [43]
Privacy	• No privacy issues. • A few participants felt they had to be especially active because they knew someone could see their results.	"A kind of motivation that you would say, wow that lady walked a lot!" Female, 68 years	 [44]
Use of the activity tracker	• Data was checked multiple times per day. • Activity tracker was used to gain insight into physical activity levels. • There is added value in sharing their data with healthcare professionals. • Participants expect that their healthcare professional will initiate the use of their tracker's data and that they will integrate this data in their treatment.	"I checked every day how much I did the day before and sometime when I walked or cycled, I checked when I was back how many steps that has contributed". Male, 73 years "It depends why you are with a physiotherapist, if you are there for your arm or something like that, I think it won't be added value but maybe for the movement mechanism and your back it might be of added value". Male, 71 years	 [45]
Interest in feedback	• Activity tracker provides insight into physical activity level. • Participants who were not motivated by the activity trackers said that they would be if they saw that they were not active enough.	"If I didn't walk enough, I think it might motivate me, but I know now that I am active the whole day". Female, 76 years	 [46]

This study's methodology and list of design requirements can easily be used as a generic structured methodology for improving further eHealth tools for target groups. Furthermore, the synopsis of key characteristics could also be applied to further eHealth and mHealth tools for the elderly.

A limitation of this study is the potential presence of selection bias, as the only elderly individuals who participated already actively used their smartphones. Of all elderly individuals in the Netherlands in 2019 (3.2 million), [49], 60% use a smartphone [50]. However, the elderly participating in this pilot study asserted that anyone should, in principle, be capable of using the tracker. The MISS activity is designed for elderly individuals who are interested in using eHealth to track their health, and it is, therefore, most likely the group of elderly who already actively use their smartphone.

Implications for healthcare and research

Activity trackers can be valuable to healthcare because they objectively measure physical activity throughout daily activities and provide detailed feedback. However, until now, the benefits of activity trackers had not been fully realized. A potential explanation for this could be the limited feasibility of current commercially available activity trackers for both patients and healthcare professionals [10]. Additional explanations include the overwhelmingly broad spectrum of activity trackers, the lack of consumer and healthcare professional knowledge regarding which activity tracker best suits which purpose and which group, and the lack of professional knowledge regarding how to implement tracker data into healthcare treatment. This study, however, provides an overview of the features that are most relevant for the elderly, and it can be used to facilitate the process of selecting an appropriate tracker.

Further research could examine whether the MISS activity could also be used by other target groups, such as people with limited health literacy, and whether the MISS activity could be used for an extended duration. Ultimately, activity trackers and eHealth could be better implemented in healthcare [51]. Activity trackers may serve several purposes in healthcare; they can be used to monitor a patient's physical activity level, to set physical activity goals, and to evaluate the physical activity of a patient. Therefore, future studies should explore methods of using activity trackers to support healthcare professionals' clinical reasoning, as well as their communication with their patients.

Conclusion

This study offers a structured methodology that facilitates the adaptation of an existing activity tracker. It also describes a list of design requirements based on the skills and needs of the elderly. Both can be used by other researchers and designers as a model for the adaptation and further development of eHealth tools for a target group. The MOX was successfully (re)designed to meet with the skills and needs of the elderly participating in this study. Further studies should explore methods of incorporating activity trackers into the healthcare system.

Ethical approval

This study was approved by the local ethics board (Atrium-Orbis-Zuyd Medical Ethical Committee, METCZ20180012). Written informed consent was obtained from participants. All information was handled with strict confidentiality.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

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Appendix 1. Important characteristics to create a meaningful user-interface for elderly.

Variable[a]		Considered as critical	References
1	Measurements are valid and reliable	Yes (algorithm)	[10,12,15,19–22]
2	Activity tracker measures step count	Yes (algorithm)	[10,19,20,15,21,23–25]
3	Activity tracker measures burned calories	No	[10,19,21–24,28]
4	Activity tracker measures sleep	No	[10,19,12,15,28–30]
5	Activity tracker measures distance walked	Yes (algorithm)	[10,15,21,30]
6	Activity tracker measures active minutes	Yes (algorithm)	[10,21,30]
7	Activity tracker measures posture	No	[10,22]
8	Activity tracker measure swimming	No	[10,25]
9	Activity tracker measures cycling	Yes (algorithm)	[10,25]
10	Activity tracker measure heartrate	No	[10,19,28,30,31]
11	Activity tracker measures blood pressure	No	[10,28,26,30,31]
12	Activity tracker measures walk speed	No	[10]
13	Activity tracker has option to track food and beverage intake	No	[10,12,23,24,31]
14	Activity trackers provides real-time feedback	Yes	[10]
15	Activity tracker provides feedback in a day overview	Yes	[10,19,23,11]
16	Activity tracker provides feedback in a week overview	Yes	[10]
17	Feedback on the activity tracker itself	Yes	[10,19,23,11,27]
18	Activity tracker is compatible with a smartphone	Yes	[10,27]
19	Activity tracker is compatible with a computer	Yes	[10,27]
20	Feedback is shown on the activity tracker with a maximum of one act	Yes	[10,28]
21	Activity tracker provides positive motivating messages	Yes	[10,12,22–24,28,29,27,13]
22	Activity tracker provides negative messages	No	[10]
23	Text on the activity tracker is readable	Yes	[10,28,29]
24	Buttons on the activity tracker are not too small (operable with one finger without pushing another button)	Yes	[10,15,25,28,29]
25	Possibility to set an individual activity goal	No	[10,12,24,28,29,27,32]
26	Possibility for physical help when installing the activity tracker	No	[10,28,31,13]
27	No problems with logging in (not more than one attempt)	Yes	[10,21,28,29]
28	No problems with synchronizing (not more than one attempt)	Yes	[10,15,21,23,28,29]
29	Data can be shared	Yes	[10,21,22,26,32]
30	The user can decide what data to share and to whom	Yes	[10,21,25,30,27,32]
31	Data is not automatically shared with companies	Yes	[10]
32	A manual is delivered with the activity tracker	Yes	[10,15,28,13]
33	Dutch language is available on the activity tracker and interface	Yes	[10,25]
34	Manual in Dutch language	No	[10,25]
35	Activity tracker should be small (trouser pocket size)	No	[10]
36	Activity tracker can be attached with a clip	No	[10,25]
37	Activity tracker can be worn on trousers, pocket, or bra	No	[10,27,13]
38	Activity tracker can be worn on wrist	No	[10,15,27,13]
39	Activity tracker can be independently put on	Yes	[10,28]
40	Activity tracker is made from comfortable material	Yes	[10,22,28,29]
41	Activity tracker should not be visible	No	[10,19,23,25,28,29,27]
42	Activity tracker should be fashionable	No	[10,22,23,28]
43	Activity tracker can be charged by an electric socket	Yes	[10]
44	Battery life lasts 2 weeks	Yes	[10,19,15]
45	Activity tracker is waterproof	Yes	[10,19,12,15,21,22,28,27]
46	Activity tracker is damage proof (will not break after one fall of 1.5-m height)	Yes	[10,25,13]
47	Activity tracker is compatible with iOS	Yes	[10,23,27]
48	Activity tracker runs on current and new software version of smartphones	Yes	[10]
49	Step count should be visible on the activity tracker	Yes	[10]
50	Interface uses graphs and symbols	No	[10]
51	Activity tracker measures intensity of movements	No	[10,25]
52	Activity tracker measures walking stairs	No	[10,25]
53	Activity tracker shows (on tracker or app) when the battery is almost empty	Yes	[10,25]

[a]Variables based on 48 interviews with people with a chronic disease [10] (Chronic obstructive pulmonary disease (COPD), cardiovascular disease, chronic pain, oncology, osteoarthritis, and diabetes mellitus) who received treatment from a physiotherapist. Variables were propounded and confirmed with four experts in wearables.

Appendix 2. Questionnaire about the perceived effect of the MISS activity

1. *Overall, to what degree did you gain insight into your physical activity level?*
   1.1. ◯ Very much more insight
   1.2. ◯ Much more insight
   1.3. ◯ A little more insight
   1.4. ◯ No change
   1.5. ◯ A little less insight
   1.6. ◯ Much less insight
   1.7. ◯ Very much less insight

2. *To what degree did your physical activity level change?*
   2.1. ◯ Very much more physical activity
   2.2. ◯ Much more physical activity
   2.3. ◯ A little more physical activity
   2.4. ◯ No change
   2.5. ◯ A little less physical activity
   2.6. ◯ Much less physical activity
   2.7. ◯ Very much less physical activity

3. *To what degree was your physical activity more divided during the day?*
   3.1. ◯ Very much more divided
   3.2. ◯ Much more divided
   3.3. ◯ A little more divided
   3.4. ◯ No change
   3.5. ◯ A little less divided
   3.6. ◯ Much less divided
   3.7. ◯ Very much less divided