GOT-IT: A TOOLKIT FOR INCLUSIVE AND UNDERSTANDABLE LIFESTYLE DATA VISUALIZATIONS IN EHEALTH SOLUTIONS AAL-2020-7-51-SCP

D1.3: TEST

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Disclaimer

ABSTRACT

The Got-IT toolkit is an open online platform to assist in the design of inclusive eHealth solutions dedicated to end-users with low eHealth literacy. It consists of three main sections: *Inform*, *Co-design* and *Test*. Within this report the Test section of the toolkit is provided, it consists of a short checklist of criteria to test whether designed visualizations are understandable and actionable by people with low eHealth literacy (based on the outcome from T1.1, T1.2 & T1.3 of the project). Furthermore recommendations about the design process and co-designing with users with low eHealth literacy are provided.

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SYMBOLS, ABBREVIATIONS AND ACRONYMS

AAL	Active Assisted Living
D	Deliverable
DCHE	Danish Committee for Health Education
EC	European Commission
JOAFG	Johanniter Österreich Ausbildung und Forschung gemeinnützige GmbH
M	Month
PHAROS	Pharos Expertisecentrum Gezondheidsverschillen
RRD	Roessingh Research and Development
T	Task
TUW	TU Wien: Institute of Visual Computing and Human-Centered Technology – Human Computer Interaction Group
WP	Work Package

1 INTRODUCTION

The last decades eHealth services are becoming increasingly important, even more so during and after the covid-19 outbreak [1].They have been associated with a positive influence on health care outcomes [2]. However, still many available e-health services are underused and there is a lack of adoption by its users. This may be due to different technology issues, personal barriers (like cognition, motivation, accessibility) or environmental & organizational barriers [3]. A literature analysis by Schreiweis et al. showed the most frequent barrier for potential users of using an eHealth services is having limited knowledge of and exposure to eHealth services. In other words: low eHealth literacy of users [3]. It is important to avoid a second-level digital divide [4] and also include users with low e-health literacy, as the eHealth literacy of potential users has an direct effect on their eHealth behaviour [5].

The concept of eHealth literacy can be defined as the ability to seek, find, understand, and appraise health information from electronic sources and to apply that knowledge to addressing or solving a health problem [6]. It is related to sociodemographic factors such as age, gender, and ethnicity, and socioeconomic factors such as education. eHealth literacy can be assessed from different perspectives, such as social factors, patient perspectives and health professionals perspectives. The focus is often on the patient but the perspective of the e-health developer is often overlooked. There is a lack of practical recommendations for e-health developers and designers on how to take e-health literacy into account when developing their services [7].

The Got-IT project aims to provide specific guidelines to assist in the design of inclusive eHealth services, and to increase awareness for designing eHealth applications for people with low eHealth literacy among eHealth developers. Within the project an online toolkit will be created in close collaboration with the end-users of the toolkit (e-health developers). The toolkit aims to support the design of e-health applications in general, and for people with low e-health literacy in particular.

The Got-IT toolkit is an open online platform to assist in the design of inclusive eHealth solutions dedicated to end-users with low eHealth literacy. It consists of three main sections: *Inform*, *Co-design* and *Test*. The *Inform* section addresses the reasons eHealth developers should use the toolkit, and provides background information about eHealth literacy. The *Co-design* section supports eHealth developers to design for inclusive eHealth. The showcase of the co-design sessions within the Got-IT project is presented here: redesigning the Activity Coach app. Also ethical considerations for engaging with underprivileged groups are addressed in this section. This section is expected to grow with other showcases from the community. Finally the *Test* section provides an actionable checklist on criteria to test when developing inclusive eHealth solutions, that followed from literature and the results and experiences in the co-design sessions. This will be a quick tool to use for developers that prevents the need to engage with the full toolkit.

This deliverable will report on this checklist, that will be subsequently incorporated in the Got-IT toolkit.

2 OBJECTIVES

The objective of this deliverable is to provide a short checklist of criteria to test whether designed visualizations are understandable and actionable by people with low eHealth literacy. Furthermore the checklist incorporates recommendations for designing eHealth applications for users with low eHealth literacy and recommendations for co-designing with this group of users.

Relation to other deliverables

This deliverable relates to D1.1 and D1.2, it summarizes the work done within these two deliverables and Work Package 1. The checklist presented in this deliverable follows from the work presented in D1.1 and D1.2, respectively corresponding to the *Inform* and *Co-design* section of the toolkit.

The *Test* section presented in this deliverable will be incorporated in the online Got-IT toolkit, therefor it relates to D2.1 (Toolkit for inclusive design of visualizations of lifestyle data in eHealth solutions).

3 THE CHECKLIST

The Got-IT checklist provides criteria to test whether designed visualizations are understandable and actionable by people with low eHealth literacy. It is a quick tool for those who are not ready yet for engaging with the full Got-IT toolkit, and whose interest in the topic (and its added value) must be triggered first.

The checklist is divided into two sections. The first section (1.1) provides recommendations and tools for quickly testing the inclusiveness of designed eHealth solutions. Section 1.2 shows the recommendations for the general co-design and development process. The recommendations are based on input from secondary end-users, end-users with low eHealth literacy and desk research that was performed within T1.1 & T1.2 of the project.

3.1. Visualizations & Design

1. **Provide sufficient contrast between foreground and background items in your visualizations and graphs, as well as in your eHealth application in general.**

The use of good contrast was rated by the co-design team in the Got-IT showcase as one of the most important recommendations for eHealth developers. This will make the information better accessible to not only users with low eHealth literacy, but to everyone.

The below figures show an example of the result of the case study with the Activity Coach app. Figure 1 shows the 'Step' page of the Activity Coach app and Figure 2 shows the same page, but with the removal of the background image to avoid confusion and to increase the contrast.

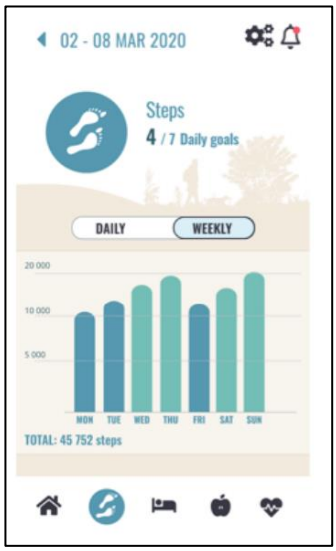


Figure 1. The old step page of the Activity Coach app with a background picture.

Figure 2. The new step page of the Activity Coach app with the removed background picture, to enable better contrast.

In the WCAG 2.0 accessibility guidelines the minimum contrast between foreground and background is recommended to be at least 4.5:1 (or 3:1 for large-scale text) and enhanced contrast should be at least 7:1 (or 4:5:1 for large-scale text).

Several contrast checkers are available online, such as:

- https://monsido.com/tools/contrast-checker
- https://webaim.org/resources/contrastchecker/

2. **Use easy and native language**

Several recommendations regarding easy and understandable language are available in the Pharos checklist (https://checklisttoegankelijkeinfo.pharos.nl/checklist in Dutch), the most important being:

- Use short sentences and easy words on A2-B1 CEFR (Common European Framework of Reference) language level. See **Error! Reference source not found.** for the CEFR language l evels. More information on these language levels can be found here: https://www.coe.int/en/web/common-european-framework-reference-languages/level-descriptions
- Use active sentences
- Avoid difficult technical or medical terms
- Avoid non-native words
- Avoid percentages and formulas

Also, consider making your application available in different languages or multi-language. E.g. also think about people with an immigration background.

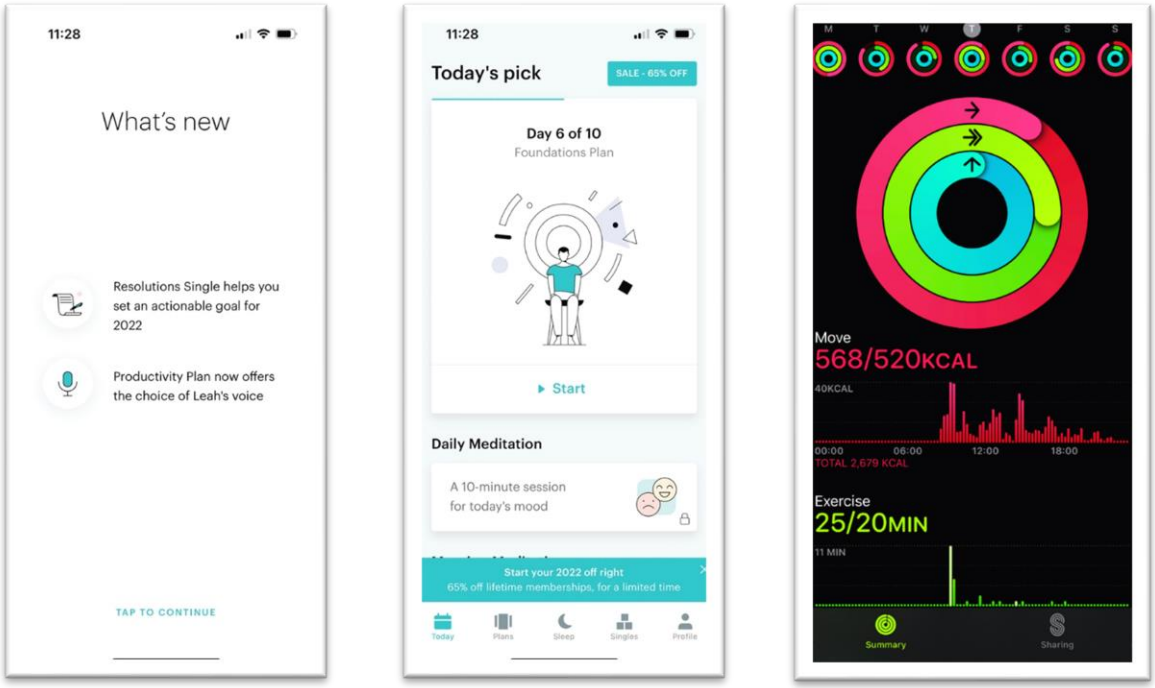
Use language that is accessible, non-discriminatory and gender-inclusive (gender should only be made visible, when it is relevant for the information or communication)

3. **Place the most important information in the centre of the screen and make it bigger than the rest.**

Figure 3 shows an example from one of the co-design sessions of the show case with the Activity Coach app:

Figure 3. The result of one of the co-design sessions with end-user with low eHealth literacy, when re-designing the Activity Coach app: the most important information is placed in the center of the screen and made bigger than the rest.

Figure 4 a, b and c show some more examples:



a. b. c.

Figure 4. a, b, c. Examples of screens with the most important information placed in the centre of the screen and made bigger than the rest.

4. Make sure that images, icons and symbols match with their meaning

Images, icons and symbols are very useful for replacing text. When using them make sure they are clear, recognizable, simple, consistent and meaningful/understandable by everyone. Icons should be labelled with text whenever possible. See some example below.

a. b. c.

Figure 5, a.b.c, examples of meaningful icons labelled with text as well.

5. Highlight important information with intuitive signal colours

The most important information should be highlighted. Use colors (signal colors) with caution, especially when there are feelings/meanings assigned to them. Save the colour red for when it is meant to signal danger. See f.e. Figure 6 where the heart rate graph in red was perceived as dangerous. Use the colour green when you want to stress that something is good, safe or positive.

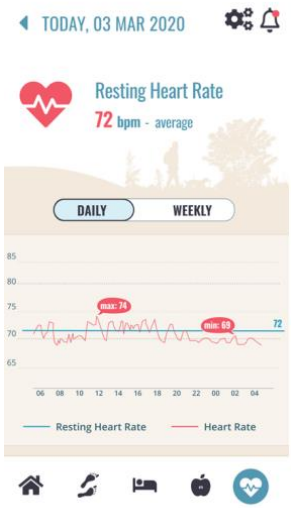


Figure 6. Screen of the Activity Coach showing heart rate data.

Also, always check the color for users that are visually impaired – for example color blindness (the majority of design programs have an option to switch between the color modes), as well as older users who cannot differentiate colors too well. It's best to always use an icon or a background highlight to accompany important notifications in order for them to be noticeable. There are online services available that let you test your interface for accessibility with respect to color blindness, like VisCheck (https://www.vischeck.com/).

6. Avoid presentation of too much information, as this can be perceived as overwhelming

The following screen from the Activity coach app was perceived as overwhelming for the end-users, because too much and repetitive information is presented on one screen (see Figure 7). Also, the black background was perceived as useless and overwhelming.

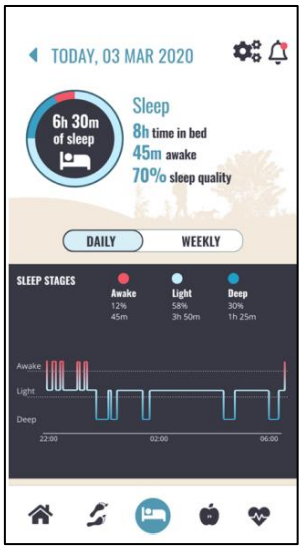


Figure 7. Screen of the Activity Coach app showing sleep data.

Another example of too much information shown on one page is the following screen of the Activity Coach app showing the Heart Rate (see Figure 8). In one screen the resting heart rate, the heart rate over time and the actual heart rate (HR) at the current time are shown. End-users perceived this as overwhelming and for them it was hard to distinguish between the actual/average or resting HR.

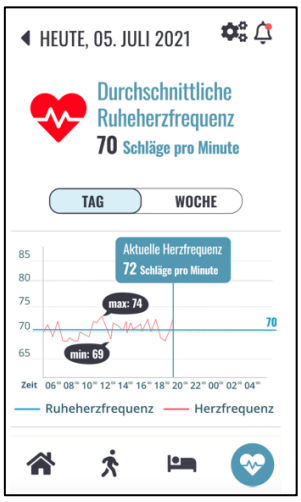


Figure 8. Screen of the Activity Coach app showing heart rate data.

Make sure that no scrolling is needed and everything fits on the screen.

7. **Interactive elements: Provide them in distinct styles that make them easy to identify and place them on the left side or above**

It should be clear for all users which parts/buttons are clickable. If, for example, it is possible to interact with a graph to zoom into more detailed information this must be made clear to the user with distinct styling. Also, keep in mind that clickable buttons are often perceived as too small (see point 9 in the checklist).

8. **Make sure graph visualizations are labelled**

Graph visualizations should be labelled, e.g., describing clearly what a data presentation means, also given people with low eHealth literacy are not always familiar with such visualizations.

Add icons or other descriptions to the graphs labels to make numbers clearly understandable (e.g., time, hours). F.e. in Figure 7 and Figure 8 it was not immediately clear that the x-axis is the time in hours.

9. **Use bigger fonts and buttons**

Fonts should be a minimum of 16 px. Some sources recommend 12 px, but these were even perceived as too tiny.

Preferably, users should have the possibility to increase or decrease font sizes at will.

Sans serif typefaces are often preferred for on-screen readability.

In general, wherever there is a 'recommended' size or distance specified, designers should view that as the absolute bare minimum for any interface targeting older people or users with low eHealth literacy.

10. **Adaptability/personalization**

Given the individual differences between users in their experience of using eHealth applications, we recommend to: adaptability and personalization of eHealth applications in:

- Personalize the (health) goal(s) that the end-user can obtain via the service

- Personalize the level of details in graphs. End-users with low eHealth literacy have difficulty understanding graphs at all, for them it might be better to just show a number or a very simple graphic representation.
- Personalize interface design in terms of color, sounds
- Personalize the amount of and difficulty level of health information.
- Personalize the available functionality; only provide basic functions to keep it simple and not overwhelming, and extend functionality upon explicit request by the end-user.

11. Don't use ads and pop-ups

Suddenly appearing advertisements and pop-ups were perceived as one of the most annoying things while using eHealth applications and websites in general, according to end-users with low eHealth literacy. It is one of the reasons people get stuck and do not understand how to proceed using the application, causing a lot of drop out.

If you need to use ads anyway, make sure that they are easily removable.

12. Make sure privacy statements are understandable, and be transparent about collection of data

During the co-design sessions, participants were reluctant to agree with Privacy statements, without really understanding them. Try to avoid long texts explaining privacy statements, instead think of explaining them with pictures and short sentences.

Be transparent about the data that will be collected by the application, and do not collect data unless it's necessary.

13. Add the option of audio/ read aloud the content of the app/visualization

Most devices support the use of a read aloud function, or already have this functionality integrated. Make sure it can be started from the application itself.

14. Keep interaction gestures for touch screens simple

Do not use complex gestures that require more than two fingers. Simple horizontal, vertical, or diagonal movement is fine, as these are all natural motions. Avoid incorporating gestures with quick movements, difficult positioning, or multiple gestures that require the use of both hands or more than two fingers. (https://www.toptal.com/designers/ui/ui-design-for-older-adults#:~:text=When%20designing%20for%20older%20adults,these%20are%20all%20natural%20motions.)

3.2. Recommendations for development and co-design

15. Aim for diverse groups

Co-creation is a collaborative process: Always actively recruit diverse groups and include people with disabilities and of all genders throughout the design process. Acknowledge them as specialists that contribute new approaches and angles of view. Be open-minded, listen to participants' experiences and value their contributions. Remember that participants are experts in their own right.

16. Take time and resources in consideration

The process of inclusive design and co-creation allows for considerable time and other resources. Take into account that getting familiar with new eHealth applications is often too time consuming and frustrating for users with low eHealth literacy. Consider one of the following solutions:

- Provide an onboarding procedure within the application.
- Provide a short, understandable video on how to use the application.
- Provide a short tutorial at the start, with the option to skip it and restart it again later.

When introducing new eHealth applications to patients, it is best to foster a bottom-up-approach, i.e. familiarize the users with the tools and raise the awareness and acceptance among the patients themselves. New eHealth solutions are accepted most, if there is a positive word-of-mouth amongst the users. It is furthermore best to take it slow with the introduction of new digital tools to ease the patients into it.

Whenever possible, care providers should be involved in the process of introducing a digital health solution to patients and clients.

17. Health- and medical information provided should be evidence-based

Studies show that it is important to make medical information and advice trustworthy to the users, therefor evidence-based, good quality and user-friendly presentation of data is needed [8, 9, 10]. Always state the source of medical and health information, and only include information that is based on clinically validated information.

18. Seek to be impartial and non-discriminatory

eHealth applications should be designed in an inclusive, accessible and non-discriminatory manner.

Do not reflect stereotypes (e.g. choices of color, typography, symbols, etc.) and take into account differences in physiology between genders.

If information regarding gender is relevant give more than two binary gender options or make this question optional

19. Recognition and reimbursement of participation and expenses during co-design sessions

In many or even most cases participants do not get any refunds for participation (apart from reimbursement of travel expenses). If possible, incorporate in the budget a generous refund pot. In case a refund is offered to participants, make sure that the administration around refund claiming is made as easy as possible for participants. Facilitate prompt payment of refund and check this with the participants. Also, participants may appreciate it when they can keep any gadgets that they used

to test during the project. Send your participants a brief report about the project outcomes and their contributions to these. If feasible, discuss the reimbursement options at recruitment or at the beginning of the project to make sure that the reimbursement is as preferred.

20. **Provide (long-term) motivation to use & keep engagement with your application**

Long-term motivation is key.

In order to prevent users to stop using your application, we recommend to add a sense of accomplishment/success, f.e. using a smiley in the app or providing a reward by collecting points, when a job is well done.

Diverse kinds of gamification aspects can be used to reach a higher motivation to engage with eHealth applications. F.e. avatars and virtual coaches can support the user during navigation, and provide personalized notifications. Providing group challenges will enable peer-activities in the digital environment and increase engagement as well.

Users react in different ways to notifications about rewards, therefor we recommend to provide the option to personalize how often and in which way users would like to receive these notifications.

21. **Provide (technical) support & education to your users, and make it easy to reach contact persons**

Technical problems and loss of data can be highly frustrating to users, even more so to users with low eHealth literacy. In most cases it leads to a situation where they will stop using the application. In these cases it is important to provide sufficient support, and to make it clear were to turn to in case of technical issues or other needed support (f.e. during installation of the application). Support at every stage is necessary. It is also recommended to provide the option to request assistance when starting with the app. In these cases group sessions could be organized to help & educate several people at once during face-to-face workshops.

22. **Providing interfaces to other programs**

With the rise of digital healthcare, the amount of available eHealth applications is overwhelming. Whenever possible we recommend to provide interfaces with other eHealth applications, and aim for central data storage.

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