**AAL Project no: AAL-call-2018-152**

**frAAgiLe**

**Platform for detecting and preventing frailty and falls**

# DELIVERABLE D3.3a. Qualitative final evaluation and recommendations for further improvement

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| **Keywords** | |
| **Abstract (for dissemination)** | This deliverable´s main objective is to analyse the feedback received from the testing and describe the implementation of changes in the technologies |

[1] L Legal agreement, O = Other, P = Plan, PR = Prototype, R = Report, U = User scenario

[2] PU = Public, PP = Restricted to other programme participants (including the Commission Services), RE = Restricted to a group specified by the consortium (including the Commission Services), CO = Confidential, only for members of the consortium (including the Commission Services)


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## Table of Content

# 1.About this document

## 1.1 Role of the deliverable

The role of this document is to explain the feedback received during the three phases of testing that have undergone development up until the production of this report: co-creation, lab testing and first half of the final trial. This deliverable also includes descriptions of the changes implemented in the monitoring and mitigation tools as a result of the previously mentioned feedback.

## 1.2 Relationship to other frAAgiLe deliverables

This deliverable is closely related to D.3.1. which describes the validation process, the basis that led to the data collection which is now becoming active feedback as shown in this report and to D1.2. On Boarding Progress report.

## 3. The feedback received from extended co-creation

### 3.1 Introduction

In parallel with the field trials, there have been additional co-creation phases carried out by TERZ and BZN as the organisations are not involved in the field trials due to the clinical orientation of the study. The goal was to receive feedback mainly on usability and accessibility aspects. The inclusion criteria were the same as for the lab testing (described in D3.1 Field trials' and validation plan). This parallel approach allows the technical developers to optimise and test the product through iterative improvement cycles in parallel with the field trials, so they do not have to wait until each field trial phase is completed. Thus, there is more time for product optimisation in terms of usability and accessibility.

### 3.2 Results

The extended co-creation workshops were conducted by BZN and TERZ only. Feedbacks were collected by interviews and participants submitted diaries. The aim of the extended co-creation was to collect further feedback on the adapted designs and games. There were in total 11 healthy or mildly impaired primary users above 55 years; six participants at TERZ and 5 participants at BZN. The average age of the participants is 60 years of age, ranging from 60 years to 74 years. Out of the 11 participants, seven were female and four male. Nine out of the 11 participants were retired. The participants' living situation is summarized in the table below by area of residence.

Diagram 1: area of residence

| | | living situation | | | |
|---|---|---|---|---|---|
| | | with spouse | with partner | alone | Total |
| area of residence | rural | 3 | 0 | 0 | 3 |
| | urban | 5 | 1 | 2 | 8 |
| | Total | 8 | 1 | 2 | 11 |

The results are presented in an explorative way and suggestions of users are included.

### 3.2.1. Usability

In general, the users found the game mostly childish. Suggestions were made such as to incorporate a consistent design. Participants missed clear instructions for the set up and for most games. Moreover, for most games, participants missed a clear icon to end and exit a game.

Some participants had issues finding the tests. Participants were interested in the results, however those were not displayed. Some information about the tests were in English.

One participant forgot the password. The participant was not able to send a request via table but was only able to update it through the web interface.

In Switzerland a system usability scale was used. See table below for detailed answers.

| | |
|---|---|
| I think that I would use this system frequently | 3.666666667 |
| I found the system unnecessarily complex | 3.2 |
| I thought the system was easy to use | 3.5 |

| | |
|---|---|
| I think I would need the support of a technical person to be able to use this system | 4.333333333 |
| I found the various functions in this system were well integrated | 3.8 |
| I thought there was too much inconsistency in this system | 4 |
| I could imagine that most people would learn to use this system very quickly | 3.4 |
| I found the system very cumbersome to use | 3.833333333 |
| I felt very confident using the system | 4.2 |
| I needed to learn a lot of things before I could get going with this system | 4.166666667 |

Table 1: Scale 1-7 (1 = Disagree completely, 7 = Completely Agree).

Seeing how the average at all questions is neither good nor bad, there is definitely room for improvement in each category.

Further comments on usability:

- When opening the app for the first time, it should be better indicated that the app always needs to be connected to the internet, for example, larger print or warning sign.
- What is the health score for? It is already at 31 when I start. Add an explanation about the health score.
- The pathways on the left are not easy to find particularly when not using a tablet on a daily basis

- Have more clear help functions for connecting Squegg, activating bluetooth, GPS, internet etc.
- Squegg: battery status or empty battery not indicated/unclear.
- The games are partially too incomprehensible, too complex. Might be also due to the missing/wrong translations.
- The app expects previous or good experience on handling Android Tablets.
- Support is crucial in order to be able to use all applications
- The entire app appears "botchy". No character identifiable. The knowledge from one game can't be transferred to the other.
- In part I'm still not entirely sure what the goal of a game is or what its means are.
- At the beginning patience is crucial. After a while, one gets used to the app and it works well
- Easy to open the home screen, log in, change the language.
- Most users had staring up issues and found it therefore too tedious from the beginning.

### 3.2.2. Grip me

Participants missed clear instructions for the game. However, they liked the goal of the game. The language used was not always clear, therefore easier vocabulary should be used.

Further comments on the game:

- Squegg connected with the app, but had to be re-connected to use grip me.
- Unclear instructions: Which hand should I use?
- Participant would like to have a tablet stand to do this exercise

### 3.2.3. SPPB

Participants had difficulties connecting to the game and starting the game. They had to reconnect multiple times. Instructions were only available in English.and therefore not understood.

Further comments on the game:

- I didn't realise that the camera had to be set to selfie. Add this to the instructions.
- Some translation issues

### 3.2.4. Kwido

Most participants could not access the game and therefore did not play the game. The few that did access the game could not follow the instructions as it was only Spanish.

Further comments on the game:

- There is no option for not or always forgetting today's date. This should be added.
- Favourite game

### 3.2.5. Exercises

In general, participants like the physical activities section. Most found it not clear what the option to change categories does. It should be better explained. Participants found it easy to find and access videos.

- Better support to choose the right video needed.
- More videos should be available. The video's should be switched after some time otherwise it becomes too boring

### 3.2.6. Sailgility

Some participants were not able to access the game. Those who did either liked the game due to the simple exercises and the videos showing the exercise, others found the game was not a challenge. Most participants found the instructions for this game insufficient and therefore the game was unclear to them. Participants also missed a clear icon to end the game. Such an icon should be easily viewable. Translations were incomplete. Some users criticised that the game was unsuitable for the tablet they used.

Further comments on the game:

- There is a screen with a % when starting. What does this mean? [Loading screen]. Very problematic for users. Show loading progress and have it be language specific
- Before playing, the camera needs to be activated and distance set. Where can I see what the camera is capturing during the game?
- Recurring error message.
- The installation of the game was tedious.
- Favourite game

### 3.2.7. Sapa

Participants found Sapa to be an interesting game, well made and that it was fun. Some participants found the game was a bit boring and no challenge as it was too slow and repetitive. The instructions should be shown at the beginning.

Further comments on the game:

- There was a recurring error message after the first level.
- There's not a clear icon to end and exit the game.
- Beginner level: instructions good
- Standards level: instructions insufficient. Some items cannot be grabbed.
- I liked the game because it was not quick and I could play it easily.
- Buttons are overlapping
- After completing a level the game does not move to a next level but the player has to go back and choose a new level.
- The music is annoying. Better music should be added.
- Colours of the levels and options could be different

### 3.2.8. Chop it

Some participants found the game fun but a bit that the elements were falling too fast, others found it boring. More levels and various difficulty levels should be explored such that elements fall slower. Some participants did not find it as clear what to do in the beginning.

Further comments on the game:

- Languages are mixed up and translations should be checked. Some instructions appear in German, some in Spanish. In addition, some dishes are titled wrong.
- There's not a clear icon to end and exit the game.
- Recurrent spontaneous termination of the game "The server has sent an unknown error message".
- Music and sounds intermediate well. Some sounds are annoying.
- More traditional recipes would be good to have
- Liked the game but forgot halfway through what food she needed to find ingredients for. Display the name of the food on the screen.

## 4. The feedback received from the first round of trials (1st prototype assesment)

### 4.1. Introduction

The system tested for this study was frAAgile, designed to detect and prevent frailty in older adults in their home setting. The usability testing attempted to represent realistic exercises and conditions, therefore the participants included in the trial test the solution at home for 6 months.

The purpose of this study was to test and validate the usability of the current user interface and to evaluate user's experience and impressions on the app. To this end, measures of effectiveness, efficiency, and user satisfaction, such as such as the time and ease of use of the application, the connection of the other devices (Squegg, smart band),

their opinions on the games, and opinion on the overall system, were captured during the usability testing.

A second objective was to assess the reliability of one of the devices included in the study. Specifically, we evaluated the Squegg's test-retest reliability as compared to a gold standard tool for assessing grip strength, the Jamar dynamometer. The Squegg has been designed for grip training and hand therapy and comes with a companion app. The companion app also allows for the display and recording of continuous handgrip strength data. All of these features make the Squegg handgrip device a potentially useful tool for clinical and home assessment. The inter-instrument reliability between the Jamar dynamometer and Squegg was analysed using intraclass correlation (ICC). Please see the results for this analysis in section

## 4.2. Method

### 4.2.1. Participants

A total of 40 participants were initially enrolled in the study. Participants were older adults aged 60+, 20 were recruited by ANA and 20 by MAT.

From ANA 2 participants had dropped out of the study and wanted their data to be excluded. One further participant dropped out at the 3rd month assessment but their details and answers, for both baseline and 3rd month assessments, are included. The reasons were:

- All disliked the games, found them childish and badly executed.
- They found the app rudimentary in general.
- Complained that the devices do not connect/or keep disconnecting from the app/tablet, and saw no point in using them.
- They said that the entire app is annoying to use and see no advantage in doing so.

From MAT 5 participants have dropped out by the 3rd month assessment, their data are available for baseline assessment only. The reasons were:

- One participant changed her mind about her availability 20 days after the baseline assessment. She mentioned that she was too busy with grandchildren to use the frAAgiLe application
- One participant found the games and exercises were far below her standards.
- One participant had arranged an unexpected long-term trip to the UK for medical purposes.
- One participant was not comfortable with the technology. She could not concentrate on using the app.
- One Participant got bored with the application because she managed to navigate through the games in a short period of time, therefore she had to do the same things over and over again afterwards.

After removing the dropouts, the final analysis included 33 participants.

The participants are not compensated for their time in any way, this is clearly stated during recruitment and in the informed consent. Participants are tested on 3 occasions, baseline, 3months and final assessment at 6 months. Thus far the baseline assessment and 3rd month assessment have been completed.

During the baseline assessment participants were trained on using the platform, assessed on several evaluation tests and given the devices (tablet, Squegg, fitness band). In between in-person appointments, participants received regular calls to check in that everything is going well.

Participants had a mix of backgrounds and demographic characteristics. Table 1 below depicts participants by characteristics, including demographics and cognitive status. Participant names were replaced, at storage and in all correspondence, with Participant IDs so that data cannot be tied back to individual identities.

Participants were scheduled for 1.5 - 2-hour sessions at baseline and approximately 30 minutes for 3rd and (upcoming) 6-month follow-up. Spreadsheets were used to keep track of the participant schedule, and data resulting from the assessments.

ANA also recruited 10 additional seniors who are part of the control group; these only took part in a baseline assessment where demographic data and evaluation tests were collected; they are **not** testing the solution at home. They will only be tested once more at the 6th month assessment.

*Table 1: Participant Characteristics*

| Participant | Age | Education | MMSE | Edmonton (baseline) | EQ-5D (baseline) | Health scale | Edmonton (3rd month meeting) |
|---|---|---|---|---|---|---|---|
| **ANA1** | 83 | Postgraduate | 28 | 7 | 21132 | 80 | 8 |
| **ANA2** | 69 | Professional school | 27 | 8 | 41143 | 70 | 5 |
| **ANA3** | 83 | University | 27 | 8 | 31322 | 95 | 3 |
| **ANA4** | 69 | University | 29 | 1 | 11112 | 90 | 3 |
| **ANA5** | 69 | University | 29 | 1 | 11111 | 90 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **ANA6** | 65 | Highschool + | 30 | 1 | 11121 | 90 | 3 |
| **ANA7** | 65 | Highschool | 30 | 2 | 21232 | 90 | 3 |
| **ANA8** | 70 | Highschool + | 27 | 0 | 11121 | 100 | 2 |
| **ANA9** | 61 | University | 28 | 3 | 11122 | 100 | 1 |
| **ANA10** | 69 | University | 29 | 3 | 11122 | 75 | 1 |
| **ANA11** | 73 | Professional school | 29 | 1 | 11111 | 70 | 1 |
| **ANA12** | 87 | University | 28 | 6 | 32233 | 85 | 4 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **ANA13** | 60 | University | 29 | 1 | 11111 | 90 | 1 |
| **ANA14** | 60 | University | 29 | 2 | 11112 | 90 | 2 |
| **ANA15** | 62 | Postgraduate | 30 | 0 | 21121 | 90 | 3 |
| **ANA16** | 89 | University | 25 | 1 | 21111 | 95 | 2 |
| **ANA17** | 60 | University | 29 | 2 | 11121 | 75 | 3 |
| **ANA18** | 74 | University | 27 | 7 | 21133 | 95 | 3 |
| **ANAHC1** | 75 | Undergraduate | 27 | 4 | 21124 | 85 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **ANAHC2** | 73 | Postgraduate | 30 | 7 | 32333 | 50 | |
| **ANAHC3** | 65 | Undergraduate | 30 | 5 | 21131 | 75 | |
| **ANAHC4** | 71 | Undergraduate | 26 | 5 | 21131 | 70 | |
| **ANAHC5** | 76 | Undergraduate | 30 | 0 | 11111 | 99 | |
| **ANAHC6** | 81 | Undergraduate | 30 | 2 | 11121 | 95 | |
| **ANAHC7** | 67 | Highschool | 28 | 4 | 31143 | 70 | |
| **ANAHC8** | 68 | Highschool | 28 | 3 | 11121 | 90 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **ANAHC9** | 68 | Highschool | 28 | 2 | 11121 | 90 | |
| **ANAHC10** | 65 | Postgraduate | 30 | 1 | 11121 | 90 | |
| **MAT1** | 65 | University | | 2 | 31231 | 90 | 2 |
| **MAT2** | 67 | Professional school | | 0 | 11112 | 85 | 0 |
| **MAT3** | 66 | High school | | 2 | 21131 | 85 | 0 |
| **MAT4** | 74 | High school | | 1 | 11111 | 90 | 3 |
| **MAT5** | 71 | High school | | 1 | 11121 | 80 | withdrew |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MAT6** | 65 | Post university | | 0 | 11111 | 95 | 0 |
| **MAT7** | 67 | Post university | | 0 | 11111 | 80 | 0 |
| **MAT8** | 83 | High school | | 5 | 31132 | 75 | 4 |
| **MAT9** | 81 | post university | | 0 | 11111 | 80 | 0 |
| **MAT10** | 68 | Professional school | | 2 | 11111 | 80 | withdrew |
| **MAT11** | 70 | Professional school | | 0 | 11111 | 75 | 0 |
| **MAT12** | 81 | professional school | | 3 | 11111 | 90 | withdrew |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MAT13** | 83 | High school | | 4 | 32111 | 65 | 5 |
| **MAT14** | 66 | High school | | 1 | 21122 | 75 | 1 |
| **MAT15** | 76 | University | | 1 | 11111 | 90 | 0 |
| **MAT16** | 76 | University | | 4 | 21121 | 80 | withdrew |
| **MAT17** | 71 | University | | 1 | 11111 | 90 | 1 |
| **MAT18** | 72 | professional school | | 2 | 11111 | 75 | 3 |

***Note.*** *ANA – code ID for participants recruited for the active group (those testing the platform at home) by Ana Aslan International Foundation; ANAHC - code ID for participants recruited for the control group by Ana Aslan International Foundation; MAT - code ID for participants recruited for the active group (those testing the platform at home) by Materia; MMSE – Mini Mental State Examination,*

*participants were tested only at Ana Aslan International Foundation (we wanted to make sure their cognitive status respected the inclusion criteria); Highschool + – This represents Highschool + 2 years of post-High School education.*

### 4.2.2. Study Design

Overall, the objective of this pilot was to uncover those areas where the application performed well (effectively and with satisfaction) and the areas where the frAAgile application fails to meet the needs of the participants. The data from the pilot will serve as a baseline for the next iteration of the platform (on which we are currently working on). In short, this testing serves both as means to record current usability, but more importantly to identify what improvements must be made.

During the baseline and 3rd month assessment, participants interacted with the platform and the devices. Each participant was provided with the same instructions. The platform was evaluated for effectiveness, efficiency, and satisfaction as defined by measures collected and analysed for each participant.

**Tasks a (baseline)**

Several tasks were constructed that would be representative of the kinds of activities a user might do with the system at home. These were divided into sections to reflect the measures being tested, and tasks were assigned to create a workflow representative of each measure:

1. The patient's enrolment (opening the app, forgotten password)
2. Choosing a test, opinion on needing a carer to complete some of the tests, finding the test result
3. Finding and choosing physical exercises to perform
4. Finding videos on health-related topics
5. Choosing a game, game impressions (graphics, sound, gameplay) and satisfaction (3 available games so far)
6. Using the Squegg device, ease to connect, task impression
7. Overall app impressions

## 4.3. Procedures

### 4.3.1. Procedure for baseline assessment

Upon arrival, participants were greeted and their identity was verified and then assigned a participant ID. Each participant reviewed and signed an informed consent, explicit consent and information letter. A representative from the test team witnessed the participant's signature and also signed the documents as a witness.

The person conducting the tests was an experienced practitioner; they moderated the session including the administration of the evaluation tests MMSE (ANA only), Edmonton, EQ-5D and Task list. The researcher obtained during-task rating data and took notes on participant comments. Participants were instructed to perform the tasks mentioned above (see Task a).

Note, at the baseline assessment, none of the participants had any prior experience with this iteration of the application.

While the participants were going through the tasks, the researcher was taking notes on the ease of use and the participants thoughts (see Appendix 1 – Task List a).

Participants' demographic information, errors, deviations, and verbal responses on the task were recorded into a spreadsheet. Participants were then given all the devices and were informed of the following appointment (3rd month assessment).

### 4.3.2. Procedure for 3rd month assessment

After approximately 3 months of using the application at home participants were scheduled for the next in-person assessment.

This session lasted approximately 30 minutes during which participants were tested using the Edmonton Scale and the EQ-5D Scale and performed another series of tasks on the app (see Tasks b, below).

**Tasks b (3rd month assessment)**

1. The patient's enrolment (opening the app, log in, changing the language)

2. Choosing a test, opinion on needing a carer to complete some of the tests, finding the test result

3. Finding and choosing physical exercises to perform

4. Finding videos on health-related topics

5. Choosing a game, game impressions and satisfaction (3 available games so far)

6. Using the Squegg device, ease to connect, task impression

7. Using Mementia exercises, task impression

8. Overall app impressions

Participants' errors, deviations, and verbal responses on the task were recorded into a new spreadsheet. Participants were then informed of the last appointment (6rd month assessment - yet to be completed).

## 4.4. Test Locations

At ANA, the test facility included a quiet testing room with a desk, and recording computer for the administrator. Only the participant (and when available his carer) and administrator were in the test room. To ensure that the environment was comfortable for users, noise levels were kept to a minimum with the ambient temperature within a normal range.

At MAT, participants chose to be tested in their own home (due to the prevailing epidemiologic context).

### 4.5. Test Forms and Tools

During the baseline assessment and 3rd month assessment, various documents and instruments were used:

· Informed Consent, Explicit Consent and Information Letter

· Researcher's Guide (Task list a & b, for baseline and 3rd month assessment respectively)

· Evaluation tests (MMSE, Edmonton and EQ-5D)

Examples of these documents can be found in Appendices 1 and 2.

## 5. Results

### 5.1. Participant demographics (for both baseline and 3rd month assessments)

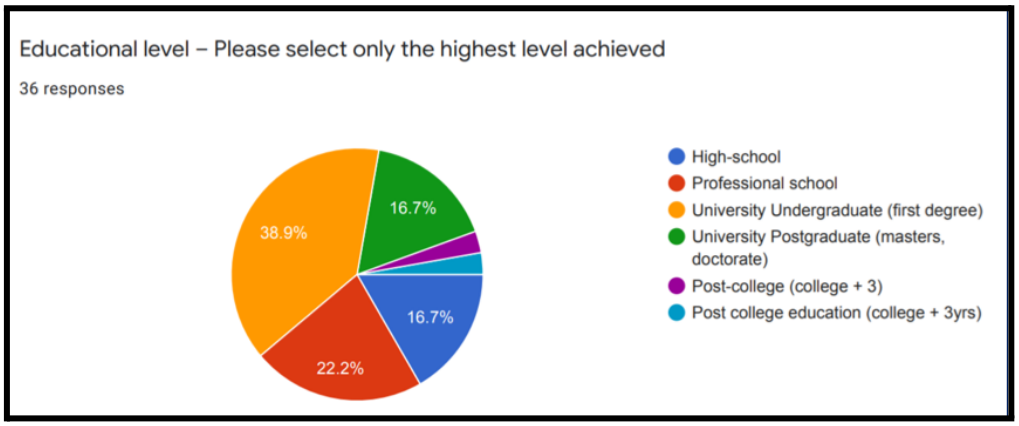
36 participants in total (18 participants from Romania and 18 from Cyprus) responded to the survey.

Age: Mean age of participants was 70,92 (60 – 83 yrs.). Half of the participants were between 60-69 yrs., 15 were between 70-79 yrs. and 3 participants were over 80.

Gender: 23 participants were female and 12 were male. 1 participant chose not to respond related to their gender.

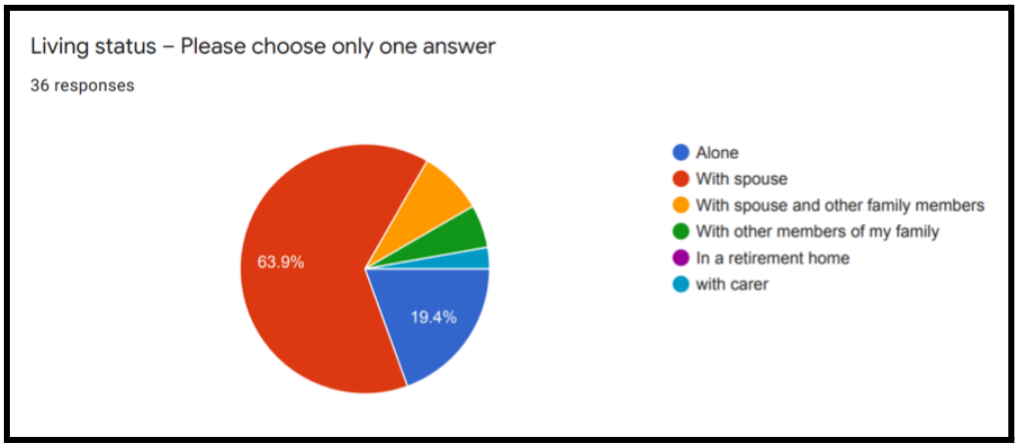
Level of education: The majority of participants (22) attended University, of which 14 were educated at undergraduate level and 8 at postgraduate level; 6 participants graduated high school and 8 professional school (see Figure 1).

*Figure 1. Participants level of education*




Living status: the majority of participants (23) live with their spouse, 3 participants live with their spouse and other family members, 2 with other family members , 1 with a carer and 7 live alone (see Figure 2).

Figure 2. Participants living status




Area of residence: the vast majority of participants (33) live in an urban area , 2 in a semi-urban area and 1 in the rural area.

## 5.2. Results from baseline assessment

### 5.2.1. Tests/App

#### 5.2.1.1. Graphics comments

"Graphics are just ok"

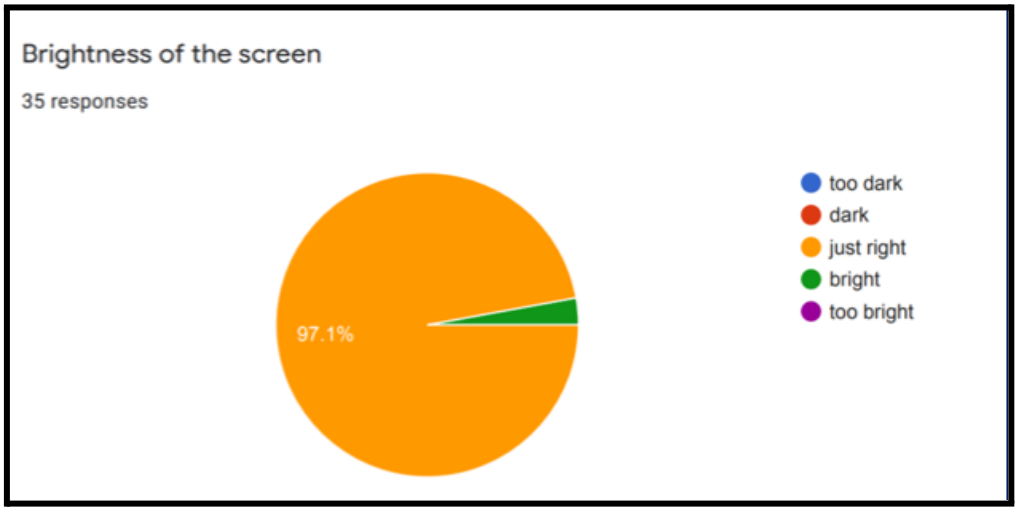
"When the game starts it should be in another colour. Usually red indicates something which is invalid."

"Liked it"

#### 5.2.1.2. Brightness of the screen

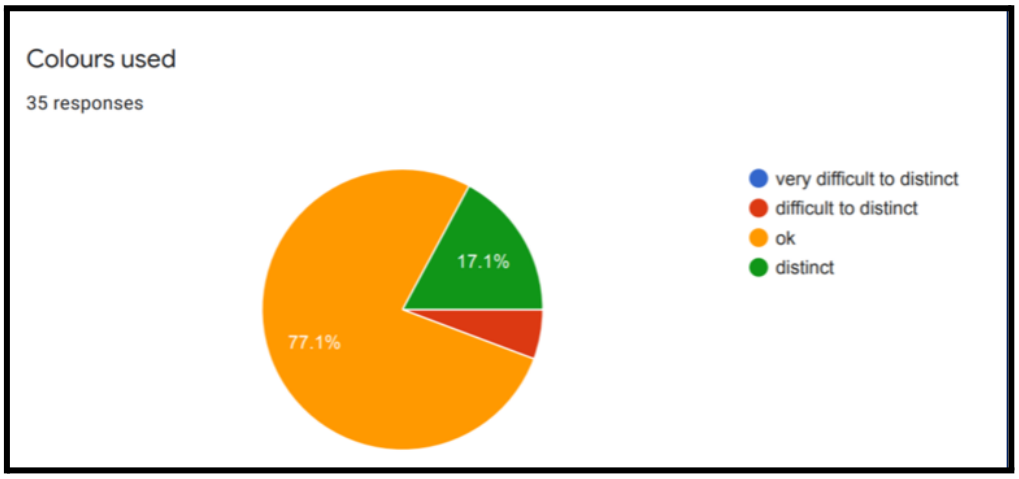
The majority of participants were satisfied with the brightness of the screen, 34 out of 35 considering it "just right" and only 1 qualified it as "bright" (see Figure 3).

*Figure 3. Rating on screen brightness*




Colours of the screen were seen as "ok" by the majority of participants (27), 6 found the colours as distinct and only 2 as "difficult to distinguish" (see Figure 4).

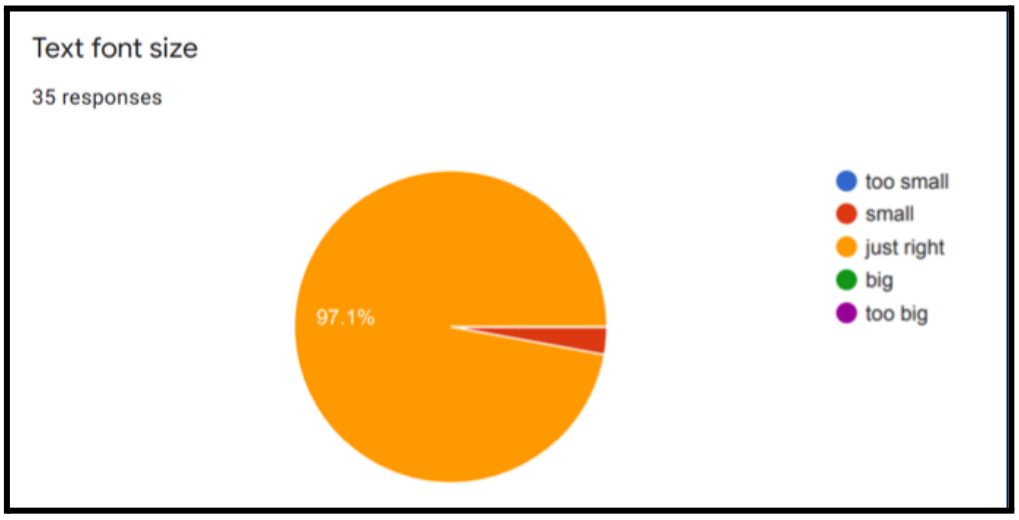
*Figure 4. Rating on screen colours*




### *5.2.1.3. Text font size*

34 out of 35 participants consider that text font size is "just right" with only one respondent considering the font size small (see Figure 5).

*Figure 5. Rating on text font size*

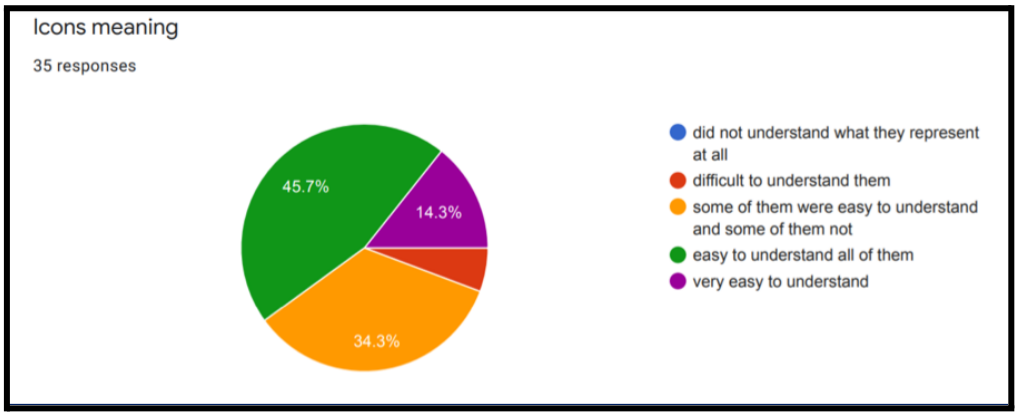



### 5.2.1.4. Icons

All but one participant were satisfied with the size of the icons. The level of satisfaction was lower with regard to how easy it was to understand the meaning of the icons. 2 participants had difficulties understanding the meaning of the icons and 12 reported that

"some of them were easy to understand and some of them not". For 16 participants, icons were easy to understand and for 5 very easy to understand (see Figure 6).

*Figure 6. Rating on ease of understanding icons meaning*




**5.2.1.5. Some comments:**

"Very well understood"

"Needed a lot of guidance"

"The entire graphics of the app is rudimentary"

"Very easy"

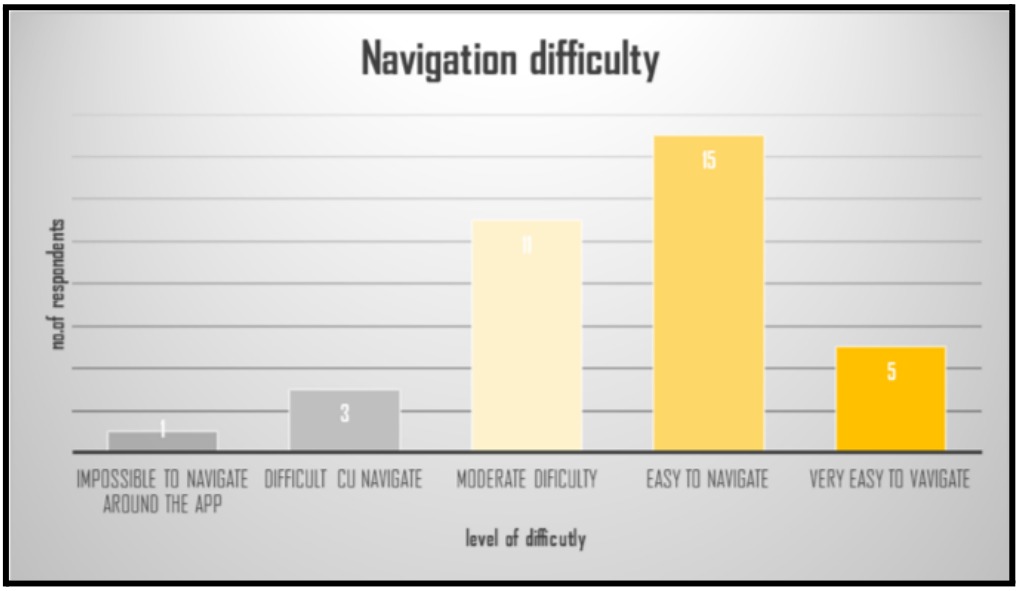
"Need some guidance"

### 5.2.2. Input & flow

#### *5.2.2.1. Navigation difficulty*

Navigation difficulty obtained a score of 3,57 out of 5 with 20 participants considering the device easy (15) and very easy (5) to navigate, 11 rated the level of difficulty as moderate and 3 as difficult and 1 as impossible. 3 of the participants having difficulties navigating were over the age of 80 (see Boxplot 1).

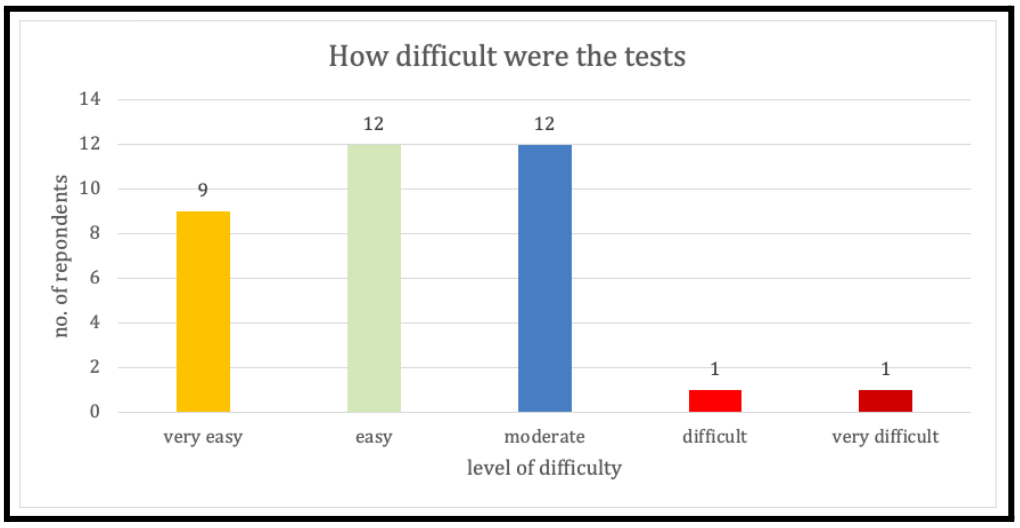
*Boxplot 1. Rating on navigation difficulty*




### *5.2.2.2. Evaluation tests difficulty*

Test difficulty obtained a score of 3,57 . 21 the participants (the majority) considered the tests as easy (too easy). Two participants considered the tests difficult – both were over the age of 80 (see Boxplot 2).

*Boxplot 2. Rating on the difficulty of performing evaluation tests*




### *5.2.2.3. Some comments*

“It’s not an intuitive system, I cannot tell what comes next. It does not work well.”

"[I would like] To have a built in BMI calculator - rather than have the user do it separately and then enter the value."

"Very easy. More [tests] should be added ."

"More evaluation tests."

"Need to add more evaluation tests."

"Very easy [to perform]."

"Needed guidance to perform any test."

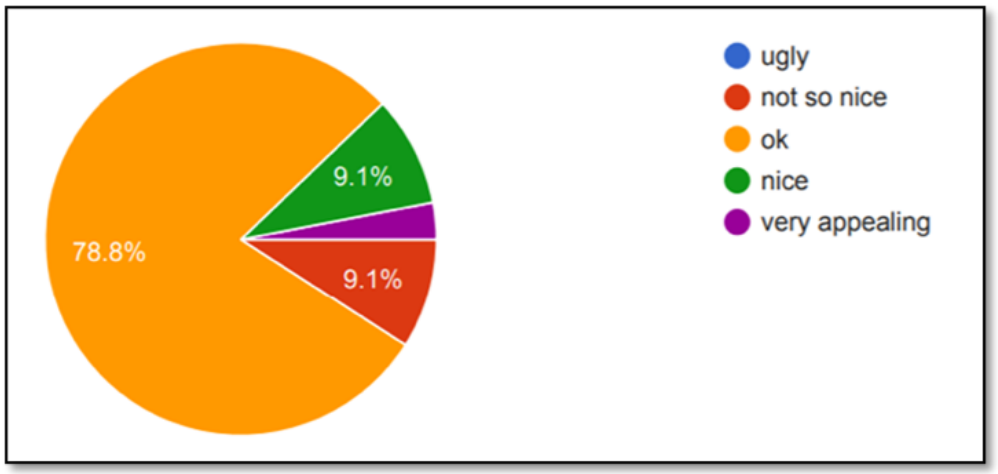
### 5.2.3. The Games

#### *5.2.3.1. SAPA*

##### 5.2.3.1.1. Graphics: Landscapes and models

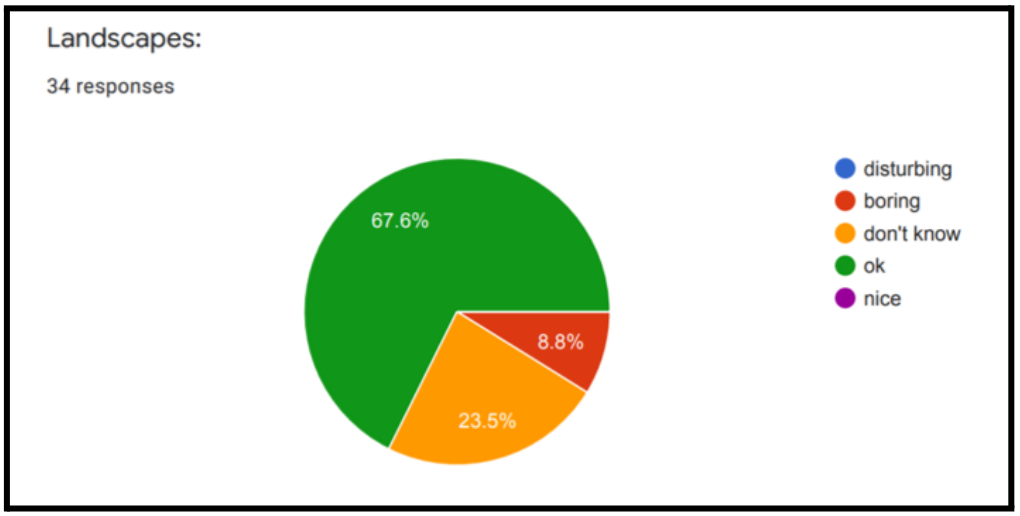
Overall opinion on the graphics was average with a score of 3 out of 5, the majority of participants rated it as "ok, nice or very appealing". Only 3 participants were not satisfied with the graphics of the game (see Figure 7).

*Figure 7. Rating on SAPA game graphics*



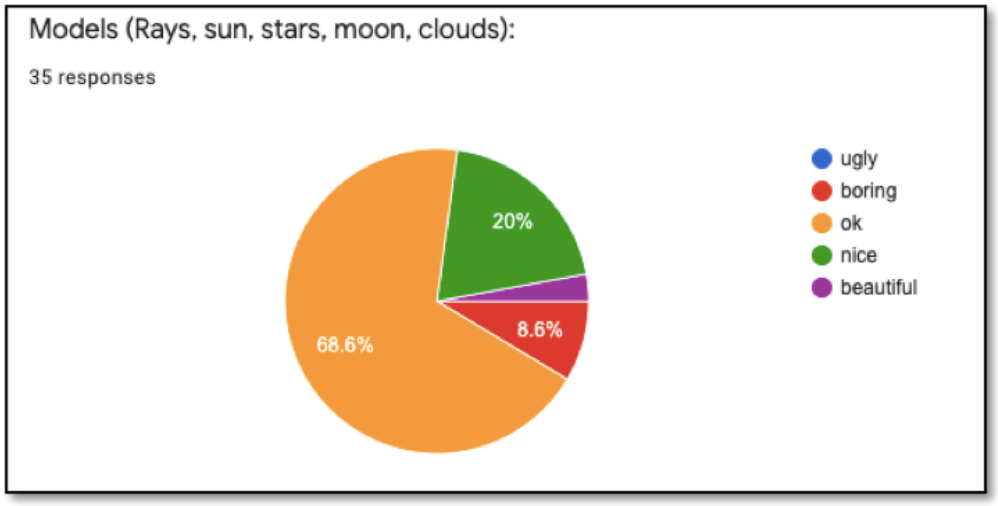
No responders rated  landscapes as nice. The majority (23 participants) rated landscapes as “ok” and 8 did not know how to appreciate the landscapes, while 3 participants considered them as boring (see Figure 8).

*Figure 8. Rating on SAPA landscapes*




The level of satisfaction with the graphic elements (models) is a bit better with 1 respondent considering them as “beautiful”, 7 as “nice”,  24 as “ok” and 3 participants thinking that graphic elements were boring (see Figure 9).

*Figure 9. Rating on SAPA graphic elements (models)*

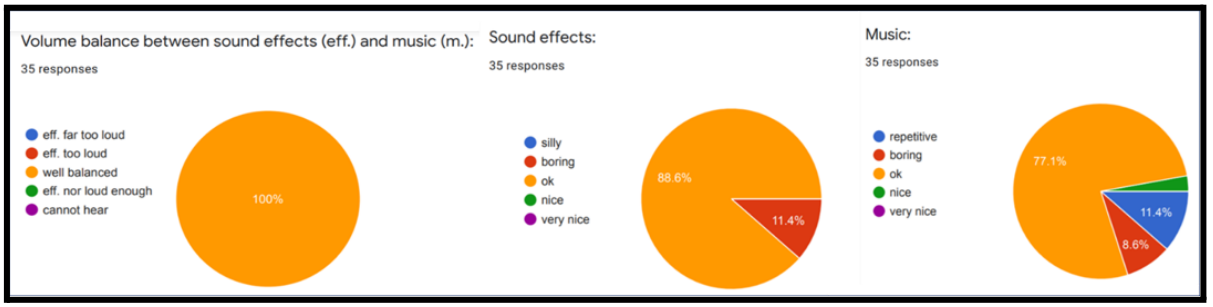



#### 5.2.3.1.2. Sound

Auditive elements (sounds, music, volume balance between sound effects and music):

Volume balance between sound effects and music was considered well balanced by all participants. None of the participants rated the sounds as nice or very nice and 4 rated sounds as boring. The majority of participants (31) rated the sound as ok. 4 participants thought the music was repetitive, 3 rated music as boring, 1 as nice and 27 as ok (see Figure 10).

*Figure 10. Rating on SAPA auditive elements*

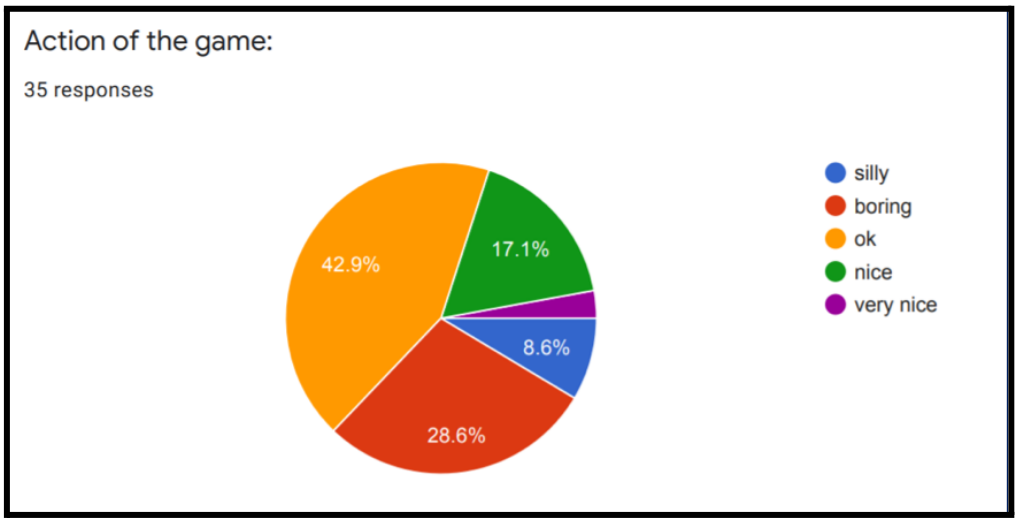


#### 5.2.3.1.3. Input & flow

Action of the game: has a mean score of 2.77 out of 5: 3 participants considered the game to be silly, 10 as boring, 15 as ok, 6 as nice, 1 as very nice. Thus, even if the majority of participants (57%) have a positive appreciation of the action of the game, 43% of participants are clearly dissatisfied.

Overall difficulty of the game has a mean score of 2.34 out of 5, with 20 participants considering the game easy and very easy, 10 participants considered the difficulty as moderate and 5 as difficult.

*Figure 11. Rating on SAPA game play (action)*




#### 5.2.3.1.4. Some general comments on SAPA game

“Not very interested in the SAPA games. Tried them but I find them boring. The Sun is not moving.”

“The tutorial is difficult to follow.”

“Sun is not moving, so [he] doesn't play the game.”

"It moves very slowly, with my fingers even slower. Annoying!"

"Sapa games are very boring. I don't want to play Sapa Normal [normal difficulty levels] because the sun is not moving, so I gave up."

"Liked it at the beginning, but then it got very boring. She gave up using it. Sapa Normal [normal difficulty levels] is not functioning well, because the sun is not moving."

"Sapa Normal [normal difficulty levels] sun not moving. Needs improvement."

"There should be verbal instructions. It is not intuitive what I have to do."

"I'd rather do physical activities (walk) rather than sit and play games."

"A lot of improvements should be done."

"Sapa Basic [easy difficulty levels] is very easy and boring. Sapa Normal [normal difficulty levels] although it is a bit more challenging, since I cannot move the sun I gave up on it!"

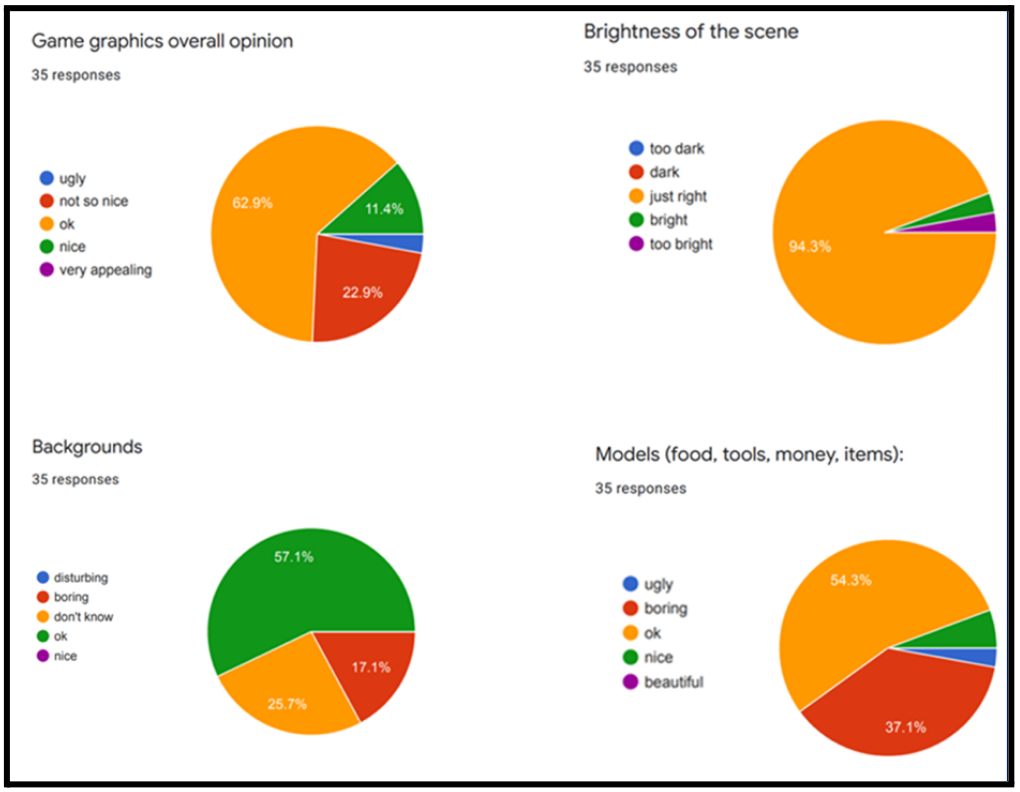
"Improve the Sapa Basic [easy difficulty levels] game."

#### *5.2.3.2. Chop it!*

##### 5.2.3.2.1. Graphics

Overall graphic presentation of the game gained a score of 2.82, out of 5; with most participants (22) rating it as ok and 4 as nice; 9 participants were dissatisfied with the graphic presentation of the game (8 rated it as not so nice and 1 as ugly); no respondent rated game graphics as very nice. The lowest score was obtained by graphic elements with 14 participants considering them as boring (13) or ugly (1), only 2 participants rating them as nice and no respondent as very nice. The majority of participants (19) rated graphic elements as ok (see Figure 12).

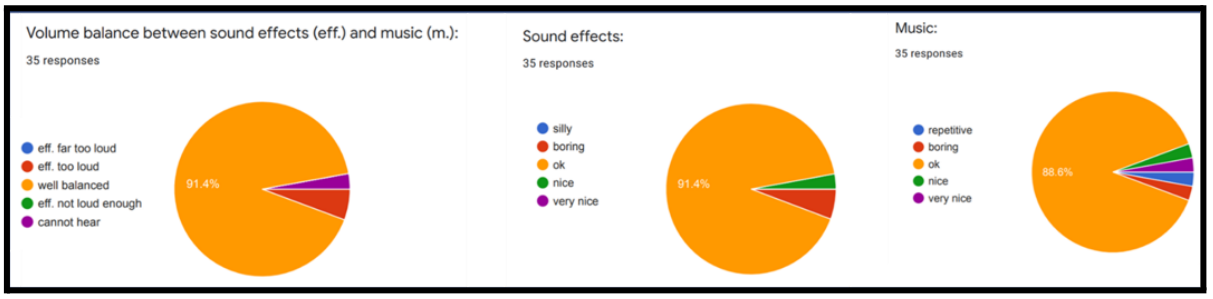
*Figure 12. Rating on Chop it  game graphics*




### 5.2.3.2.2. Sound effects

Music obtained a mean score of 3 out of 5: 33 participants were satisfied with the music (31 – responded ok, 1 nice and 1 very nice); only 1 respondent rated it as repetitive and 1 as boring. 2 participants considered sound effects as boring, 1 as nice and the rest as ok. 1 participant could not hear the sounds, 3 considered effects as too loud and the rest of 31 participants considered the volume as well balanced (see Figure 13).

*Figure 13. Rating on Chop it sound effects*

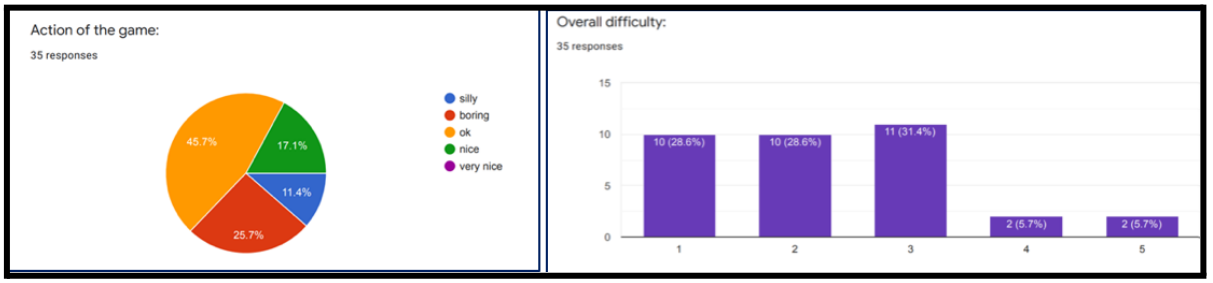



#### 5.2.3.2.3. Input & flow

Action of the game- received a score of 2.5 of 5: 6 participants rated the game as nice, 16 as ok, 9 as boring and 4 as silly. The level of appreciation for the game was similar among women (2.34) and men (2.8).

Difficulty of the game received a score of 2.3 of 5: with 20 participants rated the game as too easy (to 10 easy; 10 easy), 11 as average and 4 as difficult. All participants who rated the game as difficult and very difficult were over the age of 80 (see Figure 14).

*Figure 14. Rating on Chop it sound effects*




#### 5.2.3.2.4. Some general comments on Chop it

“I don't know how to start the game - add a start button.”

“A bit boring and games should be more challenging.”

“Recipes get me confused when I have to choose the ingredients.”

“The models (food, etc.) better highlighted, make them more distinguishable.”

“ It’s interesting for me because I like new things, however, the game is for children.”

“The images/overall game is not expressive enough, some of the figures are unclear.”

“Recipes not right.”

“Very easy game.”

“Not interested in this game so much.”

“[she didn’t know how to star] I didn't realize that I had to look at the list to see the ingredients.

“Not my type of game to play.”

“The easy level has no sound. There should be sound instructions describing the models/food products.”

Observation: She became impatient (and annoyed) when playing the normal levels (as opposed to the easy version)because she could not do it properly.

Observation: She likes playing Sapa basic and chop it memory games.

“Very easy for me.”

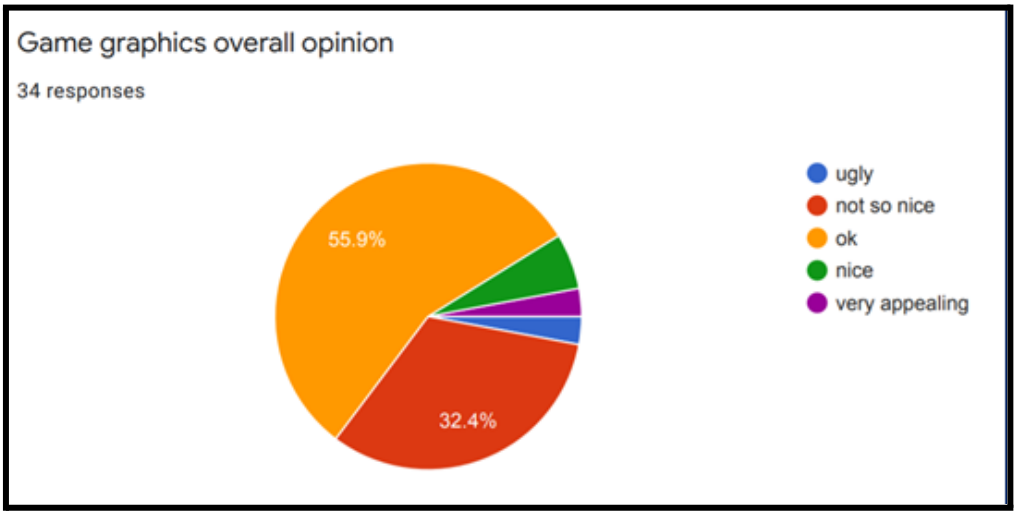
“Not interested in the Chop it game.”

#### *5.2.3.3. Sailgility*

**5.2.3.3.1. Graphic presentation**

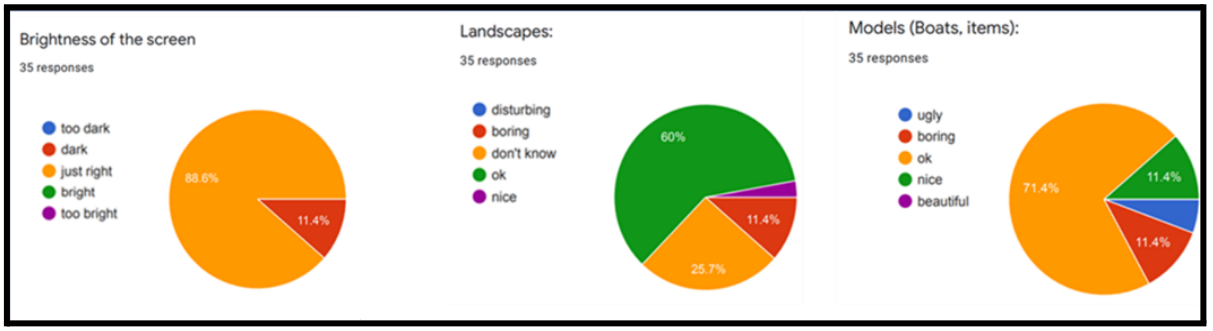
Overall graphic presentation of the game gained a score of 2.74. 22 participants were satisfied with game graphics, 1 rated it as very nice, 2 as nice and 19 as ok. 12 participants were dissatisfied with the graphics 11rated it as not so nice and 1 as ugly (see Figure 15).

*Figure 15. Rating on Sailgility general graphics effects*




31 participants considered the brightness as ok, 4 participants rated the brightness as too dark. Landscapes obtained a score of 3.52 out of 5 with 1 participant rating it as nice, 21 as ok, 4 as boring. The mean score for the models used in the game was 2.88. 4 participants rated the models as nice, 23 as ok, 2 participants as ugly, and 4 as boring (see Figure 16).

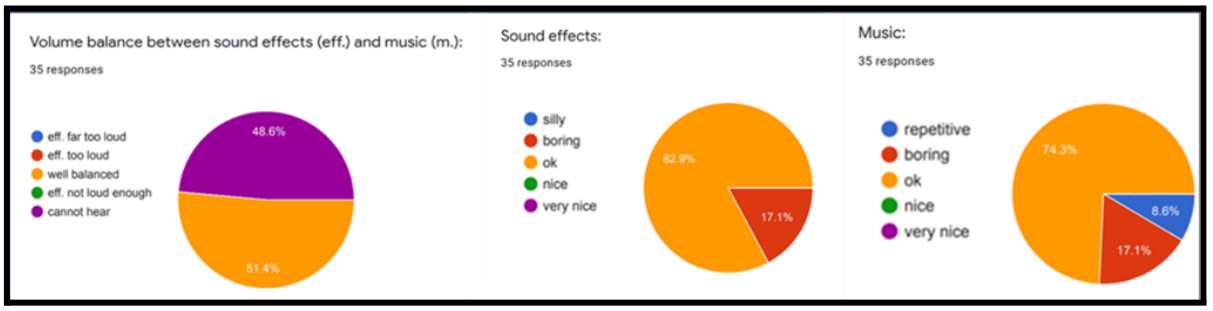
*Figure 16. Rating on Sailgility individual graphics effects*




### 5.2.3.3.2. Sound

Sound effects obtained a mean score of 2.6 out of 5. 25 participants rated sound effects as ok and 6 as boring. Music: 26 participants rated music as ok, 3 as repetitive, 6 as boring. 18 participants considered the volume balance as appropriate; 17 could not hear (did not notice it) (see Figure 17).

*Figure 17. Rating on Sailgility sound effects*




### 5.2.3.3.3. Input & flow

Action of the game- received a score of 2.63 of 5 : 6 participants rated the game as nice, 14 as ok, 11 as boring and 4 as silly.

Difficulty of the game received a score of 2.4 of 5 : with 21 participants rated the game as too easy (16 easy; 5 very easy) , 10 as average and 3 as difficult and 1 as very difficult. Two of the participants who found the game difficult were over 80 years old, one 65 and one73 yrs. and all were female.

#### 5.2.3.3.4. Some general comments on Sailgility

“The mannequin should be replaced by a physical person. In some cases, it is not so clear what exercise is performing.”

“Sometimes I don't understand what exercise is performed by the mannequin.”

“Squegg is too strong for the participant to use. Preferred not to use it.”

“When I start the game the screen flips without any input from me. The app is slow.”

“The game, graphics and action are very simplistic.”

“When launching the app, the screen turns.”

“Exercises performed by the mannequin are very easy and boring.”

“The screen flips when the game starts and I cannot flip it back.”

Observation: Needed help

### 5.2.4. Some of the participants views on the overall platform:

“There is a delay between my input and the game's reaction.”

“[for the easy version of Sailgility] I cannot tell if I am doing the correct movements, there should be some feedback (maybe use the camera).”

Observation: The screen kept turning for Sailgility, which annoyed her.

“Childish!”

“Games should be more advanced.”

“Finds the whole frAAgile program very easy, boring and not appealing.”

“I hardly imagine what benefits playing these games could bring to me!”

"I keep forgetting that in order to go back to the main menu in the app I need to press the button labeled."

"FRAAGILE. Use a different name."

"All the games have to become more appealing and challenging."

"More games with advanced levels."

"Improvements are needed in the Sapa games, more advanced levels, more evaluation tests."

"Improve Sapa game, add more levels."

Observation: Far too easy for the participant. Got very bored playing the games, very repetitive and there were no changes for a long time. Withdrawn from program.

"The app is in a very rudimentary form. It's very unintuitive - and we were graphical engineers. It was not clear to me if the platform actually records my movements (especially for Sailgility basic). These things get me frustrated, bore me and make me not want to use the platform/play."

Observation: Had to withdraw because he could not follow the procedure.

"Very easy games for people of my age. More advanced games should be added in order to cover more age."

## 5.3. Conclusions from the Baseline Assessment

### 5.3.1. Required Improvements

#### *5.3.1.1. Overall system*

More intuitive icons as one third of respondents had difficulties understanding some of the icons' meaning

More diversified tests.

#### *5.3.1.2. SAPA*

Solve the technical issue with the Sun not moving properly.

Include a written tutorial that is easier to understand.

Add more levels, which are more challenging.

#### *5.3.1.3. Chop It!*

Improve figures graphics: some of the models/food items are unclear.

Include a start function.

Improve tutorial – several respondents did not understand what they were supposed to do.

#### *5.3.1.4. Sailgility game*

Solve technical problems with:

- the sound - some levels have no sound.
- the speed – "*the app is slow*".
- *"upon starting the game, the screen flips without any input"*
- *"the delay between player's input and the game reaction"*
- "the mannequin [explaining the movements] with a real person instead"

While the device is generally player friendly and easy to navigate, the main issue identified by this survey is that tests and games are not very appealing to respondents. They required more entertaining, diversified and age appropriate games and tests. Another issue pertaining to the games is that the instructions should be clearer.

### 5.4 Results from the 3rd month assessment

### 5.4.1. Start/Home Screen

#### 5.4.1.1. Login function (18 participants from ANA)

- this function was easy for all 18 participants.
- 1 could not remember her password – they suggested text/SMS recovery would be useful.

#### 5.4.1.2. Home screen - Opening the app (18 participants from ANA)

- this function was easy for all 18 participants.
- 1 participant needed to press multiple times.

#### 5.4.1.3. Changing the language (18 participants from ANA)

- this function was very easy for 15 participants .
- 1 participant did not find it straight away but managed without help.
- one participant needed help - did not know where the settings were.

### 5.4.2. Finding different sections of the app (tests, games, videos, ect.)

#### 5.4.2.1. Choose an evaluation test (18 participants from ANA)

- this task was very easy for 13 participants
- on 1 tablet - The calendar was not showing even though it was showing when it was set up at the baseline assessment
- one participant needed to press repeatedly - Quote: "You have to press 10 times to select an answer. I don't think the tablet is the problem, rather I think it is the software."
- one participant still does not find the task as intuitive – Observation: after selecting an answer he waits for the next screen to appear automatically, he forgets that he needs to press next.
- chose IQCODE -Some difficulty in selecting/pressing answers.
- all participants required for more tests to be added

#### 5.4.2.1.1. Some evaluation tests can only be performed with a carer (18 participants ANA)

- all 18 participants did not mind having a carer to monitor them/perform the tests with
- 7 participants mentioned that they do not need a carer yet

#### 5.4.2.2. Find the games section

- easy for all 18 participants

#### 5.4.2.3. Find information videos (26 participants from ANA + MAT)

- easy for all 26 participants
- 5 mentioned they had no interest in videos as they can use internet/YouTube for that
- 4 complained that there are very few videos and nothing interesting
- 10 participants would like to see more videos about other topics. Quote: "Very few topics. I want a variety especially with recent topics like Covid and climate change".

#### 5.4.2.4. Find Physical Exercises section (26 participants from ANA + MAT)

- easy for 20 of the 26 participants
- 3 participants needed help at all exercises
- for 1 participant the dragging exercises in Kwido Mementia were very difficult
- 3 participants struggled with SPPB - Quote: "Its impossible to do on your own. Even if I were to put the tablet down somewhere, then I would not see from that distance what is going on". Observation - They had to give access to the camera from the settings, they did not know how to do that on their own.
- 1 participant found the voice in SPPB annoying and horrible [the speech function does not work in Romanian] and they think its impossible to complete without help.

- 7 participants consider that more exercises should be added and all should advance to new levels.
- 4 participants found physical exercises useful
- 3 participants would not use the application
- 2 participants had to be reminded where they would search for the exercises categories

#### 5.4.2.5. Find the Heath Results section (18 participants ANA)

- easy to find for 6 participants (1/3)
- 9 participants could not find the results on the first try as they looked in the Tests section, but eventually (after browsing) found it.
- 1 participant complained that some of the font sizes are too small.
- several participants do not understand the test results - requested a more detailed results output.

### 5.4.3. Selecting an exercise

#### 5.4.3.1. GRIP ME (19 participants ANA + MAT)

- for 2 participants the Squegg could not pair with the app.
- 4 participants could not connect the Squegg on their own.
- 3 participants use it offline at home.
- 6 participants use it regularly; 2 find it useful - one finds that her hands go numb at night, and by using the Squegg they don't go numb..
- 6 participants can connect it but do not use it; they played a bit at the beginning but then stopped. 1 participant suggested a more engaging interface – Quote: “something with driving a car or that game from the fun fair where you hit something with a hammer and they tell you how strong you are (with lights and sounds) - something that is visually appealing.”

***Areas for Improvement***

- We should create visual instructions on how to connect and charge Squegg

#### 5.4.3.2. Kwido Mementia (31 participants ANA + MAT)

- 10 participants (MAT - Greek version) –still have the Spanish version, request translation; 1 participant complains that the Greek translation is very bad - Sentences do not make sense.
- 2 participants liked it but would not play more than once or twice - Quote: "I would not play it more than once. The first time you play you are curious to see what it has to offer, but it does not engage you so that you want to play again."
- 7 participants like it without any complaint - Quote: "They are easy but I would play this because they are based on logical thinking."
- 1 participant likes it but would prefer it to be more complex, difficult
- 1 participant – Quote: “I like the game but the results do not always reflect the reality”
- 1 participant has difficulty completing the levels where you have to drag items.
- 2 participants - The images could not be placed on the squares. Observation - the game probably had an error.
- 1 user reported there were some errors in the games
- 1 participant – Observation - the game did not display properly on his tablet (though it did on others) the bottom part of the screen was cut out so he did not see all of the answers. We didn't know how to change it.
- 1 participant – Observation - There were game errors again, instruction did not correspond to the answers.

### 5.4.4. Games

#### 5.4.4.1. Sailgility (33 participants ANA + MAT)

- 1 participants / Normal version [normal difficulty levels] – Observation - she cannot play, and she finds it too difficult.
- 8 participants reported that the music cannot be heard in some cases
- 8 participants reported that animations are not downloading.
- 1 participants asked for more advanced exercises

- 5 participants preferred a real person instead of a mannequin performing the exercises
- 4 participants reported that for the Normal version [normal difficulty levels] the tablet movement does not synchronise well with the game - Quote: "The delay (between tablet movement and game reaction) is annoying. Rudimentary graphics."
- 5 participants reported like it and play often
- 2 participants reported that they dislike the Easy version but like the Normal version: Quote: "The easy version does nothing." The normal version is actually nice, I played it a few times - still I cannot seem to win the game though".
- 3 participants reported that the coordination is too slow - Quote: "The game responds very slowly; the graphics are bad and the movement makes you dizzy."
- 4 participants consider the game is boring and not engaging.

#### 5.4.4.2. SAPA (33 participants ANA + MAT)

- 13 participants reported problems with the sun movement
- 10 participants consider the game very easy or childish; they want more levels and additional memory/puzzle games. Quote: "These are cheap games - they are not relevant for our age - even if I were suffering from mental problems (they meant cognitive impairment) they would not help with anything - they would just annoy me. "
- 6 participants like the game
- 1 participant reported errors at the end - Quote: "I keep getting an error at the end of the game when I get the sun on the box."
- 2 participants reported that an error appeared for every game – “An error has occurred. You need to choose to cancel to continue.”
- 2 participants said that SAPA Normal is slow - Quote: "It moves annoyingly slow, I don't have the patience to play."

- 1 user regarding the Easy version - she noticed that this game does not give them encouraging feedback, and wanted it – Quote: "Why is it not telling me well done again?!"
- 1 participant mentioned that for people whose hands tremble (like them) these types of games are difficult to complete.

#### 5.4.4.3. Chop it (21 participants ANA + MAT)

- for 5 participants the recipes got them confused when they had to choose the ingredients.
- 7 participants reported that the tutorial instructions are not clear; they did not know how to start playing the game, where to get the ingredients - Quote: "Horrible game.. The instructions are unclear. Even if you follow the tutorial when you try to do what it said you still get it wrong. You get annoyed playing this game!"
- 9 participants found the game too easy/boring/childish: Easy version [easy difficulty levels] - Quote "For a younger person it's easy. Too easy even for me."; Quote: "The theme bores me. Maybe at nursery they want to sort apples with oranges...completely inadequate for our age. It makes you feel that at this age everyone expects you to be mentally retarded"; 2 of them found the game "annoying"
- 5 participants complained that the items in Chop it Basic [easy difficulty levels] move too fast: Quote: “the fast movement hurts my eyes, I cannot focus on the moving items."
- 2 participants reported that the game has errors.
- 2 participants complained that the ingredients do not fit the recipes’, they are not intuitive
- 1 participant – Quote: “on the main screen buttons are overlapping”
- 3 participants had problems with translations still missing
- 4 participants enjoyed the games

- 1 participant liked the game but forgot half way through what food she needs to find the ingredients for - Observation - Maybe display the name of the food on the screen?
- 1 participant liked the game but proposed that some more traditional recipes would be good to have

### 5.4.5. Some of the participants views on the overall platform

They wanted some of the items/figures to be more natural (i.e. in Chop it, Mementia), better translations, clearer instructions (games and tests).

Quote: "I think you need to add content that is actually interesting. And clear instructions, you could add trial levels to make sure people understand."

Quote: "Apart from the games, which I dislike, the platform is ok. The tests seem relevant to our age."

Quote: “I would like more complex games and to improve the platform, to be easier to play with it”

Quote: “More games and to run easier”

Quote: “I expect the platform to improve, to be more attractive and stimulating, applications should run easier, more interesting games.”

Quote: “Easier to use, better synchronisation between tabled input and system/game reaction. To get positive feedback for all the games. To have more games.”

Quote: “A more intuitive and better responding software.”

Quote: “The games are very childish. Plus, they are so slow in responses you get annoyed playing.”

Quote: “Better graphics, more attractive content. Alerts to remind him to do the tests and play the games something that is said in a fun way like Quote: "You beat me the last time, want to try again?"

Quote: “Better games, games that engage/stimulate you.” She thinks there is no need for the exercise and learning sections, you can get those by other means. She does not trust the test results.

## 6. Comparison between Squegg and Jamar

### 6.1. Design

We used a repeated measures design to control for individual differences between participants. Participants were given numerical IDs and assigned to start with either the Squegg or the Jamar device first. Right- and left-hand grip strength of odd (ID) number participants were measured with the Squegg dynamometer first and the Jamar dynamometer second. Even (ID) number participants were measured in the opposite sequence. The design is consistent with the Mathiowetz et al. (2000) study, which compared the Jamar and Baseline dynamometers and Mathiowetz (2002) study comparing Rolyan and Jamar dynamometers.

All instruments were checked for damage and inspected for proper function and the Jamar device was recalibrated right before the start of the study. Standard procedures recommended by the American Society of Hand Therapists (Fess, 1992) were followed to collect grip strength data. Participants were seated with their shoulders adducted and neutrally rotated, elbow flexed at 90°, forearm in neutral position and wrist between 0 and 30° of flexion and between 0 and 15° of ulnar deviation. After participants were positioned appropriately they were instructed to squeeze the dynamometer, standard verbal reinforcement was given, 'Harder! ... Harder! ... Relax' (Mathiowetz et al., 1984, p. 224; Mathiowetz, 2002). Three measurements were taken for the right hand and then the left hand, in alternating sequence to control for potential fatigue effects. The time between trials was about 15 seconds, which is the time needed to read and record each score. The mean of the three trials is then used for data analysis. Following the measurement of the right hand with the first dynamometer, there was a timed 5-minute interval until the right hand was tested again with the second dynamometer. The left hand was tested during this 5-minute interval. Based on a previous study (Mathiowetz, 1990), the time between trials and between dynamometers represents the adequate amount of time to reduce the risk of fatigue (Mathiowetz, 2002).

#### 6.2.1. Participants

The sample included 20 females and 20 males, right and left-hand dominant. All participants were healthy and free from any neuromuscular, orthopaedic dysfunction affecting hand strength, all patients with injuries, deformities, degenerative or inflammatory functional limitations of the upper extremities as well as patients with dementia, a history of brain injury or stroke, were not included in the study. Participants were aged between 55 – 89 and were predominantly self-reported right-handed (NR = 38; NL = 2).

### 6.2.2. Data Analysis

The mean of the three trials from each hand (3 measures for the left a 3 for the right, alternating each hand) for both devices was used for data analysis. The influence of which device was used first (starting device) to measure maximal grip strength (MGS) on overall mean MGS was analysed using one-way analyses of variance ANOVAs for each device. Statistical differences in overall MGS between gender (male vs female) was calculated using analyses of variance ANOVAs for each device. Paired-samples t-tests were used to compare overall mean MGS, and mean MGS for each hand, between the two devices.

The inter-instrument reliability between the Jamar Dynamometer and Squegg was analysed using intraclass correlation (ICC). ICC values of less than 0.5, between 0.5 and 0.75, between 0.75 and 0.9, and greater than 0.90 indicate poor, moderate, good and excellent reliability, respectively. The ICC values were calculated for all data collectively, as well as separately for each hand. The correlation between the Jamar Dynamometer and Squegg  measurements across all participants, age and gender was also calculated using Pearson's correlation.

Statistical significance was calculated at a 95% confidence level ($p < 0.05$).

## 6.3. Results Mean MGS

Figure 1 shows the mean MGS for each hand on the three trials, with each device. There were no significant differences between the overall mean MGS scores as measured with the Jamar Dynamometer (M=29,2; SD=10.42) and with the Squegg device [(M=29,2; SD=8.56); t(-.002), p=.988]; no difference between mean scores for the right hand as measured with the Jamar Dynamometer (M=29,59; SD=10.56) and with the Squegg device [(M=29,92; SD=8.45); t(-.370), p=.713]; no difference between mean scores for the left hand with the Jamar Dynamometer (M=28.81; SD=10.73) and with the Squegg [(M=28.49; SD=8.96); t(.357), p=.723].

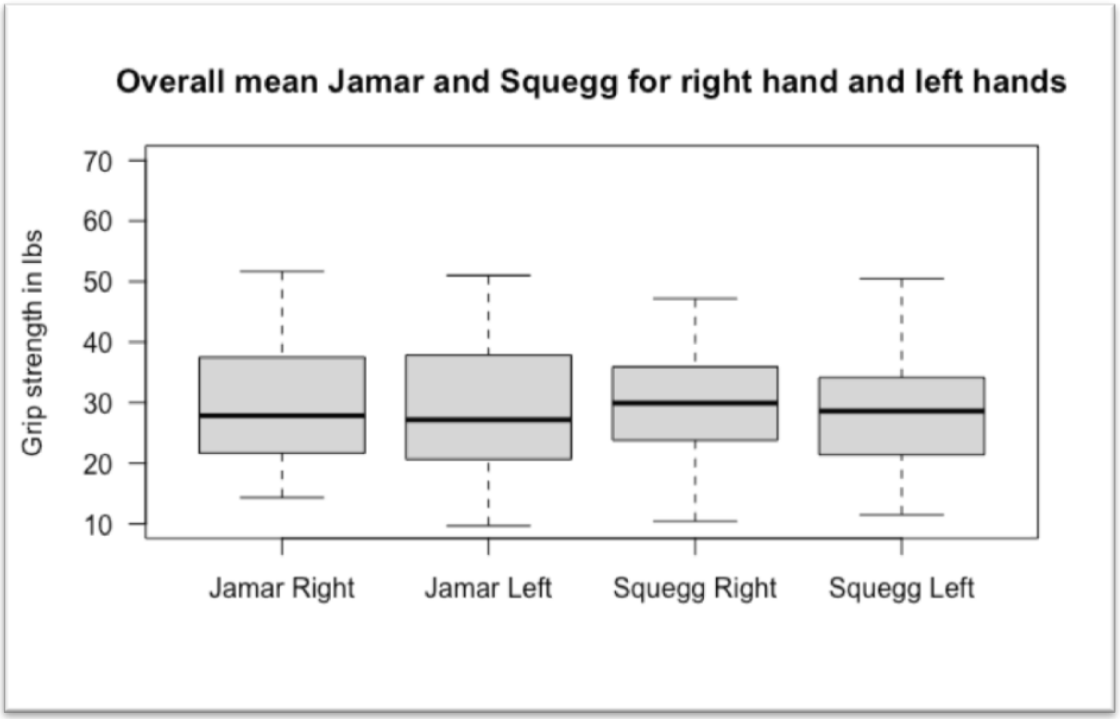



Figure 1. Mean MGS for both hands, right and left hands measured using Jamar vs Squegg. There were no significant differences between MGS measured using Jamar vs. Squegg for the comparisons performed (see reported paired t-test).

There were  significant differences in overall mean MGS between participants that started with the Jamar Dynamometer (M= 25.64; SD=7.2) and those starting with the Squegg (M= 32.77, SD=9.64) (F(1,39)= 7.038 p=.012) suggesting that the starting device influenced the results.

Significant gender differences were found with both instruments with men having higher overall mean MGS compared to women (p<.001 for both instruments).

A Pearson correlation was calculated between the Jamar Dynamometer and Squegg  measurements across all subjects, age ranges, genders and hands. The Pearson correlation coefficient ρ was 0.85 (p < 0.001), indicating strong agreement between the two devices.

Inter-instrument reliability was tested using intra-class correlation (ICC). The overall ICC value was computed across all data collectively. It resulted in an overall ICC of 0.912 ([0.83 - 0.95]; 95% CI) which indicates a good-to-excellent inter-instrument agreement between the two devices. The ICC was also calculated separately for hand results indicating good-to-excellent inter-instrument agreement between the two devices for both the right hand (ICC of 0.905 ([0.82 - 0.95]; 95% CI) and left hand (ICC of 0.909 ([0.83 - 0.95]; 95% CI).

## 7. Changes adopted in the platform according to the user feedback

### 7.1. For the monitoring tools

Some changes included by IDE for the next round of trials:

- SPPB activities: A control and information about the use of the camera has been included.
- SPPB activities: Improved assistance for the end-users and the caregivers. Better use of the hand to start the tests.
- Kwido Mementia. The language will be accurately adjusted to the language in the profile of the end-users.
- Kwido Mementia. The system will check if the accessibility tools of the tablet could interfere with the interface of the games.

- Kwido Mementia. Bugs during games solved.
- Motion app. Improved support for the different languages and to new devices like Lifevit smartband.

Changes made by University of Geneva according to the received feedback:

- Several changes made in the translations of the platform.
- Adaptation of the algorithm as designed by testing sites.
- Integration of the games.
- Improved integration of the Squegg.
- Improved integration of the tests.
- Inclusion of explanations for the health score.
- Inclusion of timer in the videos.
- Inclusion of a clear introduction.

### 7.2. For the mitigation tools

After having received the feedback from the testing partners and the co-creation sessions, the University of Deusto has worked on the following changes:

- Creation of a scoring system according to the selected level, time and speed. In order to adapt to the requests coming from co-creators for active feedback.
- Creation of extended levels from very easy to very difficult, to adapt to the needs of diverse players.
- Creation of personalisation systems for the level design, to further adapt to the diversity of players so that everyone can design their own game difficulty.
- The games have been designed so that everyone can understand them in less than 10 minutes, according to feedback that claimed that users are not willing to spend more than 10 minutes trying to understand the game.

- Games are quick, not lasting more than 2 minutes per match, so as not to become tiring for users.
- Games have been adapted to real life environments so as to appeal to users.
- Any childish graphs or activities have been erased from games.
- Co-creators have chosen from the beginning the graphs in co-creation sessions from different alternatives sent by Deusto.
- New languages have been made available (Portuguese).
- Basic versions of the 3 initial games (SAPA, Sailgility and Chop it!) have been created because users found them too difficult after the initial lab testing.
- Step-by-step tutorials have been created because users refused to read instructions.
- Sailgility has been adapted to a simpler version so that it works on every tablet.
- The games have included the magic carpet so that they are more interactive and prone to be enjoyable.
- The colors of the menu of the games have been changed so as to include the frAgiLe´s chromatic span, once this was developed.
- Using intuitive colors for buttons.
- 3 new games have been created from scratch in collaboration with testers following the feedback received from the first half of the final trial.
- Including descriptions of the skills that the user will train with each game so that users know what they can be used for.
- Some of the text, especially in Chop it! has been changed to make it sound more natural according to the received feedback.
- Creation of the “return” button to go back to the app easily at any time.
- Change of the language selection menu to make it more intuitive.
- Several changes were made in the translations because of reported mistakes.
- Instruction button changed place according to requested feedback so as to be easier to find.
- Changes in the format of the scoring so that it became more visible.
- Skip buttons were created inside the game so that users could jump to the next screen, be it in video-tutorials or inside the match as requested by them.

- More games with the magic carpet.
- Changes in the brightness of the screens, especially some buttons.