Deliverable 4.6

Evaluation & integrative feedback report

Project Number	AAL 2017 – AAL -035
Project Name	Ella4Life
Duration	June 1st, 2018 – May 31st, 2021 (36 Months)
Coordinator	Virtask
Document ID	D 4.6
Release Number /Date	V1.0/30 June 2021
Checked and released by	Patty-Lou Middel
Document Type	Report, irritative
Original Due Date	01 June 2021
Dissemination Level	public
Main Editor	Clemens Nieke (HSL)
Contributing Partners	HSL, VIC, VIR, LLI, GUT, MUF, ANA
Reviewed by	Patty-lou Middel

Abstract

The purpose of D 4.6 is to gather all kinds of feedback (conversations, written structured and unstructured feedback, usage statistics) from end-users during the trials period and evaluate it for further iterative Ella4Life improvement.

What is new in this Version

This is the finale version of the deliverable.

The Ella4Life project is Co-funded by the European AAL Joint Programme

Version	Date	Changes	Name	Organisation
0.1	April 23. 2021	Initial creation and technical content of Switzerland	Stefan Winterberger	HSL
0.2	May 07. 2021	End user feedback	Clemens Nieke	HSL
0.3	May 12, 2021	End user feedback CH and RO	Edith Birrer	HSL
0.4	June 29, 2021	End user feedback Po	Mariusz Kaczmarek	GUT
1.0	June 30, 2021	Final version	Edith Birrer/Clemens Nieke	HSL

List of Authors

Clemens Nieke (HSL), Stefan Winterberger (HSL), Edith Birrer (HSL), Cosmina Paul (ANA), Mariusz Kaczmarek (GUT)

Content:

1 Common

At the start of the project, it was planned to conduct a holistic evaluation. This was no longer possible due to the Covid-19 pandemic. Evaluation and feedback had to be determined country-specifically according to the respective regulations. The country-specific view of the other deliverables from WP4 is also adopted in this document.

2 End User feedback

All AAL-JP projects aim to create a better quality of life for elderly people. To achieve this goal, the direct involvement of elderly people is needed. It is through their vast life experience and perspective that new technologies can be properly adapted to their needs. Their feedback creates immense benefits for their entire generation from the very beginning of the project. In the following subchapters, this user-related feedback is presented in detail.

2.1 End User feedback in Switzerland

2.1.1 General View

Self-determined living is one of the most important goals in Switzerland. More than 4 of 5 persons older than 80 still live in private household [1].

To be able to do so, an intact social network is crucial. Communication is very important, and for people who are physically less mobile or live alone, this is achieved primarily by technological means. The communication feature of Anne could therefore be an interesting addition to the ubiquitous telephone.

Another important feature of Ella4Life is the blood pressure measurement. High blood pressure (hypertension) is very common among the elderly. Of the population of age 75 or older in Switzerland, 55.8% of the men and 57.2% of the women were affected (statistics from 2017, see Figure 1). In the age group 65-75, it was 43.3% and 36%, respectively. So for a big part of the elderly population, measuring the blood pressure is a regular part of their life. Or should be – but remembering to do it and then keeping track of the measured values is something that can become cumbersome with age.

---

[1] Bundesamt für Wohnungswesen BWO, „Wohnsituation und Wohnformen der älteren Bevölkerung, 2008

Therefore, we considered Ella4Life's blood pressure measurement feature as interesting and important. On the one hand, Ella4Life can remind the user to measure. On the other hand, because of the measuring device which can send the measurements via bluetooth, the values are tracked and there is no need to manually write them down.

Personen mit Bluthochdruck

Bevölkerung ab 15 Jahren in Privathaushalten
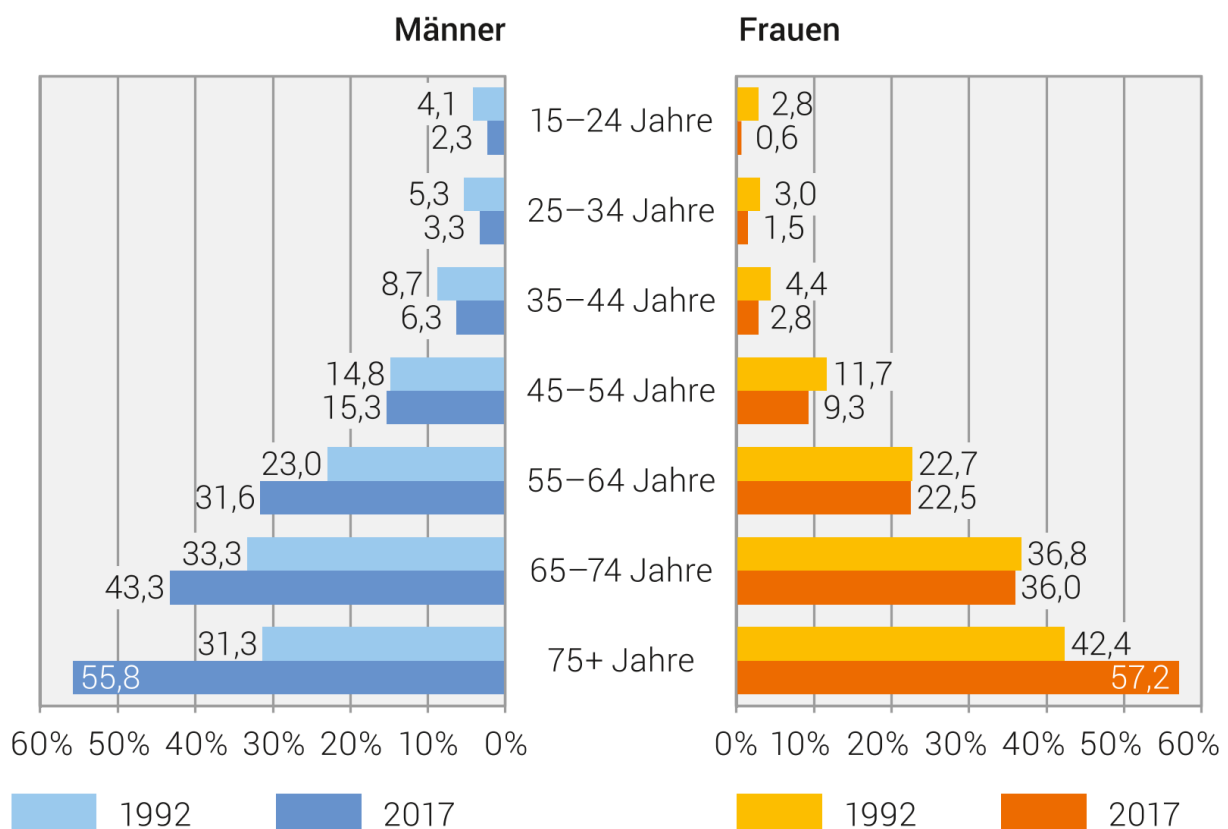
Quelle: BFS – Schweizerische Gesundheitsbefragung (SGB)   © BFS 2018

Figure 1 Hypertension in Switzerland by age groups (1992 and 2017)

2.1.2 Features' usefulness from the users' perspective

The interviews with users reveal two or three features that were considered as most useful:

- Agenda / Reminders
- Blood pressure measurement
- Video call (not surprisingly, this was mentioned especially by persons living alone)

The Swiss have two peculiarities in their mentality that promote the acceptance of these features of Ella4Life. One is the reluctance of asking for help, which is considered as a "harassment of the other" and is therefore avoided as long as possible. The other is a certain pressure towards perfection, to lead a perfectly organized life and household.

The agenda feature helps in this organization and in not needing help and is therefore highly appreciated. The same is true for the blood pressure measurement feature.

The appreciation of the video call feature has an entirely different origin. During the COVID-19 pandemic, we used Ella4Life specifically among people living alone, to prevent against their loneliness.

People who normally talk to other people on a regular basis were able to stay in contact with each other through Anne.

This was a helpful tool for the Vicino site managers to see how the people are doing - the visual contact was extremely helpful and meaningful for this assessment. This gave site managers the opportunity to look into the test subjects' homes and see whether there were any worrying changes. Contact was made almost every day.

In one case, video telephony was used so that a couple could stay in contact, as the wife was moved to a nursing home and her husband was not allowed to visit.

In another case, Anne was helpful in facilitating visual contact between grandparents and grandchildren, who were physically unable to see each other due to the pandemic situation.

After the test with the Anne tablet was ended, a greater willingness to use other visual aids, such as Facetime or Skype, could be recognized. he inhibition threshold to deal with such a technical aid has been broken

2.1.3 Personal Network

We found that the acceptance and success of Ella4Life could not be explained by hard statistical factors such as age, gender, education, etc. alone. However, from the interviews with the users as well as from their questions, contacts with the support personnel and from other informal

feedback, we see the acceptance strongly connected to the following three factors:

- Social Network:
  Ella4Life could not establish new relations or interaction habits. It was only used for social connections that already existed and had a solid base from physical encounters and/or long relationships. In such cases, the Video call feature could sometimes take the role of phone calls. We tried to connect people who didn't know each other. This turned out to be difficult, however, because the inhibition of exchanging information via video telephony for the first time was too high.

  Also for the usage of other features, it was useful to talk to a known person about the use of Ella4Life, e.g. if something was not clear or the person was uncertain and thus hesitant to use that other feature.

- Some technical affinity:
  Even though the user interface of Ella4Life was designed to be very simple and self-explaining, Ella4Life was still accepted only by people with a certain technical affinity. Some persons are satisfied with radio, TV and telephone and believe that they do not need any further technical devices. Even if the simplicity of the user interface was repeatedly explained to them, it always seemed "too complicated" or the fear to "do something wrong" was too big.

- Curiosity and playfulness:
  In addition, the persons that accepted Ella4Life best showed a kind of curiosity and playfulness. Clearly, an avatar is something out of the ordinary, and even of the younger population, not many do regularly interact with an avatar that has both a voice and a face. Thus, the idea of "playing with something new" and the curiosity to "try out something" helped to accept Ella4Life in the daily routine.

2.1.4 Limitation

During the tests with Ella4Life, some limitations of the system became apparent. Most of them are not associated with the test persons or the test design, but with the society in Switzerland or in general, or with the specifics of a system with an avatar.

Some of the limitations due to the social circumstances:

- There is a strong fear of constant surveillance in one's own home. This is a particularly serious argument in a neutral country like

Switzerland. Swiss are especially keen on being free and attach great importance to privacy. Therefore, all internet-based systems have little trust. Even worse, a device with a microphone is considered as potentially dangerous because it could be hacked and used for surveillance. (This fear could not be completely invalidated by explaining the fact that in Ella4Life the microphone cannot be activated by a voice command like in other products, but only by touching the "microphone" button on the screen.)

- If the functions of Ella4Life did not meet the need of the persons completely and could not be used without support/help from a second person, they were not used. This was especially the case for the agenda, where the entries must be done on the web dashboard. For most Ella4Life users, this would have been some other person (for example the daughter, son or some other close relation). Due to the Swiss reluctancy of asking for help, this was too big of a hurdle for some, who then refrained from using the agenda feature. The agenda and reminders in general would have been accepted as useful. This can be seen from those persons that had only few and regular reminders that could be set up initially and needed no further configuration (e.g. for the medication). Then the agenda with its reminders was considered as very helpful in everyday life.

- During the COVID-19 pandemic, many families organized themselves with new tools, so also various video chat programs became established. In families where these programs were also introduced to the older generation and were accepted by them, there was no need nor motivation to use Ella4Life. On the opposite, some persons were saturated with new tools and functions and did not need anything additional, and their families did not want to confuse them with yet another additional tool.

- Even the slightest technical problems create uncertainty among users. The result is that the system is no longer used. This strongness of this effect might also have a connection to the Swiss efforts to perfection and not wanting to bother others. Maybe in different countries it would be easier to ask for help in such cases – this would be something to investigate more closely in an overall evaluation or a later project.

Some of the limitations due to the special user interface with speech and touch:

- The type of interaction in Ella4Life is still very unknown. It consists of a mix of touch and voice commands, which is very new for most

users (even younger ones). For example, it is very easy to start a video call via a voice command. However, to end the call it is necessary to touch a button, because the voice is "in the call" and can therefore not be interpreted as command.
Unfortunately, this "hang up" button is quite small, to reserve a lot of screen space to the picture of the interlocutor. We concluded that more improvements are still needed in this form of mixed interaction so it can be better integrated into everyday life.

- The voice control is not suitable for dialects, the end users are forced to speak in High German when talking to Ella4Life. However, if a person in Switzerland speaks High German, this will be perceived as laborious and unnatural. To understand this, it must be said that in Switzerland, dialects are much more important than in other countries. Dialect it is not a form of interaction among some social groups or layers nor in special contexts, but it is the main communication, among all social groups and in all contexts. In fact, one could state that Swiss dialects form an own language (or several languages) quite different from the written German. The situation can be compared to Dutch which is similar to some German dialects (especially from northern Germany), but quite different to the standard German. But for the Swiss dialects, there is no standard written form and thus (almost) no literature. So none of the dialects are considered as a language and therefore there are no speech-to-text systems for them. But as speaking dialect is the usual form of communication in Switzerland, speaking High German feels like speaking a foreign language, and so the system is perceived as a foreign body and does not become a part of everyday life.

- Sometimes the voice was felt to be too harsh or too commanding.

Some of the limitations due to the avatar:

- The avatar Anne was sometimes perceived as an unnatural and unsympathetic person. The facial expressions were perceived as rigid and cold. This shows that the acceptance of working with an avatar and "having it in the apartment" is not yet present in most people - especially older Swiss people.

2.1.5 Anne's way towards the market

There are several factors that must be considered during a market launch:

- In general, older people are not as well connected technically. Only if children or grandchildren live nearby, the technical prerequisites are given. Otherwise, it becomes difficult with installation or support of the device and with making the necessary changes.

- Using tablets with a built-in SIM card turned out to be very advantageous. Doing so, the Ella4Life system was independent from the infrastructure available in the apartment (no WLAN necessary), which was very valuable.

The attempt to distribute the system through an IT company was not successful.

The most important reasons:

- The IT service provider can provide the system and help with technical questions on site. Such a company is usually not able to build up the community, because this is not in their focus of the day-to-day business. Therefore, a cooperation with a social institution/organization is required. This combination is not easy to find.

- The tablet could only be used with Ella4L. However, the existing customers (and maybe even the company itself) would like to have "open" devices to be able to use other functions.

To address both points, an institutional partner should be found who wants to provide Ella4Life for all its customers and probably also integrate own functions into it. For example, a company offering "Living with services" could use E4L as a platform in its apartments and have functions like meal ordering service or other connections to their services integrated.

Virtask would like to build up its own distribution channel for Switzerland (analogous to Germany). There have been various attempts to find distribution partners, like Swisscom or others. For now, the companies are still very reluctant, because in times of the pandemic, everyone is more limited to their core business. An expansion of the product range (as mentioned in the paragraph above) is currently out of the question for most of them.

In any case, broad marketing is needed to reach the target group. Financially, there is great potential.

Older people are the fastest growing population group in Switzerland. Women and men there not only live longer, they also stay healthy longer. More than a quarter of the Swiss population will be over 65 in 2045. In 2016, 1.46 million people in Switzerland were over 65. By 2045, this number will rise to 2.7 millions. The number of very old people (aged 80 and over) in Switzerland will more than double by 2045. More than one million people will be over 80 years old by then. [2]

Moreover, the retirees are relatively rich compared to the total population. In 2011, 38.6% of the population over age 65 in Switzerland had liquid household assets of more than 100,000 Swiss francs, whereas in the group of age 18-64, these were only 22.1%.[3]

All in all, this shows that there is a fairly large percentage of people who have both the need and the money for a service like Ella4Life.

2.1.6 Key conclusions

Networking with each other is the most important thing. There are enough offers for everyday support in Switzerland. The focus is therefore on communication. It is crucial that there are fixed and reliable partners in the communication. These can be family members, but also social organizations.

Reminders of appointments or medications would be very desirable, but they would have to be manageable by the user (you do not want to ask someone else for every little change).

2.2 End User feedback in the Netherlands

2.2.1 General view

Livelife received very useful feedback from the reported questionnaires. End users not only gave useful insights on what they felt about the total concept but also provided us with very useful feedback regarding the specific features of the product.

---

[2] Source: https://gesundheitsfoerderung.ch/assets/public/documents/de/5-grundlagen/publikationen/gfia/faktenblaetter/Faktenblatt_015_GFCH_2016-06_-_Gesundheitsfoerderung_im_Alter.pdf

[3] Source: https://de.statista.com/statistik/daten/studie/374622/umfrage/vermoegen-der-schweizer-bevoelkerung-nach-alter-und-armutsstatus/

In general, we noticed that most of our end users highly valued the activity coaching and the social aspects (i.e. Video call, involvement of informal caretaker and the Calender) of Ella4Life. And not so much the Digital games or the use of Radio or News.

Most end users graded Ella4Life positively and informed us they would want to use the product themselves.
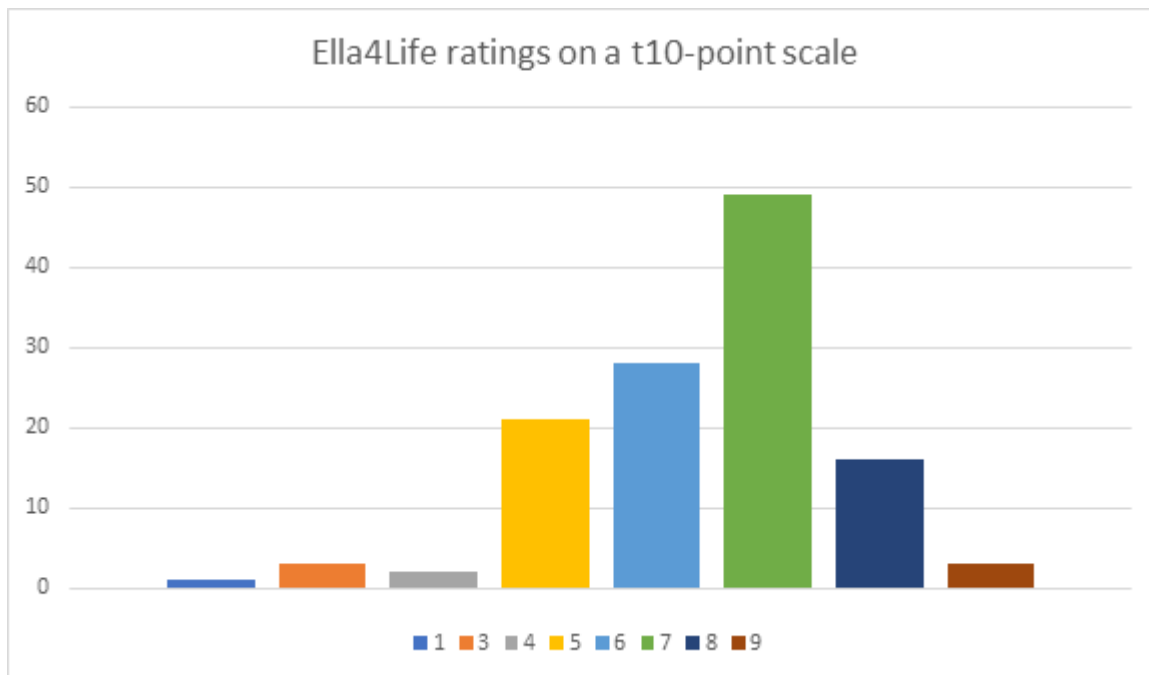
General rating of the product, where 1 means very bad and 10 means extremaly good.

Willingness to use the product on a 5-point scale
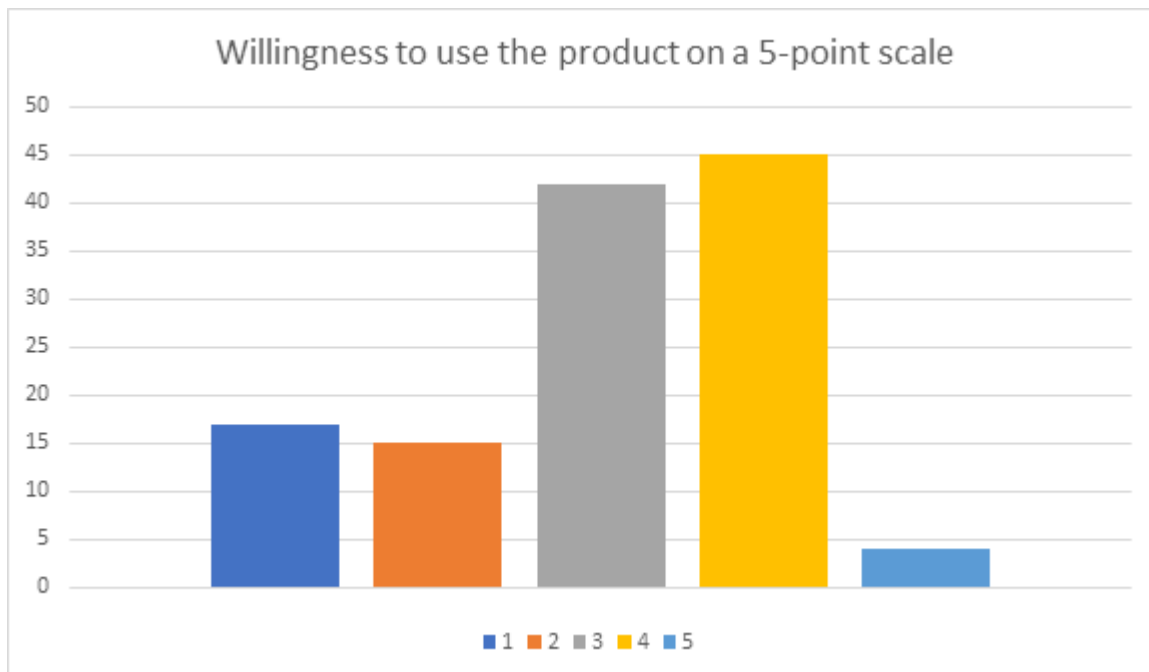
Rating 1-5, 1 is no not willing to use the product, and 5 eager to use the product.

2.2.2 Features' usefulness from the users' perspective

## Usage of radio or other media (i.e. weather forecast, news)

News is of interest to our end users yet they mentioned that they already had access to their own news channels (i.e. existing radio or tv channels or apps on a tablet or smartphone). Therefore, most of them did not see the added value of integrating a news module in Ella4Life. Also, questions were raised who would decide what news would be showed through Ella4Life and with which content. A slight distrust to news sources other than the well-known national channels was among our end users.

Radio as a source for entertainment was not interesting to most of our end users as a module within Ella4Life for a variety of reasons. Some mentioned that they simply did not have time to listen to radio, while others already had access to radio channels in a way they were more than content with or mentioned that they preferred watching television over radio.
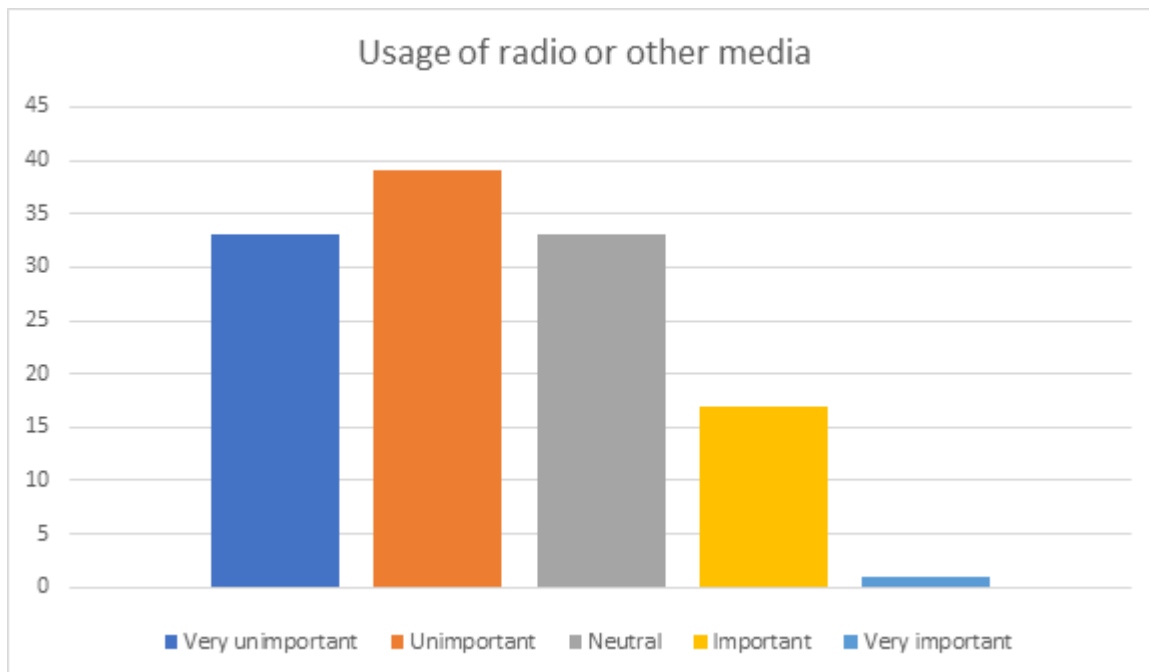
Task list

Our research showed that while most end users report the task list as useful they did not perceive it as the most unique and useful Ella4Life utility. End users who graded the task list negatively mostly reported that they either had no use for digital assistance since they still managed cognitively or since they still used pen and paper. Positive response were given from end users who mostly did not want to use the task list right now but did want to have the option available for when (mild) cognitive impairment would arise. Also younger end users were more positively towards the task list, yet they did report that it was necessary that the task list would 'talk' (synchronize) with the commonly used smartphones and the already existing apps they used.

Calender (task management)
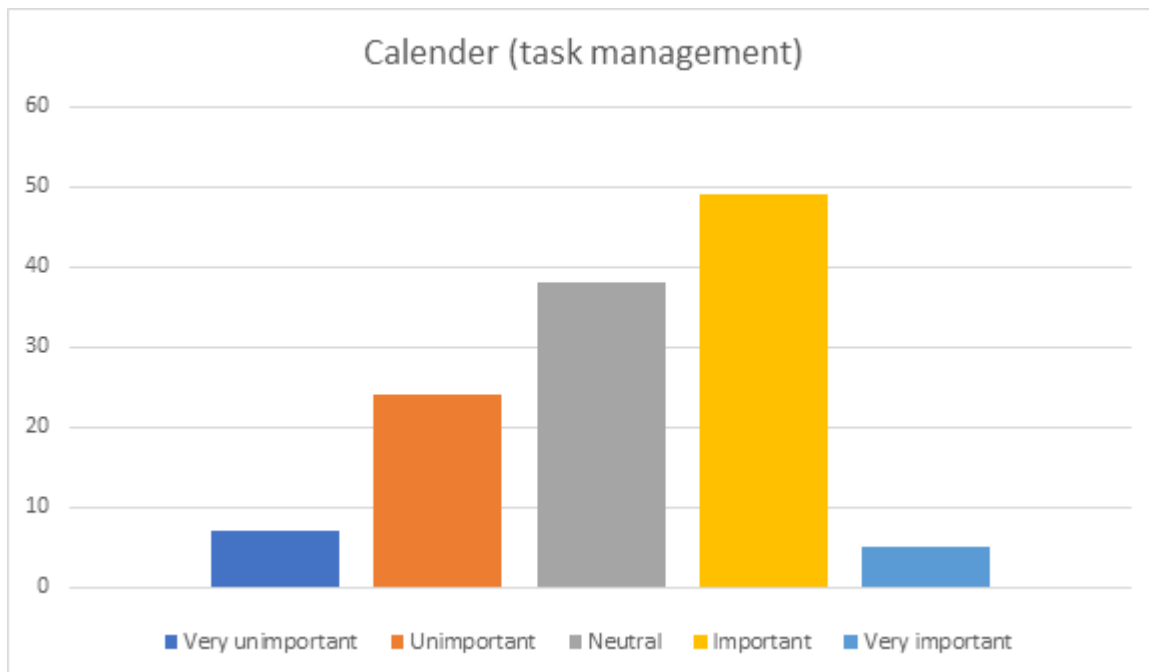
Medication management

Most of our end users responded positively towards the medication management module. Either because they already had the need for such assistance or because they wanted to be ready for when their health would decline and they need to start using medication. Some end users however did report that they wanted their own general practitioner included in the medication process supported by this module. They not only argued that their general practitioner should have easy access to the medication management module, but should also check the content every now and then for quality assurance.

Medication management
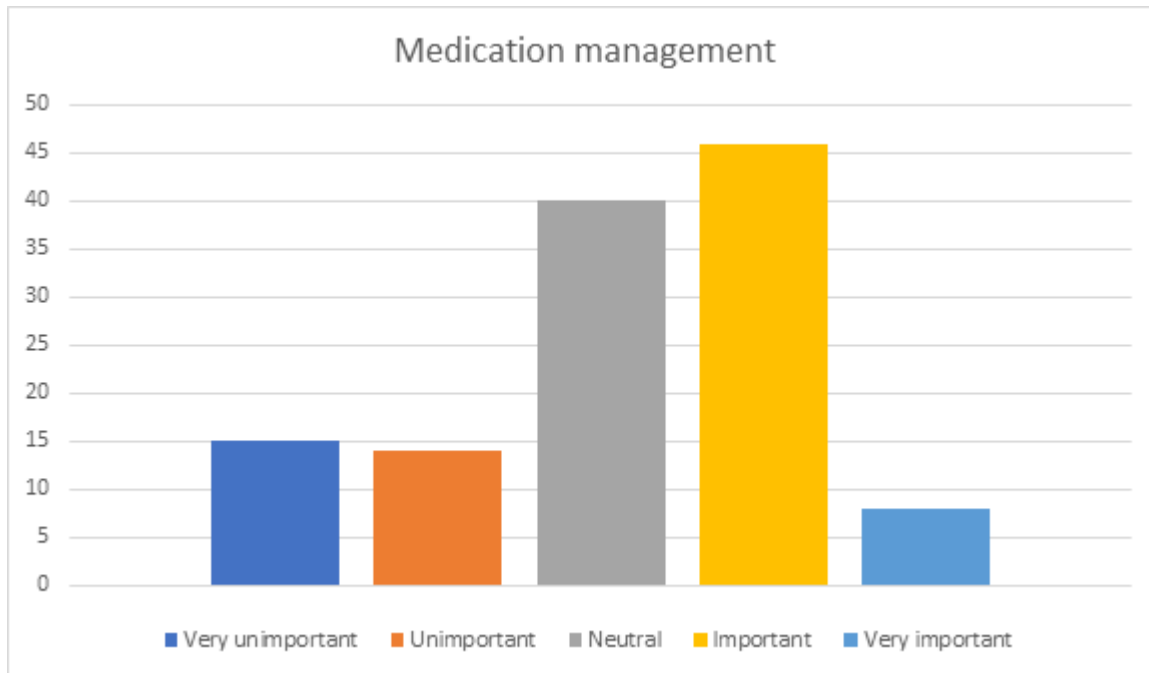
Video call

Based on the research results we have concluded the following regarding the ability to be make video calls using Ella4Life:
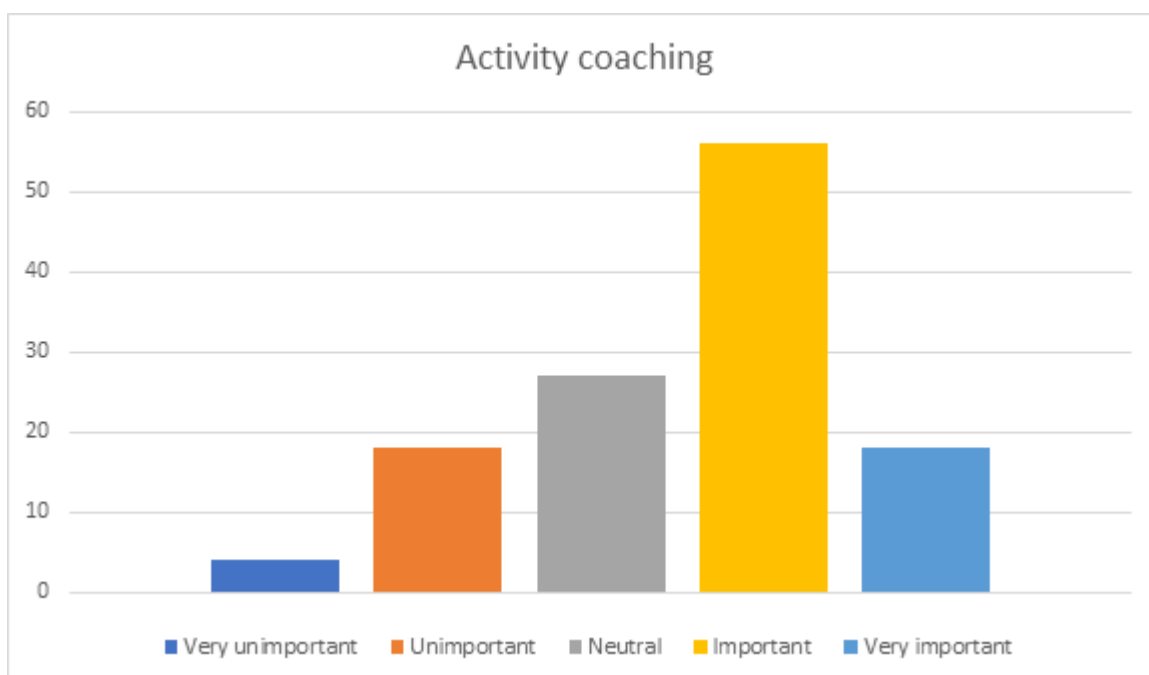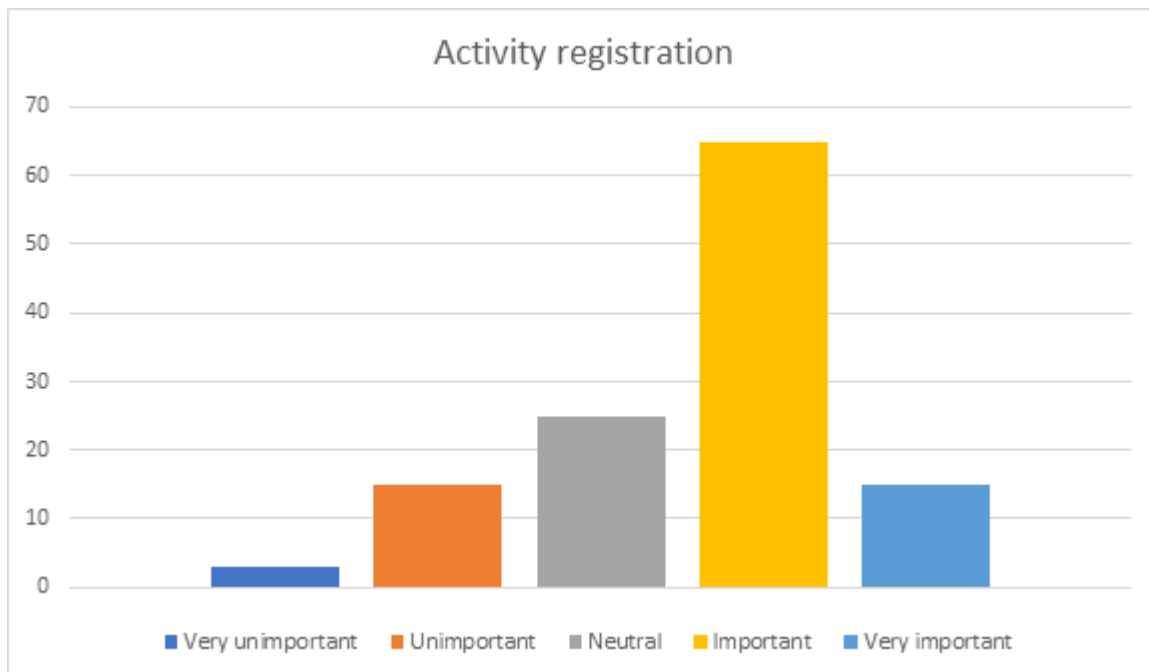
- Most end users rated this feature either positively or neutral.
- End users rating this feature as neutral mostly did so since they already had access to video calls using their smartphone.
- End users rating this feature as unimportant mostly did so since they don't want to meet other people in the digital world. Yet some did so since they had no need for this feature since they already had access to it by using their smartphone.
- End users rating this feature a important did mention that the feature has to be able to communicate with the already existing technology their younger family members use (i.e. Skype, Facetime)

Video call
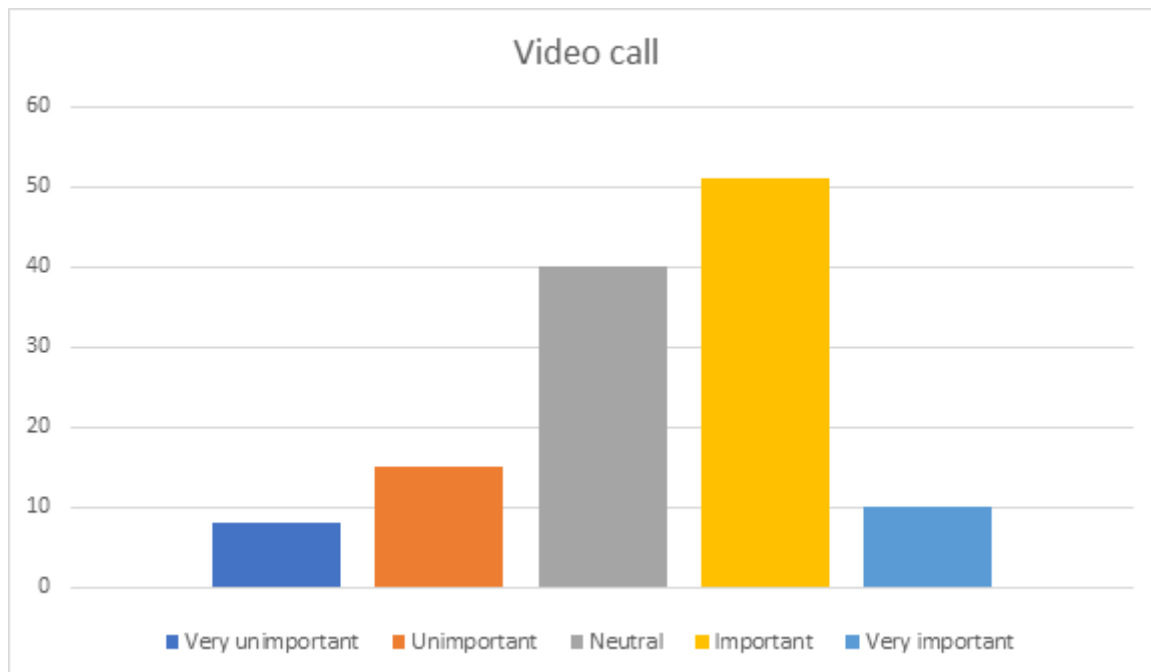
Activity registration & coaching

Most end users were quite clear about their opinion regarding Ella4Life being able to register their activity. The vast majority agreed that it was very useful to register their activity so they had insight in their activity level and would be able to be coached towards their own personal health or mobility goals. Most of this group also reported that while they already knew about other solutions able to register their activity, they did not trust the big commercial entities selling these products. Privacy and trust in a local product were highly mentioned as advantages on why they rated the ability to track activity positively for Ella4Life.

The main reason why some end users reported negative feedback towards this module, was that they perceived their own health as quite good and were in no need of assistance in reaching their current activity goals.

Activity registration
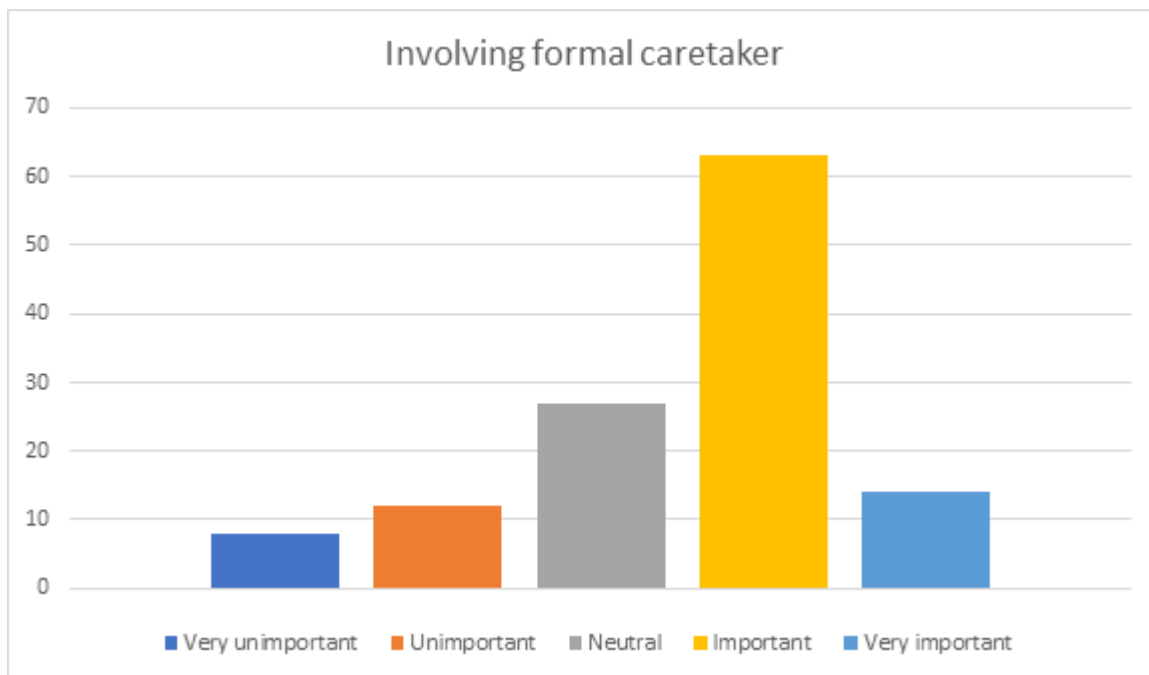

Activity coaching

Involvement of informal caretaker

Based on the research results we have concluded the following regarding the ability to be involve informal caretakers using Ella4Life:

- Most end users rated this feature either positively or neutral.

- End users rating this module as unimportant did so mainly because they want to keep contact with their close ones in the real world and do not want any digital assistance with this. Or because they felt no need in including their network since they either perceived their health as good or because they believed they would reach their goals without the help of others.

- End users rating this module as important did so mainly because they felt the need to have a social buffer included in their daily life. And reported that including their informal caretaker would help them reaching their health goals.


Digital games

Based on the research results we have concluded the following regarding the ability to play games using Ella4Life:

- Most end users rated this feature either as unimportant or neutral.

- Roughly half of the end users rating this feature as important did so because they felt alone and bored and saw this feature as a nice way to pass the time. The other half mentioned they did find it really important, but also were already able to play game on their current smartphone or tablet.

- A small part of the end users rated this feature as unimportant because they had no need in playing games. The biggest part of the end users rating this feature as unimportant did so because they already had ways of playing games. Either in real life within existing communities or through the use of their current smartphone or tablets.
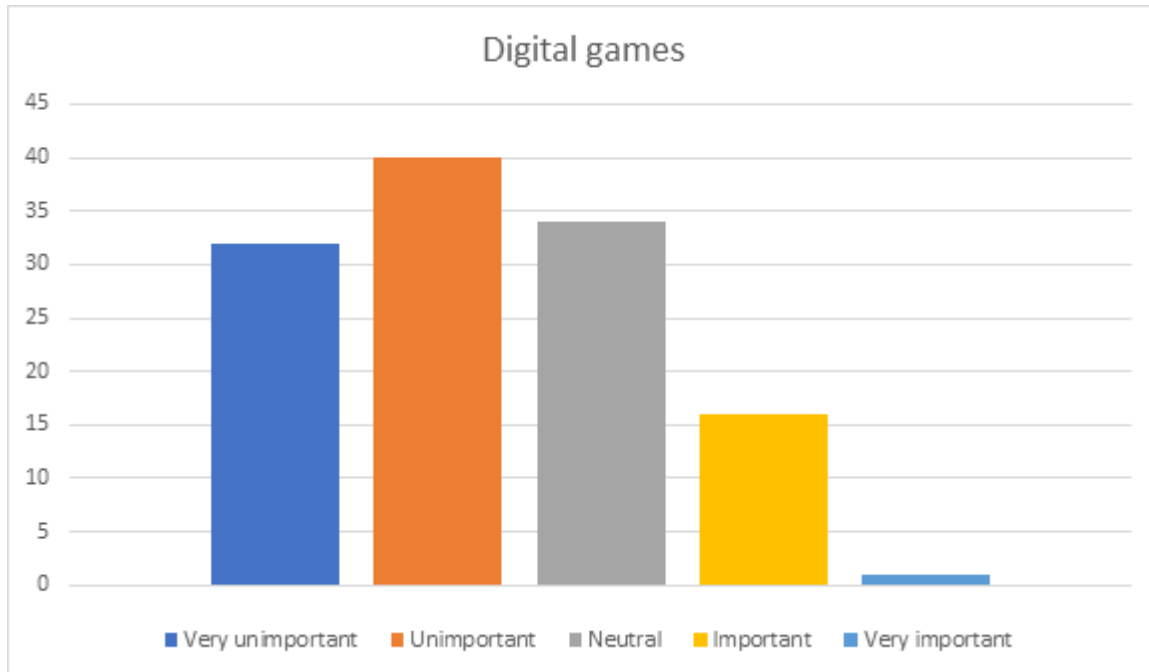
2.2.3 Anne's way towards the market

In general, most of the end users though the concept is great and believed there is a market out there for Ella4Life. However, they also believed that big commercial companies like Google or Apple could eventually produce a better product. Yet they also mentioned that privacy is of incredible importance on average for Dutch elderly, and therefore showed a preference for Ella4Life over products which might be developed by big commercial companies.

To be successful on the market our end users argued that Ella4Life should be able to communicate with the currently existing platforms like Skype and Facetime so that communication is possible with younger members of their family or social network.

The avatar was valued quite high by our end users. However they also argued that they perceived the current version as 'cold' and 'distant' and

labeled this as a critical success factor in order to be successful on the market.

Distribution of Ella4Life should be done by local service providers who offer more than just sales expertise. Dutch elderly people on average expect a tailor-made advice about to what extent they need support to have a healthy and comfortable life, and therefore which product (including which additional modules) should be bought. They prefer to buy a small basic product which over time can be extended with additional modules. The service should also offer evaluation moments every year in which the customer together with the service specialist evaluates the current product and if more of these additional modules (i.e. blood pressure measurement) should be activated.

As for the population, elderly people who want or need to stay at home is vastly growing in the Netherlands. This is greatly due to the limited access to elderly homes since the government stimulates Dutch citizens to live in their own home as long as possible and the medical specialist only allowed access to nursery home when no other alternatives are available in staying at home. Therefore elderly are more and more keen into learning about new products which assists them in having as much quality as possible while staying in their own home as long as possible. On average this population also has the financial status and willingness to invest in solutions which makes there is a large population accessible as a market for Ella4Life.

2.2.4 Key conclusions

Ella4Life can be both a hub to underlying functionalities and serve as a buddy or butler for end users in the Netherlands. If the avatar can be made even more realistic in personal contact and if the entire concept can communicate even better with existing communication platforms like Skype or Facetime, the end users will rate the concept a lot higher than they do now. Our research supports these conclusions but also showed that the current product is already highly thought of.

2.3 End User feedback in Poland

Conclusions from test conducted in Poland: At the moment, summarizing the surveys of test participants in the contact and virtual mode, it can be stated that:

- The Emma app - was rated most positively as an almost finished product. Audible messages remind you of the need to conduct a test
- Assistant Anna - at this stage of her advancement it seems of little use to a senior. The audio messages (if transmitted) appear only once, only in the audio form, if the senior is not nearby, he will not know that he has received the message, because after it has sounded, there is no trace of it. Pressure measurements are not saved in Anna. If a family member wants to save tasks to the parent, complete the calendar, and do not know English, he cannot become the administrator because the Polish version is missing.
- Bath mat - has serious limitations, the first test showed that the mat does not stick sufficiently to the bottom of the bathtub, which strongly affects the safety of the person using the mat. At the moment, it should not be used by seniors alone, as it may cause them to slip in the bathtub.

Preliminary conclusions for the future regarding the use of Ella4Life products and achievements.

- Emma application - if Medicine Men is interested in distributing the application on the Polish market, it should refine the application components in Polish.
- Personal Assistant Anna - at the beginning of the research, the participants seemed intriguing, attractive, and because of the few opportunities, they quickly lost interest in her.
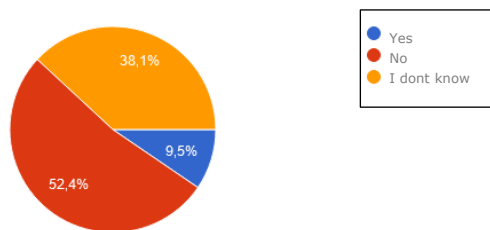
2.3.1 Impressions about Emma application:
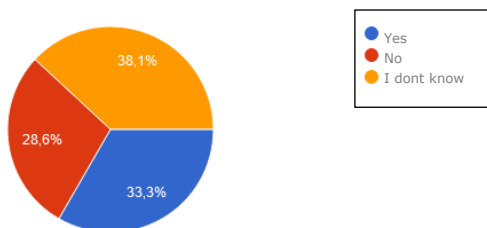
Emma App is easy in use:

Legend:
- Yes
- No
- I dont know

85,7%
9,5%
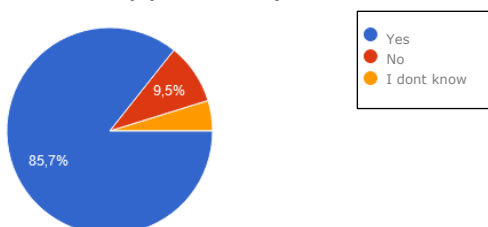
It quickly becomes clear how to operate the Emma app:

Legend:
- Yes
- No
- I dont know

14,3%
85,7%
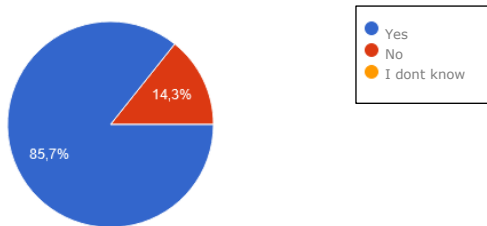
Using the Emma app gives me a higher status:

Legend:
- Yes
- No
- I dont know

38,1%
9,5%
52,4%

When using the Emma application, I am positively perceived by my friends:

Legend:
- Yes
- No
- I dont know

38,1%
28,6%
33,3%

If I could, I would use the Emma app every day:

Legend:
- Yes
- No
- I dont know

19%
19%
61,9%
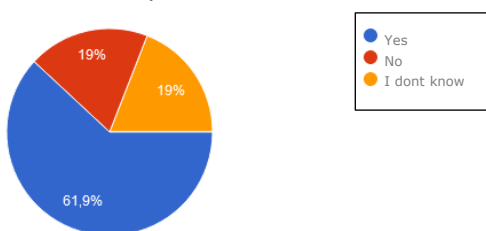
2.3.2 Impressions about Anne application:

The Anna app is easy to use:

Legend:
- Yes
- No
- I dont know

Values: 23,8% / 23,8% / 52,4%
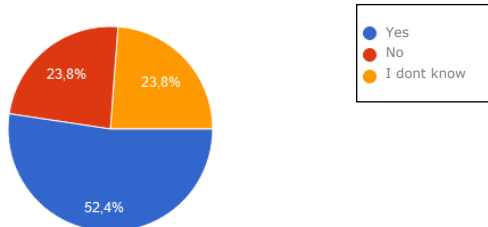
The features of the Anna app are suitable for my needs / goals:

Legend:
- Yes
- No
- I dont know

Values: 33,3% / 28,6% / 38,1%

It quickly becomes clear how to operate the Anna app:

Legend:
- Yes
- No
- I dont know

Values: 19% / 14,3% / 66,7%
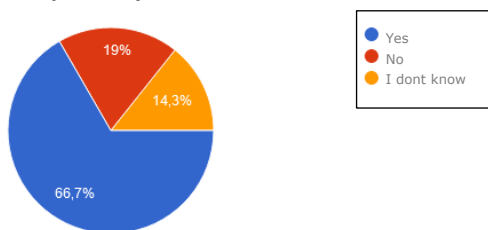
I think the Anna app is absolutely useful:

Legend:
- Yes
- No
- I dont know

Values: 33,3% / 28,6% / 38,1%
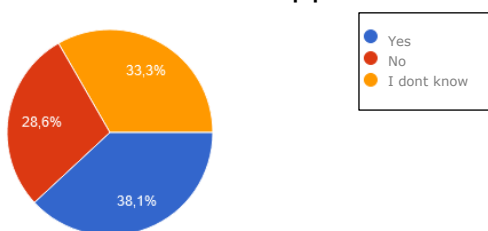
Using the Anna app gives me a higher status:
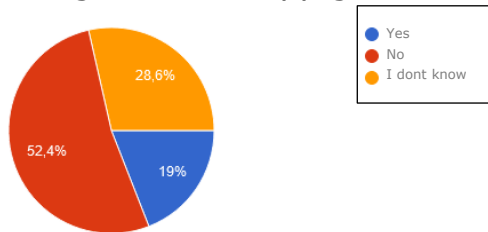
By using the Anna application, I am positively perceived by my friends:

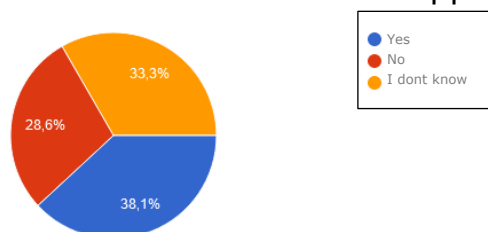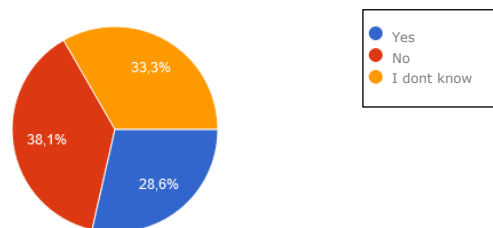If I could, I would use the Anna application every day:
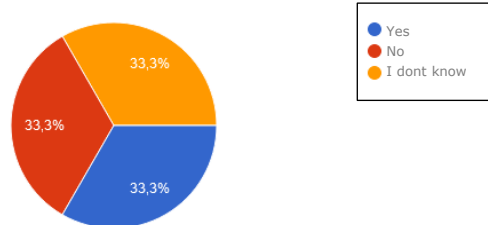
Very interesting are answers concerning the eBathtub and eChair sensors.

It should be remembered when it comes to the bathtub mat (eBathtub) that in Poland the bathtub is widely used, and among the elderly, seniors, in their old apartments there is a bathtub in every apartment. Shower enclosures are rather characteristic for new builds and young people. Hence, the demand for a mat that supervises the bathing process is very high.

The bathtub mat (eBathtub) is easy to use:
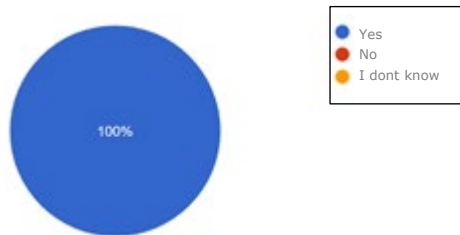
The features of the bathtub mat (eBathtub) suit my needs / purposes:
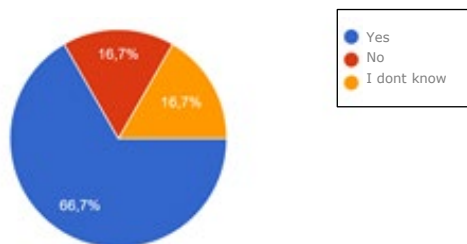
It quickly becomes clear how to handle the bathtub mat (eBathtub):
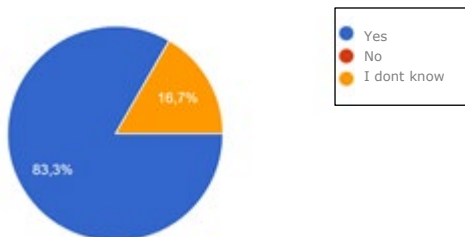
Do you become more independent with the bathtub mat (eBathtub)?
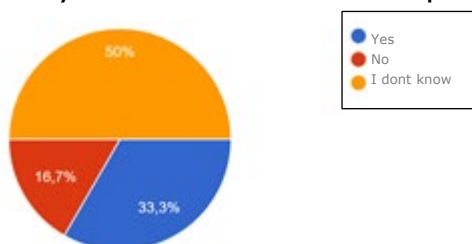
I think the bathtub mat (eBathtub) is absolutely useful:

Legend:
- Yes
- No
- I dont know

83,3% / 16,7%
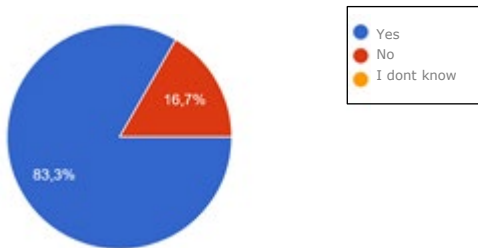
The bathtub mat (eBathtub) gives me a sense of security:

Legend:
- Yes
- No
- I dont know

83,3% / 16,7%
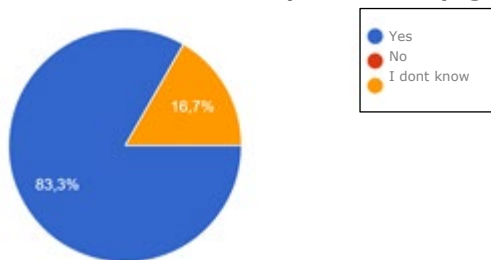
Using a bathtub mat (eBathtub) gives me a higher status:

Legend:
- Yes
- No
- I dont know

50% / 33,3% / 16,7%
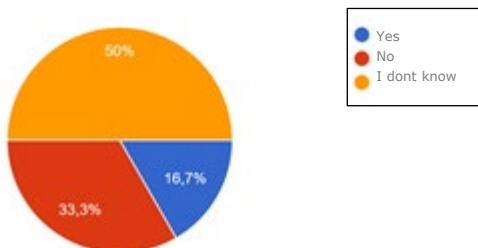
The bathtub mat (eBathtub) looks attractive:

Legend:
- Yes
- No
- I dont know

100%
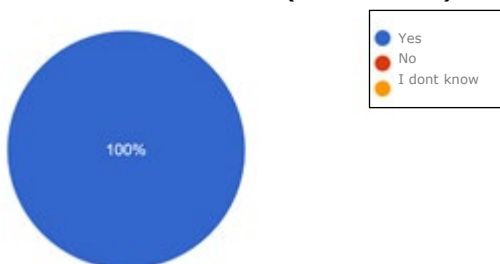
Such a positive reception of the bathtub mat is particularly important because already at the prototype stage it was possible to design and

manufacture the mat in such a way that it was accepted by the testers and resembled a commercial product.

Having the opportunity to buy such a monitoring mat (eBathtub) - I would buy it:
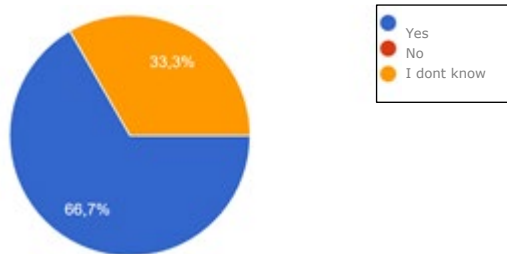
The answers provided may be a good forecast of the market demand for such a solution and the success of commercialization of the solution.

The idea of a bath supervision mat is valuable and worth developing
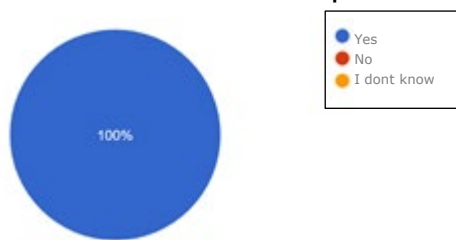
Similar questions were defined in the chair mat survey. The responses obtained are shown below.

The chair / armchair mat (eChair) is easy to use:
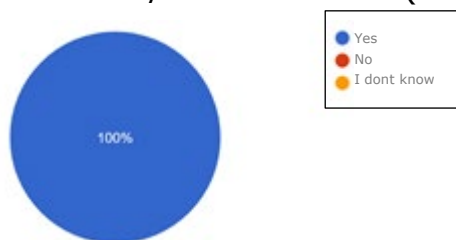
The functions of the chair / armchair mat (eChair) are suitable for my needs / purposes:

Legend: Yes (blue), No (red), I dont know (orange)
50% / 50%
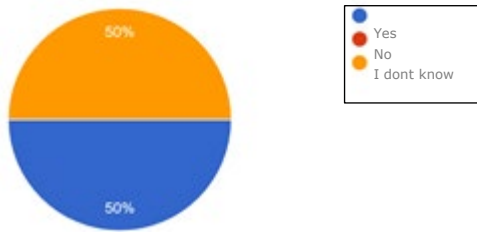
It quickly becomes clear how to operate the chair / armchair mat (eChair):

Legend: Yes (blue), No (red), I dont know (orange)
100%
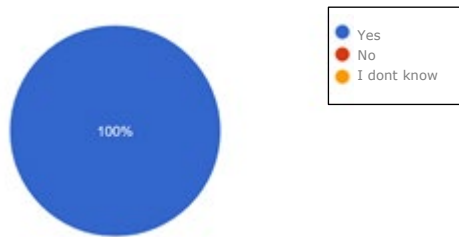
Do you become more independent with a chair / armchair mat (eChair)?

Legend: Yes (blue), No (red), I dont know (orange)
16,7% / 16,7% / 66,7%
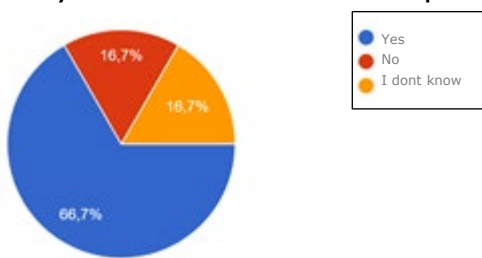
I think the chair / armchair mat (eChair) is absolutely useful:

Legend: Yes (blue), No (red), I dont know (orange)
83,3% / 16,7%
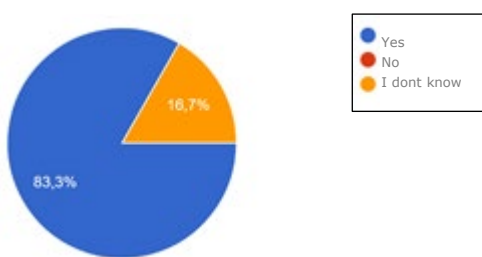
The mat for the chair / armchair (eChair) gives me a sense of security:
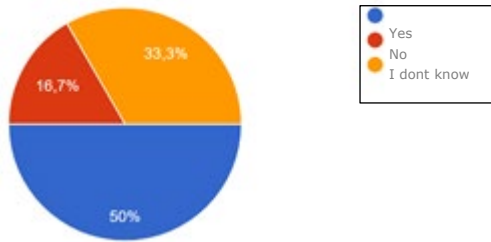
The chair / armchair mat (eChair) looks attractive:
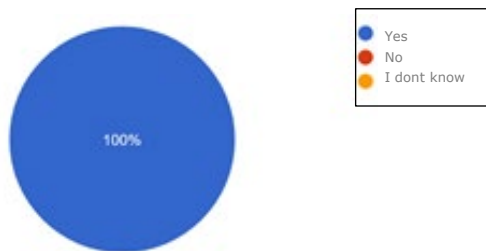
Using a mat on a chair / armchair (eChair) gives me a higher status:
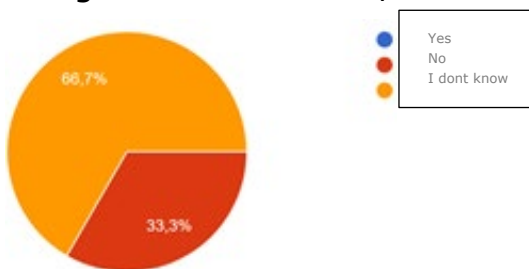
As for eBathtub, seniors are unsure if this gives them a higher status in their age group. Technical innovations among Polish seniors are not a determinant of a higher economic or social status. The vast majority of them worry about surviving the next month for a modest retirement.

When using a mat for a chair / armchair (eChair) I am positively perceived by my friends:
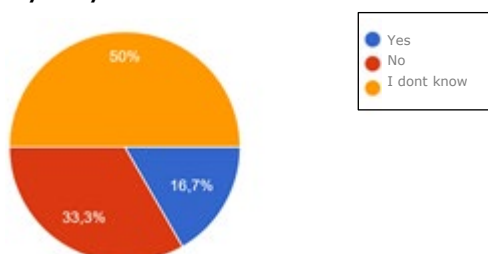
Having the opportunity to buy such a monitoring mat - I would buy it:
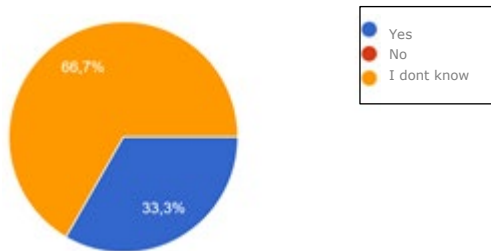
Comparing these responses to the eBathtub responses, you can see that more people appreciate the potential of a bathtub mat as a security tool. In general, nothing life-threatening should happen when watching TV in a chair or armchair. It may be different during the bath, it may be easier to feel faint, or to have a different accident.

The idea of a heart monitoring mat is valuable and worth developing:
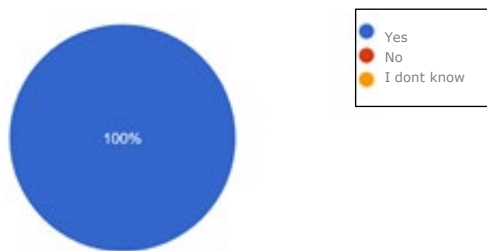
2.3.3 Key conclusions

Seniors' impressions and reflections on Ella4Life solutions:

• In terms of practicality, seniors and caregivers liked the application. Especially the possibility of observing data on the phone, illustration of the results, the possibility of checking them at any time.

• Seniors are satisfied with entering the results on the phone automatically, they have more confidence in such records than in the results recorded on paper.

• Automatic saving of results in the Emma Application is speed, practicality of data recording, saving the results on sheets is more unreliable, the senior forgets about it more often, tries to remember his results in order to pass

them on to the doctor, but most often he remembers the general data that "they were in norm", the Application contains real data, with date and time, illustrating the body's behavior during the week and within the day.

• Seniors refer to Assistant Anna mainly in terms of potential, future opportunities, because in the Polish version she works to a minimum extent.

• Seniors and caregivers indicated that it would be valuable to control the Application, saving information directly from Anna's position available to the senior.

• A certain barrier for seniors and caregivers seems to be assigning Anna to only one type of tablet, the inability to use her on a computer that the family bought for wider use.

2.3.4 Features perspective

Further possibilities and prospects for the development of Ella4Life products:

• The Covid-19 pandemic has clearly changed the approach of seniors and caregivers to remote and IT solutions. Previously, such products and solutions were associated by seniors with loneliness, abandonment, lack of relatives, people interested in the senior. The pandemic has changed the approach to telemedicine, it does not replace people, direct contact with people, but is becoming associated with safety, not meeting people without the need to. But thank to such solution we have possibility to contact with group of Ella4Life users, caregivers and physicians.

• The older people are, the less independent they are in using the Application, they can only use them with the help of their guardians or other people.

• People should prepare to use the Application and telemedicine solutions at the age of 50-60, when they have better eyesight, hearing, more contacts and friends with whom they meet outside the home and have whom to ask questions, can learn from others treating new skills as something modern, innovative and ennobling. In retirement, seniors meet new people less (less frequently they make new friends), they are dependent on their loved ones and their abilities and skills.

2.4 End User feedback in Romania

2.4.1 General view

We have inquired into the level of acceptance of each feature and how is that related with age.

We have noticed that the interest in some of the features decrease with age, while of the other increases with age.

For example, the interests and usage of Physical training, Task list and News significantly decreases with age, while the interest with Agenda, as a memory tool, slightly increases.

The usage of Photos and Radio slightly increase with age as they do not require much cognitive engagement and employ emotional memory (e.g. images, music).
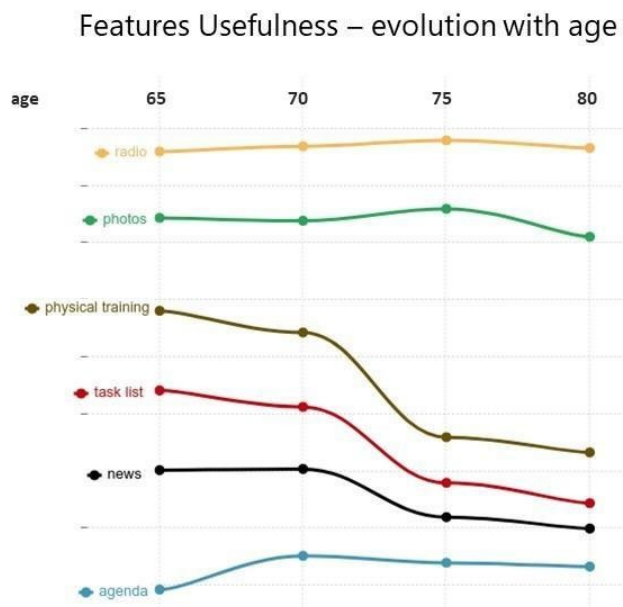
Figure 2: The perception of Anne's features usefulness based on age

It is expected that a progressive integration of all Anne's features will prolong the usage of active tasks, such as News, Task List, Agenda and Physical Training and maintain Photos and Radio to a high degree of acceptance and intensive emotional engagement for enhancing emotional memory (EEM).

2.4.2 Features' usefulness from the users' perspective

News

News is of interest to young older adults for keeping their sense of social integration.

Most of the young old adults found News of great relevance while older old adults find News of less relevance. All old adults we have interviewed perceive TV as the first source for their news.

These findings confirm other research results which show that older adults who are physically and psychologically well, generally keep an interest in news and communication media as these give them a sense of being socially integrated. If the deterioration of the psychological state of mind occurs or if the degree of loneliness increases, then older adults will look for tools or technologies to give them a sense of companionship and decrease loneliness, such as those that focus on entertainment. In this case, TV would be rather used for other than the News.
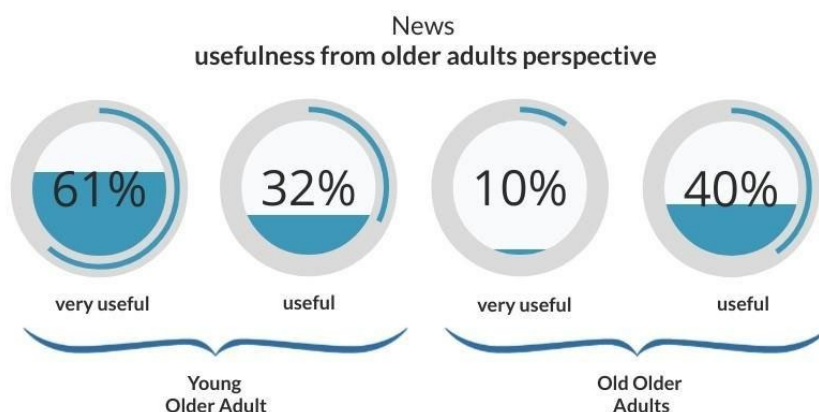
Figure 3: News usefulness from older adults perspective

Radio

Radio also gives a sense of social integration and companionship. Young old adults show low interest for listening to the radio through Anne. They have explained over the interviews that they do not have time for radio.
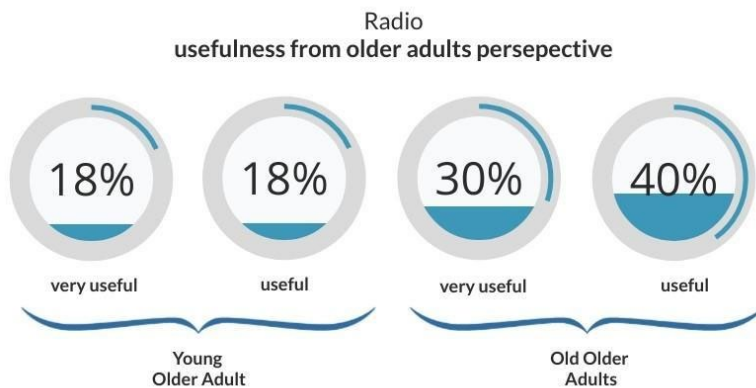
Figure 4: Radio usefulness from older adults perspective

Old older adults manifest great interest in Radio feature, while the young older adults show interest to a less degree. The increasing age related impairments and the less diversified activities can lead to a larger usage of radio with age.

Task list

Based on the research results, we have concluded the following:

1. The Task List is suitable for those who accept guidance/advice.

2. Some participants emphasized that if the app would be well individualized, specifically if the person's own preferences are very well known, then it can be brilliant.

3. When we take into account for those who accept guidance, there is a large range from those who need guidance generally for each kind of activity to those who need guidance only for specific activities

According to our participants in the study, taking guidance is a matter of psychology, of individual preferences. They emphasized that the factors influencing the degree of Anne's acceptance by older adults can be grouped in 3 categories:

1. Much depends on the culture and individual traits. ("Everyone builds their inner world").

2. Much depends on the sociability and the status of the person. Those who were high in social hierarchies or used to be important members of their community, would more easily take guidance or advice.

3. Other factors such as religious influence and spiritual activity.
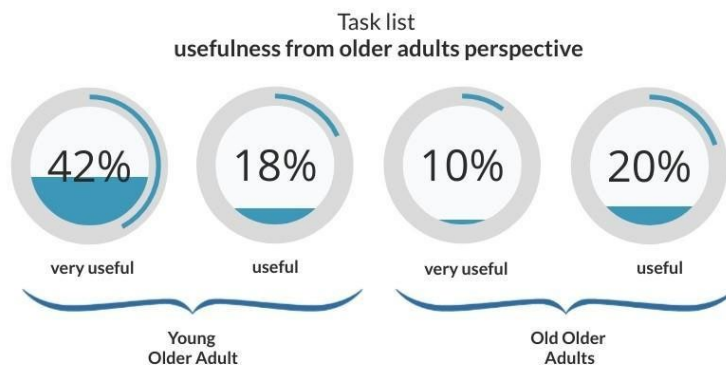
Figure 5: Task List usefulness from older adults perspective

Young older adults are more interested in this feature (60%) comparative to the old older adults (30%, from which 20% perceive Task List as just useful). Young old adults are having a more socially intensive life and show high interest in active ageing. These interests decrease with age, also due to the increase into reduced mobilities, narrowing the circle of friends to those within the family and other as such.

There are people who would just not accept or adopt guidance. Those who accept and take guidance are also those who accept alternatives to technologies they already use, such as Anne providing news, listening to the radio through Anne, or Photo Album instead of WhatsApp or Facebook.

According to the interviewees, those who are active socially and used to have high social statuses and (often) highly educated, tend to take advice and adopt assistive technologies as long as they perceive their usefulness.

More, those who are socially active, are open and aware of the importance of being active for their general well-being and look to improve and/or to support that.

Most of the participants agree that there is probably a fairly high percentage who would need and who would benefit from guidance.

Those who are not socially active tend not to accept changes in their routine. But they are interested in the other functions offered, such as News, Radio, Photo Album.

Those from rural areas are more reluctant to taking advice or suggestions and of making use of technology. Those with lower education and from rural areas tend not to take guidance or advice and are more reluctant to changes and technology alternatives.

The use of Anne as an aid for the formal caregivers was highly recommended by most of the participants in this study, older adults as well as caregivers and clinicians.

Who tend not to accept Task list

We have also accounted for the characteristics of some older adults who are very active on Facebook and Whatsapp but refused to be interviewed: 4 persons. Based on the discussions with the clinicians and the motivations expressed by those who refuse the interviews, we advance the hypothesis that people who are living alone and spend much time on the internet, would tend not to use the app. Apparently, in time, their contact with the outside world is much altered.

Agenda

Agenda should serve as writing prompts. It should be used by the older adult and the informal carer as a prompt for developing a more independent life and improve the sense of being secured. It is meant to serve both older adults with or without a SCI, as it is also a preventive tool. The complex tasks should be divided into smaller tasks and always be tracked for further evidence on the degree of independency of the end-user.
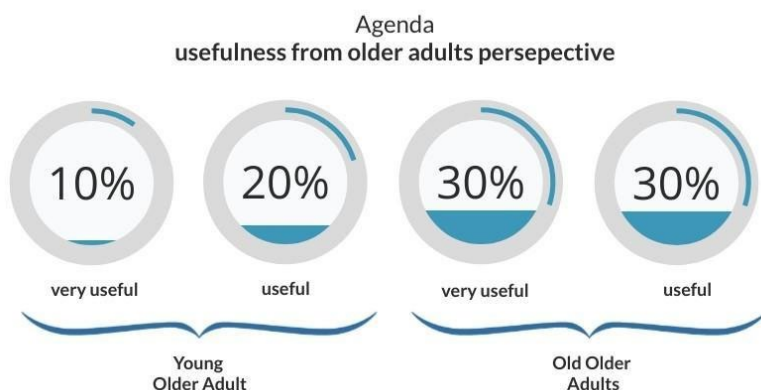
Figure 6: Agenda usefulness from older adults perspective

Young old adults see less usefulness mainly because it is an tech tool and they have a lower degree of confidence when using the new technology, and prefer to write things down on paper. Old older adults grade its usefulness higher, as their self-confidence altered with age.

The informal carers who participated in this study highly appreciate the reminder function but expressed scepticism towards the openness of the older adults towards technology.

Medicine

Many of the older adults consider that a pill reminder app is too complicated.

Physical training

Physical training
usefulness from older adults perspective

32% very useful
32% useful

Young Older Adult

20% very useful
30% useful
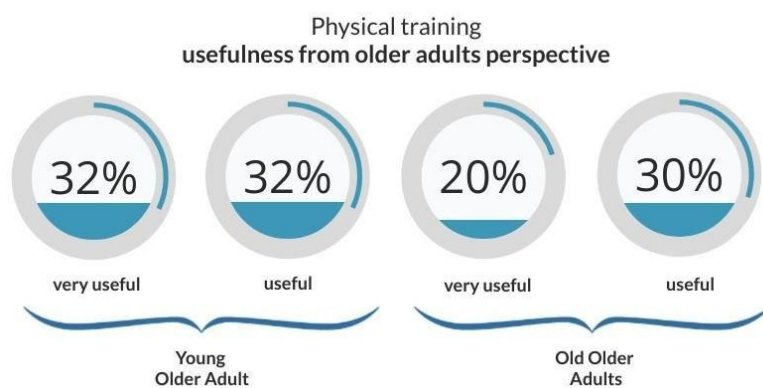
Old Older Adults

Figure 7: Physical training usefulness from older adults perspective

This feature has not been actively checked. The participants were requested just to give their opinion on that.

Older adults who were recommended some light physical exercises highly appreciate this function. Interviews show that older adults appreciate this feature as long as the exercises are not complex, and they would not take much time. They would rather look at physical training as a way of diversifying their day-to-day activities and improving their well-being.

Informal carers see much value in this feature as they should not escort their care-receivers to a physical location.
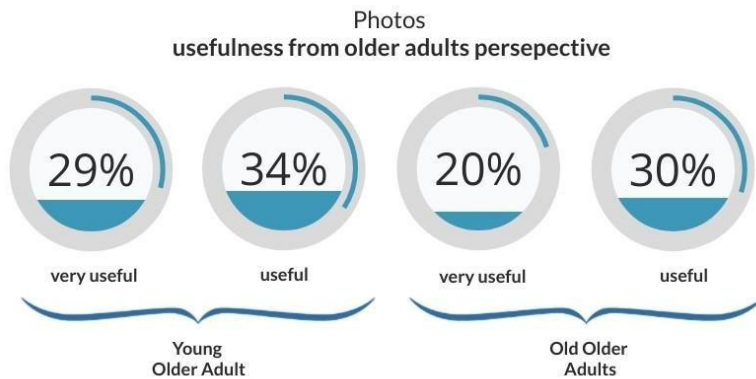
Figure 8: Photos usefulness from older adults perspective

More than half of the young old adults think that Photos is a useful feature, while about half of the old older adults also find it very useful and useful.

2.4.3 Anne's way towards the market

Anne should be a highly individualized app

Anne should be a highly individualized app in order to be effective. The information sent and suggested activities need to be highly personalized in order to be effective. It should be based on user needs and individual traits. In time, the information needs to be adapted and revised based on the changes which have occurred.

The informal carer can be supported by a list in suggesting new activities. A deployment pool of various types of activities can be given, while the informal carer uses only those who fit best to the care-receiver.

The app makes sense only if it is constructed on the personal preferences, personalities and impairments of the end-user. It should also be taken into account that the heterogeneity within the older adult population is very high, much higher when compared to the youngsters. Past experiences, abilities, interests, hobbies, curiosities, the degree of social integration, and many others should be accounted for when suggesting new activities.

Anne. The virtual assistant as a tool for the (informal) care giver

Most of the informal carers emphasized the utility of the app and expressed concern towards the easy-to-use functions of the application.

Suggested activities and their tracking are the most important aspects.

Figure 9: Agenda and Task List from the informal carers perspective

More emphasis should be put on the evaluation of the older adults' activities and the evaluation should be elaborated. A complete overview of the actions should be introduced. Which of the suggested actions have been performed?

Feedback: The informal carer or the end-user should know if the action performed was of use, was pleasant and how often it was repeated.

Suggestions: It is very useful for the end-user to revise the activities performed and any types of actions performed through the platform.

Outdoor activities and indoor activities should be suggested based on the preferences and impairments of the older adults.

News feed: Relevant information with respect to the social events happening in their town/city proximity should be promoted. RSS news feed is of great relevance to them.

Album, News and Radio usefulness
informal carers perspective

31%	21%	21%	21%	31%	21%
very useful	useful	very useful	useful	very useful	useful
album		news		radio	
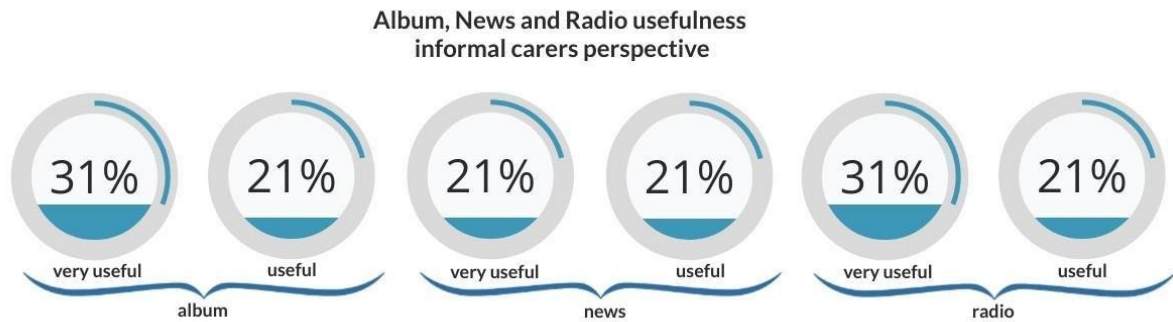
Figure 10: Album, News and Radio usefulness from the informal carers perspective

Many of the older adults interviewed appreciate positively 'anything [including Anne] which might be of help. Older adults with symptoms of SCI clearly see Anne's benefits in the fact that other can write reminders and they can do the same for their informal carers as well.

So far, we have looked at Anne just as a one -way app: eventually the family member of the older adult could suggest activities, upload pictures, or send reminders and set the agenda.

Though, some older adults suggest a reciprocal relation: the parent reminding the child that (s)he has to set an appointment, to meet someone or to call a relative that (s)he didn't do in a while.

Formal carers' perspective

According to the formal carers interviewed in this study, Anne, the virtual personal assistant, should support the work of a human personal assistant for people with cognitive impairment.

Few participants emphasized that nursing homes and care givers can make great use of the virtual assistant. One of the participants who worked some year ago as a psychologist in a nursing home said that he was actually doing at that time what Anne is supposed to do now. For example, he was hanging a sheet of paper on the door and suggested activities or reminders to the older adults about what (s)he intended to do in the following day (activities as such were listed: call a relative, take a walk, participate in a workshop).

Promotion

Anne as a companion for young old adults and Anne as an assistant for old older adults.

Generally, for the independent older adults, the presentation of Anne as a virtual assistant is insufficiently appealing. According to some of the informal carers participating in this study, promoting Anne as a companion would offer psychological comfort and increase acceptance among the young older adults. It resonates with the need for assistance in medical and permanent care. Though, that much depends on the cultural background of the person.

When promoting the Anne, an interview of 2-3 hrs long should be had. The vocabulary and the information which will be content in the video-promotion of Anne, should be taken from this interview. It is very important to exhibit the same vocabulary as the one used by the interviewee(s).

2.4.4 Methodological considerations

We developed an application prototype of an intelligent anthropomorphic virtual assistant. To test its usability, ease-of-use and the interest to adopt it, we have employed both a qualitative and quantitative methodology. It targets adherence to a more active engagement and feeling of being socially integrated, tailoring the intervention to users' needs and characteristics.

Qualitative data from open questions and telephone follow-ups were collected and quantitative data through standardized questions were taken.

Duration

We have considered an experimental dataset covering different time spans, from a week to a one-encounter test, as well as, given the pandemic context, we have evaluated the interest in using Anne though an online test where a short presentation movie has been exhibited.

Participation

We aimed to test the acceptability and the intention to adopt 'Anne. The virtual assistant', by older adults, (their) informal carers and some formal carers have been also involved through in-depth interviews. We stressed the relevance of Anne's for those at an advance age or with a subjective cognitive impairment (SCI).

A total of 101 participants were included in the tests.

Older adults:

> 49 older adults with ages ranging from 60 to 86 were included in the tests.
>
> Gender. The participants were 59% women and 41% men.
>
> Residence. From the older adults, 63% were urban, 22% rural and 14% semi-rural.
>
> Education: 50% were having university degree, 26% graduated high school, and 24% were having bellow 8 years of schooling.
>
> Income. 4% from those who participated in the survey are having a monthly income higher than 700 euros, 24% were having between 500 and 700 euros, 24% under 300 euros.
>
> Religious practice. 49% of those interviewed declared that they go to church and pray regularly, while 31% were praying regularly but do not go to the church, 14% rarely go to church and pray, and the rest were attending church very rarely or not at all. This is representative for the Romanian population where an extremely low percent from the total population declare themselves atheist.
>
> The technology literacy of those from the rural and with low education is minimal. All others use technology for specific reasons, though not necessarily in an optimal sense.
>
> Specific condition. 5 older adults who live under stress conditions, such as caring for the spouse or other relatives 24/7/365 were also included.

Informal carers:

> 48 informal carers who cover the age range of 28 to 53 were included in the study. About 56% are women. Most of them have higher education (80%) and are living with the family. Their technology literacy and use are ranges from medium to high. Most of them are

caring for their parents and some of them are caring for their grandmother or mother-in-law.

Clinicians and formal caregivers

Four (4) participants were included in the study. 2 psychologists, 1 general physician and 1 social assistant who have experience in working with people with Alzheimer, were included in the study.

2.4.5 Key conclusions

Anne can serve as companion to the young older adults. Our research results show that it would be a useful tool for building a more resilient brain, with the assistance of the informal carers. However, Anne is for those who take advice or guidance. There are multiple ways through which Anne can be of benefit to older adults with SCI, as long as an informal carer and a clinician are involved in suggesting content for the app. Informal carers present a high interest in the app but also into the function which makes them able to revise or be aware of the activities taken by the older adult.

Anne can also serve as an assistant to the old older adults. Research results show that it would be a helpful support for memory prompts, and it would engage emotional memory, as well as give a sense of companionship. Results show that Anne can be a great tool for informal carers and for formal caregivers in the nursing homes. The easy-to-use aspects should be further considered in increasing the size of the icons, the texts, and the contrast between letters and the background, as the old older adults participating the study emphasized.

3 Technical feedback

This chapter contains feedback from the end users that can be classified into technical topics. E.g., did malfunctions occur during the trials. The feedback was collected, prioritized and if possible, immediately fixed to provide a new version of Anne to the users. The technical issues were forwarded to VirTask.

The chapter is grouped by countries.

3.1 Technical feedback in Switzerland

Feedback that could be identified as a technical issue, was reported to the iHomeLab Team. They tried to reproduce the issue on their devices and collect as much information as possible to the topic to create a new issue on the issue tracker of VirTask on GitHub. In regular meetings between VirTask and iHomeLab, the issues were discussed and prioritized. If issues could be fixed a new version of Anne was released, first on the devices of iHomeLab for further testing, before it was rolled out to the end users. A lot of technical issues started from needs and wishes from the end users and ended up as a technical issue later.

Most of the issues were reported in the beginning of the trials in June/July 2020.

The following technical issues were reported from test users in Switzerland and were forwarded to VirTask:

#	Issue description	Opened	Closed
1	Anne logged out herself on many tablets in Switzerland. (Re-Log-In required)	Jun 2020	23 Sep 2020
2	No screen keyboard appeared on log-in screen.	Jul 2020	20 Jul 2020
3	Anne started a new call while a call was ongoing	Jul 2020	20 Jul 2020
4	Missed calls are shown with the username and not the display name.	Jul 2020	20 Jul 2020
5	Voice/Command recognition does not work that well for many users in Switzerland.	Jul 2020	
6	Video screen should be in full screen like in the web interface version.	Jul 2020	13 Jul 2020
7	Anne does not disappear on incoming calls.	Jul 2020	13 Jul 2020

8	Medication entries for every n* day.	Jul 2020	16 Sep 2020
9	Time and Date of Notification for a date in the calendar should be configurable.	Jul 2020	22 Sep 2020
10	A telephone contact should be shown offline if the device is in on boarding mode.	Jul 2020	
11	The size of Anne should be changeable (detached from the windows scale factor).	Jul 2020	16 Sep 2020
12	Anne disconnects after (approx. 2-3 hours) after start/reload.	Aug 2020	18 Aug 2020
13	Video calling: Default full screen setting.	Nov 2020	

Details

1. Some of the users reported, that they must log in several times repeatedly, which clearly should not be the case. VirTask was able to fix the issue.

2. In rare cases no keyboard of the device occurred when the user should have logged in. In these cases, the user was not able to type in his/her credentials. This issue could be fixed.

3. 2-3 times a user reported that Anne started a new call, while a call was already ongoing.

4. When a missed called was shown to the user, they saw the caller's username instead of the personal name. This led to some confusion, because the usernames were not necessarily recognizable. This error was already fixed earlier by VirTask, but the first end users did not receive the newest version due to a misunderstanding between iHL and VirTask. After a new version was deployed this error was gone.

5. Some user mentioned that they would like to talk with Anne in Swiss German. This is a highly technical problem, because they are not enough spoken and transcribed audio records to train a speech recognition model in Swiss German. This is current state of research in Switzerland.

6. The users mentioned that the window where they see the caller's video is too small and does not fill the screen of the device. This was solved by VirTask with a full screen mode button while a call is ongoing.

7. On some devices the avatar of Anne, did not disappear when a call was incoming, and the avatar covered a lot of the caller's video screen. This issue was fixed, and a new version was provided to the end users.

8. The users (or their relatives) wanted to add some medications for every nth day. (E.g., every 5 day). This wasn't possible so far and needed some adaptions to the dashboard of Anne where the relatives enter the medications. In today's version the medications feature could be improved a lot.

9. In the version the users started with, the reminder for a date in the calendar was fix half an hour before the meeting. The users reported that this is not convenient, and they want to be able to configure, when the notification should be announced. This was improved by VirTask and is possible in today's version.

10. In one case there was a call incoming while the device was still in onboarding mode. The caller saw the device already as online. This happened while the device was not delivered to the end user and was still on iHomelab's office. Therefore, this issue had not a high priority to fix, because it did not affect the end users.

11. For the filed trials in Switzerland, there was a device used which had a slightly smaller screen. This led to, that Anne's avatar covered to much of the screen. As a first workaround the avatar could be made smaller with the scale function of the underlying OS (Windows). But this had the side effect, that the other UI elements like buttons etc, were scaled down as

well. Therefore, the report of the end users was, that the UI was too small. VirTask could implement, that the size of the avatar can now be configured in several steps. Most of the users in Switzerland took a smaller avatar size, after this was possible.

12. On several devices there occurred an issue that the devices disconnected from the server repeatedly after a few hours of use. This issue could be solved by VirTask and the connection is now much more stable.

13. There was a wish of a user, that the caller's video is in full screen by default. This feature will be discussed by VirTask. Because it is already possible to go to a full screen mode, the issue has not a high priority.

Conclusion Switzerland

The various feedback from the end users during the trials, were of high importance for the developer team of Anne to continuously improve the software quality and Anne grew to a mature digital assistant during the project.

3.2 Technical feedback in the Netherlands

No technical feedback was reported by the End Users from the Netherlands.

3.3 Technical feedback in Poland

Remarks and impressions:

• Study participants have trouble installing the Emma app on their own phone. There are different phones, there is no single instruction on how to operate the application. The elderly cannot cope with the installation on their own, even children and carers have a problem, they need detailed instructions and outside help.

• In Poland, you can buy a blood pressure monitor that works with the Emma App, which works only with Android, this is a serious limitation, although in 2017 the sale of iPhones amounted to approx. 11% of the total

sales of smartphones (89% of Android phones), but they are presumably are people familiar with new technologies.

• The Polish language in the Emma application is still not stable, after entering the basic data and logging in for the first time, the system still changes to English and only the selection of the language through the Menu and Settings (description in English) allows you to return to the Polish language. When the phone is updated, the language changes to English again, which is an insurmountable barrier for seniors.

• The colors of the Application are pale, not very contrasting, the elderly have trouble observing the aggregate weekly results.

• Some people pointed out that even after a correctly conducted test and the result recorded in the "Graph" in the "Week" tab, there was a question mark and no confirmation of the test. And the examination on the next day removed the question mark, did not mark the completed examination on that day. In the "Chart" tab, everything was visible in accordance with the facts.

• Turning on the Anna Application is simple, it does not require knowledge or complicated skills from a senior.

• The limitation of Anna's Application is the lack of the need to confirm (for example by voice) that the message in the schedule or the received message has been listened to, acknowledged.

• The bathtub mat has passed the first tests and requires further work:

- A clear form of sound and visual signal is needed for the person using the mat that the mat is working and the data recording process is proceeding correctly.

- The mat should be safer, better adhere to the bathtub and guarantee the stabilization of the foot and the entire body of the senior.

- Both the bathtub mat and the chair mat should be made in various sizes to fit various shapes of bathtubs and chairs. In the prototype version, we have one universal size, which sometimes causes problems with adjusting to the chair that the senior has at his disposal.

- The "harness" of the mat seems to be adjusted only to standard sizes of unbuilt bathtubs.

- From a technical point of view, it has been found that the wires in the bath mat connecting the electrodes to the electronics must be a braided multi-strand wire to provide the required bending and tensile strength.

- Further work is needed to optimize the algorithm that detects the presence of a person in the bathtub. Detecting a person in the bathtub or not depends on its weight (volume), the presence of liquids and bath salts. There are many independent factors that may disturb the process of detecting a person in a bathtub.

3.4 Technical feedback in Romania

No technical feedback was reported by the End Users from the Romania.

4 Conclusions

From a technical point of view, the realization of E4L was very successful. The overall architecture with the loose coupling of the components via the message queue resulted in a solution that was both stable and robust. First, the roll-out was simple for the end user, especially in Switzerland where it was literally only "plug-in to power and start using it". And second, during the test period, only very few supporting interventions were necessary from the researchers.

The system has received the greatest support from the "younger old people". It turned out that, despite the very simple user interface, the interaction does require a certain basic technical understanding. If this was present, then the functions of E4L were found to be helpful. This was especially true for the video communication feature that was mainly used among the test users in Switzerland during the COVID-19 pandemic. There it was also found that the E4L system could gain dramatically in functionality if it could interoperate with existing communication platforms (such as Skype or Facetime). In the Netherlands and in Romania, the reminder functions (both those for medications and for other appointments) were perceived as most useful. Activity coach and work instructions were also welcome as help to remember things and structure the day. However, due to the restrictions caused by the pandemic, these initial perceptions could not be validated during a longer trial period.

System extensions through sensors like the bathtub sensor or the blood measurement device are very welcome if the end users have the appropriate infrastructure. Here, a clear difference between the eastern and southwestern countries in Europe became apparent. In the east, often the bathrooms in the apartments are quite old and have a bathtub, so bathing is very widespread, and the additional security is welcome. In the

other two countries, bathrooms are mostly renovated and only showers have been installed, because getting in and out of the bathtub is considered strenuous or dangerous for elderly people. Blood pressure measurements, on the other hand, is more widespread in Switzerland and the Netherlands, so this feature was very welcome in these countries. In general, enhancements trough sensors depend very much on the infrastructure that is common in each country.

Another issue that shows regional differences is, of course, languages. Here we faced two main problems. To our regret we had to realize that the eastern European language models are by far not as well developed as those for the western European languages. A lot of development time was spent to integrate a basic model into the Romanian and Polish versions of E4L. Still, serious errors occurred again and again, causing the systems to use English in a kind of fallback. This rendered the end users helpless since they do not speak this language. In Switzerland, there are no language models at all for the dialects spoken in daily interaction. That is why Swiss people must speak in standard German (as it is spoken in Germany or written) with language avatars. This feels unnatural, especially for older people, and therefore causes a reluctance to use the system right from the start, independent of the other properties of the system. If there were speech systems understanding Swiss German, solutions such as E4L would have a much better chance in Switzerland.

We see further potential for improvement in E4L especially in interaction and communication. An avatar is something very unfamiliar for older people. Although there were several different avatars, of both sexes, skepticism could not be overcome. It seems that an avatar does not arouse curiosity or fascination among older people. They attach more importance to an interaction that is as realistic as possible. Causes could be that existing health restrictions already generate uncertainties to start with. If then a technical system adds further uncertainties, the existing ones are intensified and add up to a barrier preventing the system usage. In addition, the different components of the system did not have uniform user interfaces. For example, the blood pressure measurement device had a small screen and the connection was done through a smartphone app with yet a different user interface, both of which were very different to the look of the user interface on the tablet. For a final product, all these interfaces should be unified to share a common look and feel. In addition, all these aspects would have to be investigated in more detail in further studies.

As a general conclusion, it can be stated that a combination of several assistance systems does not per se generate added value for the person

and thus an increase in the quality of life. It can therefore not be assumed that each additional system component automatically increases the quality of life. During the project, it turned out that often "less" is "more". Combinations must be individually tailored to the needs of each person and then linked very well together, with a uniform look and feel. For the future, it would make sense to redesign E4L to achieve a truly consistent and continuous interaction. This should be developed with end users if possible.

The E4L project was influenced very much by the three waves of the Corona virus. Access to the elderly population was not possible for a long time. Therefore, neither the planned number of end users could be reached nor was the individual's usage time of the E4L system long enough to be able to confirm the expected KPs as well as the increase in quality of life. We recommend having additional user trials where the system is used over a long period of time to get a statement regarding the quality of life of the elderly. This also provides the data to find out if the elderly and their relatives are supported by E4L in their daily life.

5 Definitions, Acronyms and Abbreviations

Ella4Life - Acronym of the current project: "Ella4Life – your Virtual Personal Assistant for home and on the road"

AAL Programme - Active Assistive Living Programme

ICT - Information and Communication Technology