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D22 - REPORT ON SERVICE REQUIREMENTS AND ANALYSIS, FUNCTIONAL AND TECHNICAL SPECIFICATION

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Definitions, acronyms and abbreviations

Acronym	Description
AAL	Ambient Assisted Living
AALA	AAL Association
AmI	Ambient Intelligence
SME	Subject Matter Experts
CBT	Community Building Toolset
MWT	Mental Wellness Toolset
SWOT	Strengths-Weaknesses-Opportunities-Threats analysis

Contents

1 Executive Summary

The aim of the project M3W – Maintaining and Measuring Mental Wellness is to catch the changing, mainly the declining of the mental capabilities. We intend to accomplish this by developing games which make possible to measure the mental capabilities, while the patients play these games with pleasure giving a chance for the systematic data logging. This can assist to determine the extent of the change in the mental state as exactly as possible.

The number of the people suffering from chronic diseases characteristic for the aged people increases as the average age augments. One of the cumbersome phenomenon typical for the diseases of the late years is the considerable mental deterioration, which makes difficult or even self-dangerous not only the life of the patient but causes an almost intolerable burden for his/her family or entourage. As the progressive attenuation of the mental capacity is a natural phenomenon in the late age, it is not a simple task even for the specialists to distinguish between natural and abnormal, and it is almost impossible for the long run for the people living together with the elder or knowing him/her closely.

This report is the deliverable D21 of the first phase of the M3W project – the discovery phase. It describes and analyses the user requirements and technical requirements for the M3W service. Chapter 1 introduces the methodology that has been used to gather the primary user requirements. Chapter 1 focuses on the primary user requirements where the developers view on the M3W features and purpose has been recorded and formatted to be understood by the primary user representatives – the Subject Matter Experts (SME). The SME have been interviewed and their say and thought are reported in chapter 3.2 and analyzed in chapter 3.3. Results from a series of Focus Group Workshops are described in chapter 3.4. In chapter 3.5 and 3.6, a summary of the critical elements for the M3W project are discussed along with a critical reflection which purpose is to adjust the developers view with the needs for the primary users. Chapter 3.7 describes the ongoing quantitative survey activity that has been undertaken the last few months to complete the qualitative survey of the primary users requirements. In the chapter 3.7.3, the preliminary results of the quantitative survey are included as part of this deliverable. They will be consolidated during the second part of the project and released as part of the final version of the deliverable.

Chapter 4 describes the specific Business of our project business partners and, finally, chapter 5 and 6 describes the consolidated functionalities and requirements for the M3W system.

2 Introduction and Methodology

Based on the results of the workshop with the developers, the subject matter experts and the focus groups with potential end users the following aspects and dimensions have been identified being critical for the further development of the M3W system.

Result presentation and follow up support: Presentation and related effects of the game results/scores are very critical. Subject matter experts raised questions regarding benchmark assessment and what happens, if people are not able to interpret the results? Potential users are willing to play the games, but they lack information or guidance how to use the results. They raise questions like:

- "What shall we do with the results?"
- "What's my actual score?"
- "What are the next steps, once we get the information that the cognitive skills are going down?"

It is very important to provide users with professional and country or area specific support once the results are going down as part of the M3W system.

➔ Users want to have the freedom to choose different game modes: purely training – entertaining mode without identification and score savings; early warning mode with storage of data and user identification

➔ Presentation of results should happen on two levels:

- Individual game level: for each game, users should be able to understand how the scoring system works, ongoing and consistent feedback about the scores should be provided
- Overall game level (cognitive skills, early warning tool)

➔ Definition of the follow up support scenario

User characteristics: The ideal user can be characterized as computer literate and 60 to 70 years old. In particular the potential users (focus groups) always mentioned that the systems would be useful for people a few years older than each person asked. This pattern could be identified throughout all focus groups. In contrast to that the subject matter experts suggested, to promote this system to people starting at the age of 40, for people in rehabilitation and early diagnosis of Alzheimer.

➔ Offering different entry points into the M3W system (main user group (60+), people with early diagnosis/rehabilitation, user 40+, etc.)

Game characteristics: The game characteristics are strongly related to the different user characteristics. Subject matter experts emphasized that the use of kiddy/childlike figures and designs (Bunny game) are very negative for people with Alzheimer diagnosis. In contrast to that, participants of the focus groups (60+, in particular women) found these games very appealing. In general potential users prefer to be able to select games from a big set. The size and shape of text and figures must be readable for people with age related seeing impairment. It should be possible to play the games everywhere and on different hardware (Mac, Windows, and Tablet with touch screen). Currently potential end users miss games that also train the fine motoric (labyrinth).

➔ Big variety and selection of games for different hardware, easy access, user guidance (introduction into the games), understandable scores and feedback, accurate size of shapes and text

Data confidentiality and privacy: It has to be made very transparent, what happens with the data. The data handling must be in control of the users. Most potential users are very reluctant to provide any personal information, some are very open. All of them want to control to whom else they provide access to the data. Potential end users as well as subject matter experts to not provide data access for insurance companies.

➔ Transparency of data handling and user control over data, responsibility for M3W data confidentiality should be defined (who's the provider of the games) and is important for trust in the system
➔ Playing with a pseudonym (without indicating name) has been proposed
➔ Consent mechanism need to be implemented

Social aspects: The social, collaborative and competitive parts of the games are judged critical by the subject matter experts. Subject matter experts and potential end users see virtual interactions critical ("replacing personal assistance by electronic means"). In particular active elderly prefer face-to-face contact and activities. Individual reaction of users concerning negative results as well concerning the early warning needs to be investigated beforehand.

Business and user requirements analyses in the context of product innovation have to face one important threat: Interview partners cannot talk about things they do not know (i.e. the innovation aspects of a development). In order to face this threat our analyses focus strongly on user problems with existing processes of work. This procedure allows defining weak points in existing workflows that can be supported and optimized using innovative technology.
When trying to design an innovative information system, one faces a plethora of problems regarding the capturing of user needs. A system is considered successful, when it meets users' needs. In order to do that, one has to hear the voice of the user and get close to him as current managerial philosophy proposes. The problem, according to Leonard and Rayport [DK1], is that users' ability to guide the development of new products and services is limited by their experience and their ability to imagine and describe possible innovations. How can developers identify needs that users themselves may not recognize? How can designers develop ways to meet those needs, if even in the course of extensive market research users never mention their desires because they assume these desires cannot be fulfilled? To answer these questions the user-centred requirements engineering methodology puts the intended users of a system at the centre of its design and development. It does this by involving users directly at key points in the project to make sure the system will deliver upon their requirements. The stages of the user-centred requirements engineering are carried out in an iterative fashion, with the cycle being repeated until the project's objectives have been attained.

Requirements engineering is a central element for the development of the M3W system, which consists of a game-based mental wellness tool (MWT) and an accompanying community building tool (CBT). In particular the development of serious games present unique challenges with respect to usability, playability and learn ability.
Within the project a human-centered requirements engineering methodology has been applied including a technology acceptance framework for the development of M3W system (taking into account game aspects as well as community building aspects) that gives meaningful and immediate feedback to developers and researches regarding the user requirements, preferences and acceptance of the system. The human-centered requirements engineering methodology consisted of a number of activities, which will be described in detail below.

1. Requirements workshop with developers „Critical to developer“: This workshop focused on requirements objectives, i.e. critical elements for the developers with respect to the MWT (such as game features, playability, motivational dimensions, and platform/technology constraints) and CBT (such as motivational dimensions, content/services, platform/technology constraints).
2. Requirements workshop with user organizations (key partners) and subject matter experts (SME): These workshops addressed the expectations and requirements of key partners (end user organizations) and subject matter experts. SME Subject Matter Experts is a broader definition for any qualified and experienced professional. In our case on the topic dementia/care. This workshop emphasized the aspects of usefulness, the desired output quality of the MWT (e.g. measurement capabilities) and the CBT. Potential conflicts between training/measurement requirements and user/game requirements have been identified.
3. Focus groups with users („Critical to user“/elderly gamer, health aware elderly): Focus groups have been performed, where small groups of potential end users were invited to get to know the basic ideas and concept of the M3W system. As part of these focus groups users have been asked about their preferences regarding the perceived usefulness, their preferences for the MWT and the CBT. In addition to that, motivational aspects have been addressed as well as barriers and main concerns of older adults who are inexperienced user of games.

User-centered requirements engineering focuses on identifying and understanding the features and characteristics of the M3W games most important to the possible users and other stakeholders (relatives, physicians). Requirements engineering determines what functionality, qualities or properties the M3W games need to get accepted by the potential users and become successful. Solid requirements engineering process prevents and resolves uncertainties and defines a clear path for the development.
The results of the requirements engineering will not be a specific design for the games – it specifies the critical elements that need to be taken into account for the design, the functionality that must be offered and the characteristics the game must have.
The goal of the process is to get a shared consensus and understanding of the M3W games. The requirement engineering should create a common vision for the developers, while being free of implicit assumptions and technological constraints.

The user needs and expectations need to be transformed into measurable qualities. Therefore it is relevant for the requirements:

- to be as specific as possible;
- to provide a definition of target performance as well as acceptable deviations → „Specification limits“;
- to identify secondary issues or side effects which might exert a negative or unexpected influence of the game acceptance.

Our methodology towards elicitation of User requirements can be summarized and depicted in the following figure:

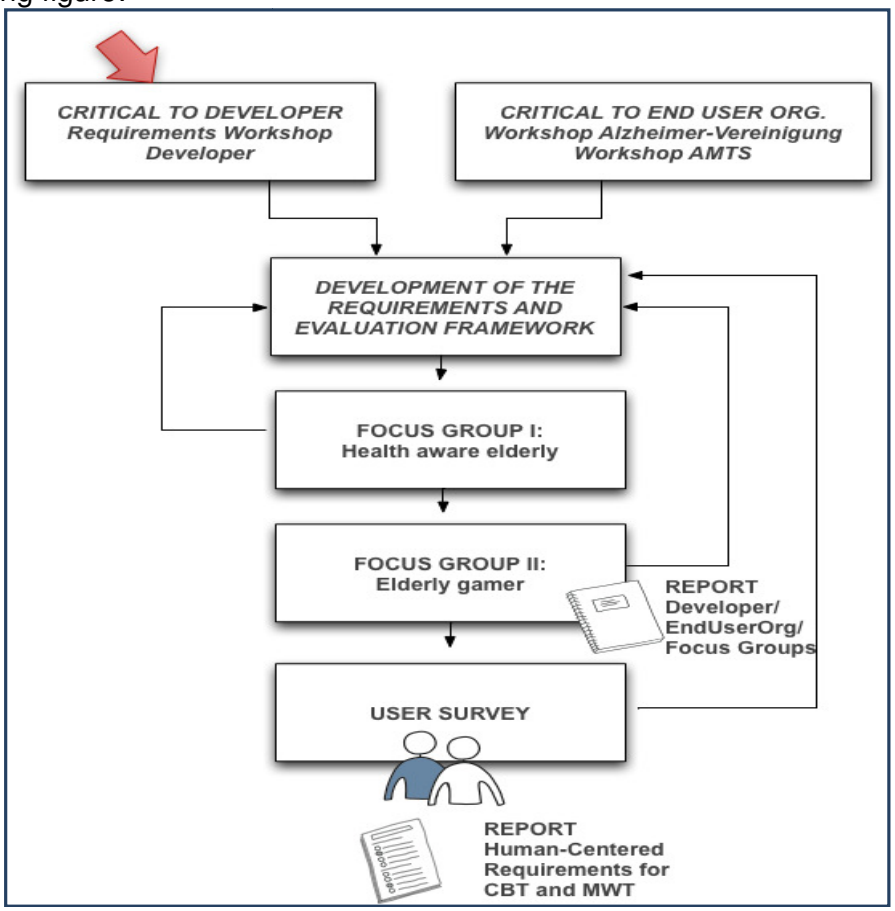


Figure 1 M3W User Requirement Engineering Process

3 Results of the M3W User-centered RE Process

3.1 Developers Workshops

The emphasis of this workshop was an open space brainstorming to identify and describe possible usage scenarios for the M3W Games and to collect and discuss critical elements and requirements in view of the developers/experts regarding these scenarios.

Three major scenarios can be summarized out of the several scenarios described by the developers.

A) People playing the M3W games
B) People motivating other people to play the M3W games
C) People using the results of the game for monitoring the mental state of other people (patients, parents)

In the following the indicated and collected important aspects and statements are listed for each scenario according the relevant requirement dimension.
The detailed results of all dimensions and statements concerning the different dimensions are shown in the Excel file "M3W-Statements_Developer_SME_FocusGroups.xls".

3.1.1 Scenario A) People playing the M3W games

For this scenario the developers mentioned the following important dimensions:

- Ease of Use
- Entertaining/Fun/Playability
- Social aspect and stigmata
- Data confidentiality

Other issues have been indicated regarding result demonstrability and presentation:

- What happens, if there is no / little confidence regarding the science behind and the reliability of the method
- "What happens if the mental ability is decreasing…"

It has also been proposed that additional data should be collected to fine tune the game results e.g. information about the mood and sleeping quality and that other additional health services should be bundled with the M3W games.

3.1.1.1Ease of Use

The developers made the following statements:

- Games must be accessible (open, no "login" required)
- The first access to the games should be open, if users want to get more features a registration process should be provided
- The system should be easy, no complicated features

3.1.1.2Entertaining/Fun/Gameplay

Concerning this dimension, the following statements have been collected:

- Games should be entertaining and addicting, people should perceive them as fun and not as measurement tool
- The first impression needs to be good
- A "Coolness factor" needs to be considered, the design should be attractive

3.1.1.3Social Aspect

Many statements have been made regarding the dimensions "social aspects" and community interactions:

- Games should be a social event for the gamers

- Collaborative gaming is a special challenge
- Multiplayer games – people might play in the same room on the same device or people play remotely together
- Games should be accessible and present at health community websites and organizations
- Games should be visible for people who are aware about mental wellness

3.1.1.4Stigmata

A lot of concerns have been mentioned concerning the stigmatization of people playing the games:

- Users can feel embarrassed and ashamed when the mental ability is going down
- System should not be used, if it leads to stigmatization

3.1.1.5Data Confidentiality

Another important dimension is the data confidentiality:

- It will be critical to convince people that the data collection is to their advantage
- How can it be communicated that data will not be used for other purposes
- Self-commissioning and privacy of data is not clear
- Concerns if the seriousness of the site is not clear

3.1.2 Scenario B) People motivating other people to play the M3W games

For this scenario the developers mentioned mostly the following important dimensions:

- Social aspects
- Data confidentiality
- Business opportunity

Regarding playing the games it has been emphasized that it must be possible for a carer or relative to help an elderly to get into the game. The developers have also been mentioned that the degree of addiction to play the games (setting a limit of how long somebody is playing) and possible side effects of the games should be considered.

3.1.2.1Social aspects

Concerning this dimension, the following aspects have been reported:

- People can connect through the games
- Physicians, careers can look for new patients
- Carer who have an interest in entertaining the patients
- Friends who want to play together
- The activity should be intelligent so that people are convinced that the gaming activity is helpful for their relatives
- People should be able to share information and activities

3.1.2.2Data Confidentiality

Again, also for this scenario, data confidentiality is an important dimension:

- Concerns about the security and privacy of the system should be considered

3.1.2.3Business Opportunity

The following business cases and ideas have been mentioned:

- Psychiatrists want to have more patients (provide people by early alerts to visit a physician.
- Pharmacy might want to make people aware
- Health care systems promoting early recognition and screenings to reduce costs
- Reduction of presence time of carers/nurses (Playing from distance with a patient)

3.1.3 Scenario C) People using the results of the game for monitoring the mental state of other people (patients, parents)

For this scenario the emphasis of the statements are on the following dimensions:

- Results demonstrability/accuracy
- Results presentation
- Ease of use
- Data confidentiality
- Business opportunity

Results Demonstrability/accuracy

The developers emphasised the accuracy of the results:

- Precise measurement must be guaranteed to not provide false alarm – what means the result, how can one interpret it?
- What happens, if the system is not accurate enough (system will not be able to give a diagnosis, like “You have Alzheimer disease”)
- Reliability of the system
- System gives feedback of performance (feedback performance measurement) but is not a medical diagnosis
- Scientifically sound system (doctors, nurses)
- Forms of feedback / results should be comparable (e.g. standardized according to age rate)

Results presentation

The following statements address the dimension result representation:

- Different types of information can be collected from patients (e.g. cognition)
- Individual data versus statistical data (other peoples’ results) analysis must be possible for different kinds of reporting, benchmark
- Easy interpretation of the results (green, yellow, red) for different user groups (gamer, doctors)
- Aggregated results, interpretation of results
- For the project it is critical, how to cope with the big amount of data and select the data that are critical for determining the mental status of the gamer
- Results and feedback must be categorized into neuro-psychological domains
- Games must be consistent and comparable with each other – e.g. results are presented to be able to provide percentage comparability (e.g. attention, visual-spatial skills, memory…)
- After a while also patients can get familiar with these domains as well

- These kinds of feedback (domains) is also used by other internet (medical) sources (e.g. case report in hospital)
- It must be clear, what is the new idea of the system, what is unique in that system – how does it differ from other sources of information

Ease of Use

The following concerns regarding the accessibility and use of the M3W system have been indicated:

- Platform accessibility, compatibility and communication – does the M3W games run on my system, device?
- Doctors are not IT-experts – how do they download the data, what kind of data services will be provided?

Data Confidentiality

Again, also for this scenario, data confidentiality is an important dimension:

- Legal issues: People must grant the right to be able to monitor the results
- Cross boarder transfer of medical data → Code instead of names?
- Anonymous data as a solution?
- Different regulations in Europe need to be considered

Business Opportunity

The following business cases and ideas have been mentioned for the third scenario:

- The system should be easy to integrate in to the existing business/work processes of a doctor or nurse
- Methodology should be accepted by the physicians/medical professionals and also be of business interest to them (Business Advantage)

3.1.4 Summary

In the table all dimensions are listed, that have been addressed during the two workshops with the developers. Further it is marked, for which scenario each dimension has been addressed by the developers.

Dimension	Scenario A	Scenario B	Scenario C
Ease of Use	x		x
Entertaining/Fun/Playability	x	x	
Social Aspect	x	x	
Stigmatization	x		
Data Confidentiality	x	x	x
Business Opportunity		x	x
Results demonstrability/accuracy	x		x
Results presentation	x		x
User characteristics			
Bundling of services		x	
Competition	x		

3.2 Subject Matter Experts (SME) Findings

The Subject Matter experts have been invited to get to know the M3W games. Before the workshops take place, participants have been asked to identify possible chances, risks and requirements of the M3W games. Based on their experience, they were able to comment on relevant dimensions as well as identify critical elements for the M3W games.

3.2.1 M3W Target group/user characteristics

The participants of the subject matter expert workshop mentioned characteristics of possible M3W users, e.g. they described the potential users as:

- Dementia affected people (40-50 years)
- People that are curious or want to know if they feel that maybe "something is different/not normal"
- Health aware persons that like to do a "self-assessment"
- People in rehabilitation after a stroke or accident
- People with "MCI"

They indicated that the M3W games are easier to use, motivate for people who are already familiar with computer use.
The results of the workshops are summarized in two sub-chapters: concerns and uncertainties as well as positive statements and suggestions.

3.2.2 Concerns and uncertainty

The subject matter experts emphasized concerns and uncertainties regarding the use of the games, in particular they raised concerns with respect to the presentation of results, the social dimension and data confidentiality:

Concerns of Reliability and Presentation of Results:

The following concerns regarding the presentation of results and the reliability of games have been mentioned:

- Benefit of each game is not clear
- The measurement should only show the individual tendency but not an overall benchmark
- "What happens" if the scores of the user are going down
- State of health might influence the game results. (Bad) game results on the other hand might influence the mood.

Concerns for Social/Community aspects

The following concerns regarding the community have been mentioned:

- The aimed social interaction is seen very critical and difficult to achieve with elderly people
- The subject matter experts would prefer to have a Face-to-Face interactions promoted by the games
- Diagnosis in a social environment is very critical and probably not accepted
- There is also a slightly negative image of IT-media in healthcare, that needs to be considered (→ "replacing people/caregivers by electronic means/games")
- Games should be assisted and played together with a professional

- Competition/competitive games are seen critical → "There are people who cannot cope with losing games"

Concerns for Data Confidentiality

Data confidentiality is seen very critical and the subject matter experts had lots of questions:

- Who has access to the data of the gamer/user?
- What happens with the data (use for analytics, where will the data go, transformation of data, what happens if the health insurance gets access? etc.)

3.2.3 Positive statements and suggestions

The subject matter experts indicated suggestions regarding the ease of use as well as entertainment and playability of the games.

Ease of use

The subject matter experts mentioned the following aspects regarding the ease of use dimension:

- Very easy game entry/Log-in →"Push one button and you start the game"
- It should be possible to play the games everywhere (e.g. while waiting, etc.)
- People should have no fear that they could break something (robust games)
- It should be clear which games are relevant for training and which games are linked to diagnostics (purpose of the games should be evident)

Entertainment and Playability

The subject matter experts stated the following preferable characteristics regarding the playability of the M3W games:

- Game should offer experiences of success
- It should be possible to have the choice between playing with scores/without results/diagnosis/playing just for fun
- Break and a stop functions of the games should be possible
- Various levels and possibility to adjust the speed/level
- Support through sound/acoustic feedback
- Easy interface, if possible tactile
- The representation should not be too small
- Focus on entertainment
- A variety of games should be available

In addition, the following aspects have been highlighted and should be considered:

- The games should be free of associations
- No childlike symbols and pictures should be used (→ Bunny!)
- Training is motivating, whereas diagnosis maybe discouraging and hindering people from playing the games
- How exhausting is it to play the games? People with dementia will not be able to play longer than 10-20 minutes
- There should be no negative feedback. Feedback should engage people to continue playing the games.
- Games should be "new" since existing games are often associated with (negative) experiences

3.2.4 Summary

In the following table all dimensions are listed, that have been addressed during the subject matter expert workshop. Further it is marked if the dimension has been addressed in terms of concern or as a positive statement/ suggestion for which scenario each dimension has been addressed by the developers.

Dimension	Concerns	Statement / Suggestion
Ease of Use		x
Entertaining/Fun/Playability		x
Social Aspect	x	
Stigmatization		
Data Confidentiality	x	
Business Opportunity		
Result demonstrability/accuracy	x	
Result presentation	x	
User characteristics		x
Bundling of services		
Competition		

3.3 Summary and comparison of findings between the M3W Developers and SME workshops

The results of the workshops indicate that there is on the one hand a substantial interest in the M3W games but there are also several concerns and slightly different views between developers and the expectations of the subject matter experts. For the requirement engineering these differences need to be considered.

The following figure provides an overview of the different findings from the developer workshops and the subject matter expert workshop related to game acceptance dimensions and relevant user experience factors (User Experience Engineering Factors or *UX Engineering*). User Experience Engineering encompasses understanding, scoping, defining and developing the user experience.

Figure 2 summarizes the developer workshops results focusing on usage scenarios of the M3W games. The subject matter expert workshop resulted in potential user characteristics.

Figure 2 M3W Requirements and their User Experience Factors

Comparing to the developers view on the M3W games the subject matter experts emphasized and judged the following dimensions more critical:

- **Result presentation**: Presentation and related effects of the game results/scores are very critical. Subject matter experts raised questions regarding benchmark assessment and what happens, if people are not able to interpret the results?
- **Social aspects**: The social, collaborative and competitive parts of the games are judged very critical by the subject matter experts. Subject matter experts see virtual interactions more critical ("replacing personal assistance by electronic means"). Subject matter experts want face-to-face contacts promoted (people should play the games together with a professional) and they indicated that competitive games could lead to disappointment of the gamers.
- **Data Confidentiality**: Subject matter experts highlighted also various concerns, aspects and dimensions of data confidentiality regarding mental wellness information (what happens with the data, who will know about the scores, what happens if insurances get the information, etc.)
- **Entertainment and Playability**: Regarding user motivation they would emphasize the training aspect and deemphasize the diagnostic/evaluation part.

Game characteristics: The subject matter experts indicated also - contrary to the developers - more detailed characteristics regarding the gameplay characteristics.

- Games should be free of connotation (for example "well known Swiss card game like "Jassen")
- No kiddy/childlike figures and designs (→ "Bunny Game")
- It should be possible to play the games everywhere

The developer mentioned more details and requirements regarding the expected mental wellness result presentation, the possible social interaction play requirements and data confidentiality.
In addition to the overall comparison, in the following section the differences in the results of the developers' and the subject matter experts' are contrasted for each dimension.

3.3.1 User characteristics

One important topic that needs to be clarified is the age of the primary user group. There is a big difference in the understanding between the view of the developers and the subject matter experts.

Statements Subject Matter Experts	Statements "Developers"
Subject matter experts target also the group 40-50 ("all adults") and suggest the use for rehabilitation. Games should be accessible for everybody even without any computer experience.	The MWT games should be accessible to everyone, also to engage community building (!!!). People that have not been yet diagnosed regarding dementia. The focus should be on mild cognitive impairment and people above 65 years. Elderly and retired people Alternatively one could introduces age categories: 40-50 years; 50-60 years; above 60

Beside differences in the results, during the workshop with the subject matter experts topics were identified, that need **further clarification**:

- The statement of the subject matter experts addressed the influence of the mood "the results of the games might influence the mood". They are concerned, that the presentation of the results of the games could negatively influence the state of the people after gaming (e.g. if the results show a decline). The subject matter experts also pointed out that the mood can influence also the game scores and this might affect the accuracy of the results and they are wondering, how this will be handled in the project.

3.3.2 Result demonstrability, accuracy --> usefulness, reliability

The subject matter experts stated that it has to be very clear what the benefits of the games are. A prerequisite for the benefits has to be that the games provide precious and reliable results.

Statements Subject Matter Experts	Statements "Developers"
The subject matter experts stated that it should be clear what the benefits of the games are. The benefit implies that the games provide precious and reliable results.	Developers see the communication and understanding of the benefits as a marketing related task. The definition of "Reliability" is not obvious to them.

3.3.3 Results presentation, measurement

The subject matter experts indicated that the games should only show a tendency. The developers basically agree that it will focus on the evolution. Benchmarks and comparison of results are seen critical.
Understanding of the results:
Developers agree that it will be difficult for the user to understand the significance of the results. Results/scores should be presented user-friendly and M3W system will act as a "Warning tool".

Statements Subject Matter Experts	Statements "Developers"
The subject matter experts emphasized that it should be possible to play with/and without results and that they don't know, how the players will react if the results going down.	At the moment there is always a login required and there is the idea to reward players with "free games". The system will only politely advise the user to see a physician when results go down.

3.3.4 Ease of use

The developers agree basically with the following statements from the subject matter experts regarding the Ease of Use:

- Very easy game entry
- No kiddy characters should be used (bunny)
- Games should offer experience of success
- It should be clear which games are relevant for training
- Games should offer various levels
- The representation should be not too small

- Games should focus on entertainment

Statements Subject Matter Experts	Statements "Developers"
It should be possible to play the games everywhere	Discussion Offline/Online, Proposal to use HTML5 and make it compatible for the use on smart phones/pads. Use of different platforms should be postponed to a later phase.
No kiddy characters should be used (bunny)	Strongly related to marketing phase
Immediate stop and leaving the games	Exit buttons available, but it would lead to loss of data
Easy interface, if possible tactile	Interesting but concerns regarding reaction time
Support through acoustics sound	Lots of sounds can be annoying, should not be part of the R&D phase.

The following statements of the subject matter experts were not clear to the developers:

- The games should be free associations → The subject matter experts stated that people often had bad experiences and negative associations with well-known games like Chess, "Jassen", and some users might prefer new (neutral) games.
- To give variety of playing → people like to have a big choice of games and different game constellations.

3.3.5 Motivation and social aspects

There are a lot of different and contrary views regarding the motivational aspects mentioned by the subject matter experts:

Statements Subject Matter Experts	Statements "Developers"
System should not provide negative feedback. Feedback should motivate users to continue playing	Yes, but they are expected to accept warnings
IT-use in the health care setting (media related-content) sometimes is seen critical in terms of replacing people through ICT means	M3W is not seen as media related-content
Social interactions/social gaming is questionable and difficult to achieve	Social networking is important, no multi-player mode is the focus, challenging other users should be possible
Games should be played with a professional carer	Caregivers probably do not have time to play the games with the patients, No, games have to be played without help by the user otherwise this platform will never be used
Competitive gaming will be difficult/critical	Some form of competition may be positive for some persons, negative for others. We have started to look at competition possibilities.

The following figure summarizes the identified differences between subject matter experts and developers regarding requirements of the M3W games. Furthermore the identified topics are related to the overall M3W requirements dimensions. As part of the requirement engineering methodology these topics have to be clarified for the further development of the system.

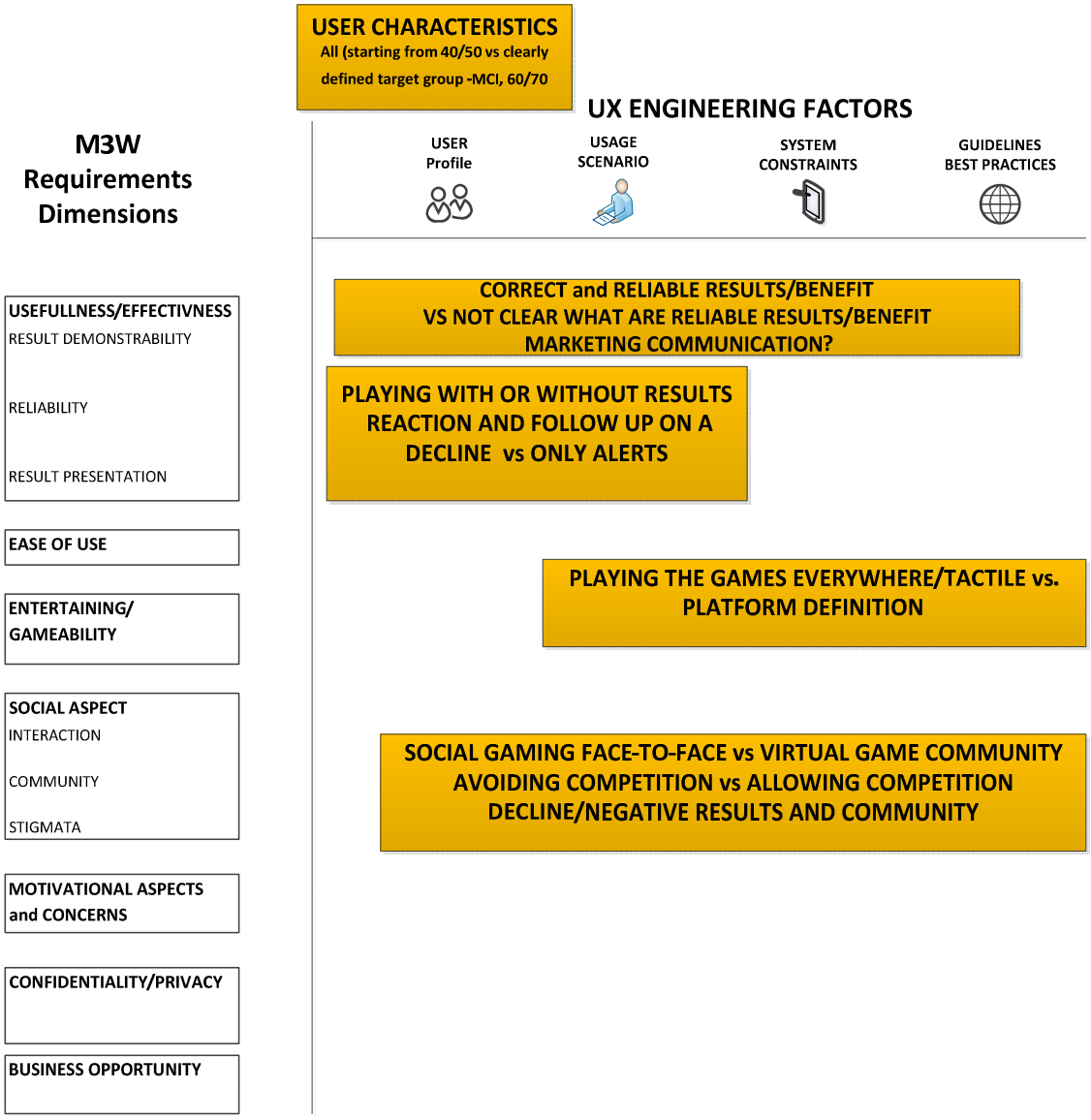


Figure 3 M3W Consolidated Requirements Dimensions

3.4 Results of the Focus Groups Workshops

Two **focus group** discussions based on Krueger and Casey (2000) have been conducted at the Alzheimer Vereinigung Zürich to gather information about the motivational aspects as well as concerns playing the M3W games. Eight elderly participants (4 female/4 male) having an understanding of dementia, Alzheimer disease and experiences as a relative or caregiver for elderly people have been participated in the two focus groups.

Focus Group I: 4 Participants (Age/Sex)
56 (f)
65 (f)
67 (f)
68 (m)
Focus Group II: 4 Participants (*Age/Sex)*
60 (f)
60 (m)
66 (m)
77 (m)

For first hands experiences the M3W Games have been presented and the participants played themselves for 20 minutes. After that the participants discussed a number of questions addressing the following aspects:

- Overall impression and design of the games
- User characteristics fitting the M3W Games
- Motivational aspects and concerns regarding the M3W Games
- Knowing about the results and result presentation

In the following section the main statements are summarized.

Figure 4Focus Group: "Online Games" at Alzheimer Community Zurich

Overall Impression and design of the Games

In general the presented M3W Games have been well accepted by the participants. They liked the variety of the games.

The participants had only some reservations regarding the "Wordpuzzle", "Odd one out" and "Solitaire". They proposed also some improvements in the user guidance and design of the games and emphasized the importance of a nice and transparent re-warding/scoring presentation while playing.

3.4.1 Impression of the Games

1. Focus Group	2. Focus Group
Favorite Games: • Rabbits • Pick one out • Solitaire • Rabbits • Fowler • Corsi Test (Speed und Memory) • Memory	*Favorite Games:* • *Fowler* • *Pick One Out* • *Memory* • *Wordpuzzle* • *Corsi Test* • *Rabbits*
Positive Statements: • Fowler is nice as it shows a real background foto • Corsi test is challenging and can train speed and memory	*Positive Statements:* • *Fowler shows nice landscape foto* • *Pick one out is challenging and interesting* *It's nice to have this variety of games*
Critical Statements: • "Wordpuzzle" should be available in the player's language (in this case German)	*Critical Statements:* • *"Wordpuzzle" should be available for the player's language* • *"Odd one out" is too easy, boring* • *For "Odd one out", "Pick one out" participants encountered problems concerning the user guidance (button next step, easy, Pop-ups)* • *"Solitaire" requires prior knowledge of the game. Not clear what's the game principle.*

3.4.2 Recommendations regarding the design of the games

1. Focus Group	2. Focus Group
Games like "Odd one out", "Wordpuzzle" should have clearer shapes/contours. These games are only black & white: Maybe contrasting colours would fit better. Text should be bolder	*A target score would be interesting for the games*
The keyboard for wordpuzzle should rely on the device keyboard (Qwert)	*It should be clear for whom the games are fitting*
Games should span over the whole screen (shouldn't be encapsulated/too small)	*Positive game experiences/success is essential*
Games like "Fowler" are nice with the real background/good atmosphere/mood	*Games should be adapted for the country/culture*
Childlike design of rabbits is accepted but could be critical for other persons	*A game is missing where the user could follow "something" on the screen (like car race, labyrinth, etc.)*

User characteristics

The participants have been asked at which age they would consider such training and what characteristics of players should be considered.
In general they recommended the games for people always a bit older than themselves. So a 60 year old participant recommended it for people age 70 years, and a 70 year old participant considered the games for people n age 80 years.
They emphasized also that possible players should be computer literate and that it will be also a generation issue. So in the future they expect more people to be computer literate whereas today elderly people might refuse "everything" that is computer-based.

3.4.3 At which age you'd consider such mental training

1. Focus Group	2. Focus Group
Starting from age 60 or 70 Starting to play, if people are not mobile anymore Starting to play might depend on various factors, for example the diagnosis of a disease	*It's also a generation related topic. Future generation will be probably more open to such trainings* *In general the game is possible for different groups of people (younger, elderly)* *People who are worried about dementia* *Starting from age 50 or 60* *Tool for the 2nd part of life*

3.4.4 User Characteristics and Considerations

1. Focus Group	2. Focus Group
M3W could be an option for people who are not mobile Dependent on various factors (diagnosis of a disease)	*People who are worried about dementia* *People who have doubts as to whether they are affected by a reduction of their mental capacity and want to check "anonymously" and get an answer.*
	It has to be differentiated between dementia and "normal" forgetfulness when getting older. Forgetfulness is a normal aspect when getting older.

Motivational, social aspects and concerns

According to the participants reasons for playing the games can be:

- awareness or being worried about dementia
- if games are entertaining and if there is a clear schedule for playing (once or two a week)

Major reasons to stop playing the games are:

- If they don't get a benefit
- If the games are boring/not entertaining/too artificial
- If they feel not well
- Misuse of data

3.4.5 Reasons to start using the M3W games

1. Focus Group	2. Focus Group
If I discover a personal weakness like no more being able to remember a shopping list, phone number etc. Playing games as wellness If I can no more prioritize and forget things. If I'm no more able to think through things logically to the end.	*Awareness due to experiences with dementia within the family* *People who care about active personal health care and prevention training*
	If people have no experiences with dementia, the chance is low that they are trying the games.

3.4.6 Concerns and reasons to stop playing the M3W games

1. Focus Group	2. Focus Group
People who are not mobile Dependent on various factors (diagnosis of a disease) If games are to artificial – better tactile games Risk that other things are weakening and that people grow lonely	*If you do such health checks, you find always something that should be treated.* *Misuse of my data (e.g. pharma industry is going to offer me something)* *If I don't get a direct benefit* *If I perceive the playing as something "surreal", "artificial"*
If it is not clear what's following after having played the games (new games? If it takes more than 20/30 min If the games are boring, monotonous If I have a physical problem Depending on my health condition	

3.4.7 Regularly playing – conditions and concerns

1. Focus Group	2. Focus Group
If possible always at a specific time during day As an alternative to watching TV Once in a week	*As an active person I'm already very busy. So it will not be easy to find a slot.* *Once or twice in a week/20 minutes*
Concerns: If the game is boring	*Concerns:* *Playing the games would compete with other activities like playing piano, doing sports etc.* *If the games would "crash" while playing, if the game just stops, if technical problems occur.* *If the games gets boring over time*

Knowing about the results and result presentation

In general the participants want to know their results. But they emphasized also that it should be possible to have the choice playing with or without scores.

Major concerns have been indicated regarding how people would react to a negative result. They are concerned if there is no support and clear follow-up procedure if a negative result is presented.

Therefore the M3W games result presentation should be in a way always encouraging and not negative. It should be clearly stated how to proceed in case of a negative trend and the results need to be understandable for both the player and the physician.

1. Focus Group	2. Focus Group
Do you want to know the results? Yes	*Do you want to know the results?* *Personally yes* *It should be possible to have the choice, to select (show results yes/no)* *What about self-endangerment (suicide), when the result shows a negative trend?*
Result presentation Maybe it should show a curve Real values Various reports should be available Always same representation	*Result presentation* *Results should be discussed with a physician (or the family)* *Textual information is preferred, maybe supported by graphics* *No misinterpretation should be possible* *Final direction of the games is probably to get negative results (negative attitude of these games?)* *What possibilities do I have to take countermeasures?* *Individual reactions to the results should be considered (does everybody understand the results, who knows about the results)* *How are the results perceived by relatives, other persons?* *Are the results really the results of person X, or does anybody else have played in the meanwhile (authenticity of the results)?*

3.4.8 Data Security and confidentiality

1. Focus Group	2. Focus Group
Data should be available for related physicians. Access needs to be secured. One central administration. "What is the medical relevance of this data?"	*It should be possible to select if data are going to be saved online.* *Data should be made anonym.* *It should be impossible to hand-over these data to other parties.*
Which Data would you provide? Age, sex, information regarding health situation, medical condition For a person with a diagnosis it is critical to provide a name (insurance issues). Totally open. Even with name (only one person mentioned this)	*Which Data would you provide:* *Age, sex, region, profession* *But no Name, no personalized data* *Context information possible (drugs, mood, etc)* *Pseudonym would be good.*

3.4.9 Various points and topics to be considered

1. Focus Group	2. Focus Group
Social contact is important for playing Playing alone in a group is critical Weak players will go away from social playing "Where is the right time to go to a physician?" Negative Feedback is critical, how will the player react? People tend to cheat if they have bad results ("children play the games instead of the elderly")	*The games should be promoted to have a good image* *Check with BAG about the promotion of these games.* *Not only one supplier should offer the games.*

3.5 Summary focus groups and critical elements

The system development of the M3W Games should focus on the following three important dimensions and related critical elements:

- Rewarding and result presentation of the games (correctness and playable with or without results)
- Design and playability of the games → easy access, user guidance, understandable scores and feedback, accurate size of shapes and text, nice looking design
- Data security and confidentiality → anonymous or with pseudonym responsibility for M3W data confidentiality should be defined (who's the provider of the games)

The following issues that depend either on the user characteristics or the available usage scenario should be considered within the project:

- Ideal user characteristics (computer literate, 60 to 70 years old)
- Individual reaction on negative results needs to be investigated during prototype testing
- Definition of the follow up support scenario (What happens after playing and receiving negative results)?
- For the community building (how will "weak players" behave, data confidentiality etc.), face-to-face community is preferred comparing to virtual community
- Promotion, communication and presentation of the service

The following figure shows the critical elements and their dependencies of the M3W games based on the focus groups results.

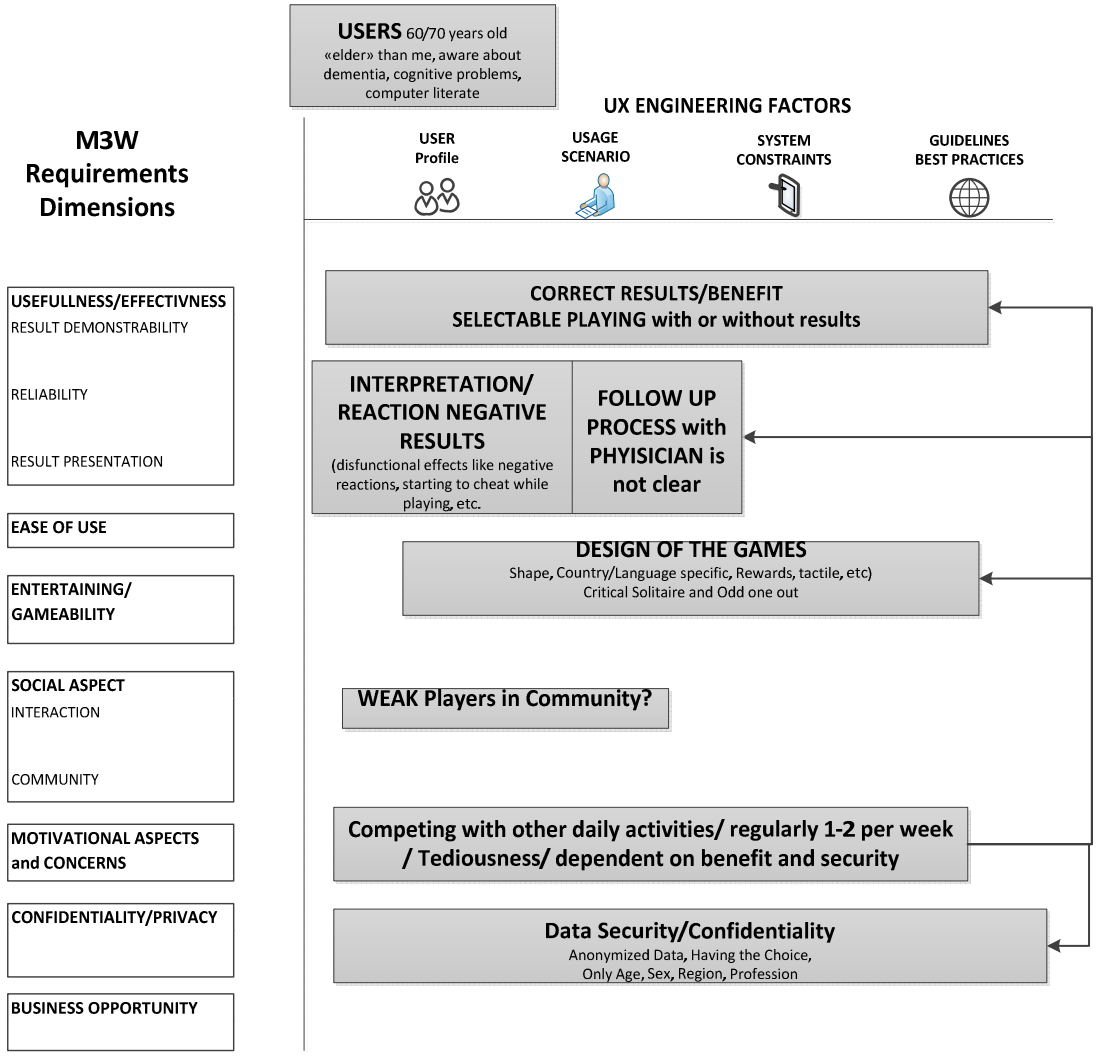


Figure 5 M3W Critical elements based on the focus groups findings

3.6 Discussion and Critical Reflection

This section concludes with a critical reflection on the M3W user requirements engineering process.

So far the used requirements engineering methodology was based on a qualitative data collection and analysis approach, focusing on a small number of participants. Given this fact, the results have to be interpreted in a qualitative and not quantitative way.

Within the different discussion and focus groups one also has to be aware of gender differences. In the workshop with the developers only men attended, whereas in the workshop with the subject matter experts only women participated. In focus group 1 was only one man, in focus group 2 only one woman participated. The differences in the results might also be interpreted in terms of these gender differences.

Another aspect that needs to be taken into account is the age of the participants in the focus groups. All participants were older than 55 years. Considering this fact, the results of the focus groups so far did not take into account considerations of younger generations. Besides from the workshop with the developer data where only collected in Switzerland. Only careful generalizations in terms of the European dimension should be made.
Comparing the results of the different groups, a huge distinction in the expectations becomes apparent. A reason for the differences may be that throughout the requirements engineering analysis for some criteria and aspects clear definitions were still missing: for example the definition of the primary user group and their characteristics (healthy people or people with mild cognitive impairments, 65+ or 45+); what means "measuring" in the project? Will measures be taken for a scientific reason or for an individual? What means scoring? How is the transparency of the scores given?
The results of the user-centered requirements engineering identified a number of critical aspects. Some of them should be clarified and for others clear decisions needs to be made within the consortium. These clarifications and decisions will support the further development of the M3W project.

3.7 Quantitative Survey for the determination of the M3W User profile

A quantitative survey based on the results of the "M3W User-centered Requirements Engineering Results" has been developed in German and initiated beginning of April 2013. The survey seeks to learn about living conditions, habits, attitudes towards people with dementia, individual health and prevention strategies, the use of the internet as well as online communication tools and most important on gaming manners and online-gaming activities.
A questionnaire has been made accessible online to group of potential users from tree different user communities provided and mediated by our partners.
The Alzheimer Swiss Society provided us access to their members (mental health conscious persons), their relatives and their caregivers and/or care professionals.
The Zurich University of Applied Sciences has made available the questionnaire to their employee which hopefully will augment the number of potential respondent.
Our business partner AMTS, a subsidiary of CISCO CH, has given us access to a large group of health professionals and CISCO will open it selectively to their employees worldwide. However, the worldwide audience needs a more careful design of our questionnaire and a precise selection of group samples have to be clearly identified before we can start the process with CISCO International.
Therefore the questionnaire has been translated from German into French, Italian, Hungarian, Greek and, last but not least, English. The English version is an addendum to this deliverable referred as **M3W-D22-Annexe_01_User_Survey_Questionnaire.docx**.
Here are the preliminary conclusions on the on-going quantitative survey on the User profile for M3W.

3.7.1 Methodology

The relevant topics and dimensions of the survey have been defined based on the results of the developers' requirements workshops and on the focus groups conducted at the Alzheimervereinigung Canton Zurich.

Based on the goals of the M3W project, the aim of this survey is to conduct large scale information about maintaining and measuring mental wellness for the requirements engineering with respect to behaviour, knowledge and of the population of the participating countries.

The main topics are:

- Characteristics of the sample
- Attitude to dementia, early detection and dementia screening
- Use of the Internet
- Online navigation and communication
- Gaming behaviour and gaming motivation

The survey is based on the following literature

- O'Connor, M. L., McFadden, S. H. (2010): Development and Psychometric Validation of the Dementia Attitudes ScaleDementia Attitudes Scale, International Journal of Alzheimer's Disease, Volume 201.
- Fowler, N. R., Boustani, M. A., Frame, A., Perkins, A. J., Monahan, P., Gao, S., Sachs, G. A. and Hendrie, H. C. (2012), Effect of Patient Perceptions on Dementia Screening in Primary Care. Journal of the American Geriatrics Society, 60: 1037–1043.
- Luck T, Luppa M, Sieber J, Schomerus G, Werner P, et al. (2012) Attitudes of the German General Population toward Early Diagnosis of Dementia – Results of a Representative Telephone Survey. PLoS ONE 7(11).
- Pletneva, N., Vargas, A., Boyer C. (2011): D8.1.1. Requirements for the general public health search. KHRESMOI EU project .
- Engl, S.: mobile gaming - Eine empirische Studie zum Spielverhalten und Nutzungserlebnis in mobilen Kontexten, Master Thesis.
- Haagsma, M. (2008):Gaming behavior among Dutch Males: Prevalence and Risk, Master Theseis Faculty of Behavioral Sciences, University of Twente, Enschede

Parts of the items have been developed particularly for the M3W project.

The survey was published online. Using the distribution list of the ZHAW, participants received an invitation email with information about the survey, asking them to participate and the link to the survey, guaranteeing absolute anonymity. 583 people responded to the link and 169 actually filled in the survey (respondent rate 29%) in the first round (without further reminders). Results from the external participants are not yet included in this report.

3.7.2 Preliminary Results

In this report only preliminary results from an on-going survey are summarized and the results lack representativeness and allow only bounded assumptions (less education, age, gender sensitive so far).

The responding participants can be described as follows. 82.7% of the participants had the Swiss nationality. The other participants had the following nationalities: German, Austrian, French, Italian, Netherland, Portuguese, and Britain. 65.5% of the participants were female, 34.5% were male. The age of the participants varied between the age groups “between 21-30 years” all the way up to “above 80 years”. 63.7% of the participants were younger than 51 years (see Table 3-1 Age of Respondents).

Table 3-1 Age of Respondents

Age categories	Frequency	Percentage	Cumulative Percentage
0-20 years	0	0	0
21-30 years	26	15.5	15.5
31-40 years	36	21.4	36.9
41-50 years	45	26.8	63.7
51-60 years	37	22.0	85.7
61-70 years	17	10.1	95.8
71-80 years	5	3.0	98.8
older than 80 years	2	1.2	100.0
Total N	168	100.0	

Concerning the level of education, 77.4% of the participants hold a university degree. Given this fact the results have to be interpreted carefully, since this sample represents a group of highly educated people in Switzerland (see Table 3-2).

Table 3-2: Level of education

Level of education	Frequency	Percentage
Vocational training	14	8.3
Advanced College/Applied University	12	7.1
High School	10	6.0
University Degree	130	77.4
Other	2	1.2
Total	168	100.0

With respect to their professional status, participants could select multiple answers. 60.7% of the participants stated to be employees without supervisory function. 28% indicated being employees with supervisory function. Only a minor portion is self-employed (see Table 3-3).

Table 3-3: Professional status

Multiple answers possible	Answers		Percentage of cases
	N	Percentage	
In training (students, trainee)	13	5.5%	7.7%
Further Education / Training	13	5.5%	7.7%
Employee	102	43.2%	60.7%
Senior / Supervisor	47	19.9%	28.0%
Self-employed (no employees)	11	4.7%	6.5%
Self-employed (with employees)	6	2.5%	3.6%
Working in the Family company	7	3.0%	4.2%
Hauswife/man	18	7.6%	10.7%
Unemployed	2	0.8%	1.2%
Retiered	12	5.1%	7.1%
Non-working	5	2.1%	3.0%
In total	236	100.0%	140.5%

Summarizing, the sample can be categorized as highly educated employees, between 21 and 60 years, mostly being Swiss. 25% of them have a rather high income.

3.7.3 Attitude toward the M3W topical domains

In this section the following topics will be addressed:

- Attitude to dementia, early detection and dementia screening
- Use of the Internet
- Online navigation and communication
- Gaming behaviour and gaming motivation

3.7.3.1Attitude toward dementia, early detection and dementia screening

More than 60% of the participants know or knew somebody, who has or had Dementia or Alzheimer (see Table 3-4).

Table 3-4: Knowing somebody who has/had Demetia or Alzheimer

	Frequency	Percentage
Yes	103	61.3
No	65	38.7
Total	168	100.0

With respect to their familiarity with dementia / Alzheimer participants indicated that they partly familiar with the topic. Nevertheless they agree that today we can do a great deal to improve the lives of the people with dementia / Alzheimer. Participants were asked to

indicate how much they agree with a number of statements on a 5-point answering scale (1=completely agree, 2=mainly agree, 3=partly agree, 4=mainly disagree, 5=completely disagree) (see Table 3-5).

Table 3-5: Attitude towards dementia

	Mean	Standard Deviation
I am very familiar with dementia / Alzheimer	2.90	1.325
These days we can do a great deal to improve the lives of people with dementia / Alzheimer.	1.82	.779

Note: N=168, Answering scale: 1=completely agree, 2=mainly agree, 3=partly agree, 4=mainly disagree, 5=completely disagree

People were asked to indicate how much they agree with statements concerning the acceptance of dementia screening. The following results are ordered according to level of agreement. The participants only partly agree that early detection of dementia / Alzheimer increases the chances of treatment being successful. In contrast to that, they tend to disagree, that treatment for dementia / Alzheimer is available today. There is no statistic significant difference in the results with respect to sex and whether they know somebody with dementia / Alzheimer or not. However this needs to be looked at in detailed when the final data set is available.

Table 3-6: Acceptance of dementia screening

	Mean	Standard Deviation
I believe that early detection of dementia / Alzheimer increases the chances of treatment being successful.	2.57	1.036
I would like to know if I am already suffering from dementia / Alzheimer's.	2.71	1.445
I would be prepared to get myself tested with a screening procedure for early detection of dementia / Alzheimer's.	2.65	1.262
I would like to know if I have a significant risk of getting dementia / Alzheimer's.	2.96	1.292
I would like to be examined by a doctor for signs of dementia / Alzheimer.	3.26	1.345
I believe that treatment for dementia / Alzheimer's is available today.	3.47	1.032

Note: N=168, Answering scale: 1=completely agree, 2=mainly agree, 3=partly agree, 4=mainly disagree, 5=completely disagree

With respect to benefits of dementia screening participants see the highest benefit of dementia screening to gain more time to arrange with their families – to plan their future. They do only partly agree that a preventive medical check-up would motivate them to choose a healthy lifestyle. There is no statistic significant difference in the results with respect to sex and if they know somebody with dementia / Alzheimer. Again the results are ordered according to level of agreement in the Table 3-7.

Table 3-7: Benefits of dementia screening

A preventive medical checkup would…	Mean	Standard Deviation
give me more time to discuss my nursing and care with my family.	1.98	.972
give me more time to discuss my finances with my family.	2.04	1.049
give me more time to plan my future.	2.27	1.186
enhance the therapy and treatment options.	2.33	.958
If I was found to have dementia at an early stage, I would be more willing to take part in clinical studies or research projects on this illness.	2.62	1.071
motivate me to choose a healthy lifestyle.	2.71	1.169

Note: N=168, Answering scale: 1=completely agree, 2=mainly agree, 3=partly agree, 4=mainly disagree, 5=completely disagree

A number of statements addressed the stigmatization of dementia screening. The results showed three main aspects – namely in Switzerland people do not fear family intern knowledge about health status, however, they expect emotional stress for family members.

Important to stress is, that people are reluctant concerning insurance aspects such as getting no longer life insurances and long term nursing insurance. Furthermore, they fear losing their driving license (see Table 3-8).

Table 3-8: Stigma of dementia screening

	Mean	Standard Deviation
My family would suffer emotionally.	1.97	.912
I would lose my driving licence and other privileges.	2.36	1.079
I would no longer get life insurance.	2.73	1.374
I would not get long-term nursing care insurance.	2.80	1.310
I would become desparate.	3.10	1.098
My family would suffer financially.	3.26	1.233
I would live in a care home.	3.27	1.113
I would be worried that my employer might notice it.	3.28	1.313
I would be ashamed or embarrassed.	3.54	1.158
If people knew, I would no longer be taken seriously.	3.57	1.092
I would lose my home.	3.63	1.006
I would no longer get health insurance.	3.65	1.199
I would be concerned in case my health insurance provider found out about it.	3.76	1.119
I would not want my family to know about it.	4.04	.990
My doctor would no longer offer me the best possible treatment for other medical problems.	4.09	.861

My doctor and other health professionals would no longer listen to me.	4.09	.846

Note: N=168, Answering scale: 1=completely agree, 2=mainly agree, 3=partly agree, 4=mainly disagree, 5=completely disagree

Another topic addressed the contact point for professional help in connection with dementia / Alzheimer. Participants were asked to state, who or what they see as contact points for professional help in connection with dementia / Alzheimer. The answering scale ranged from 1=definitely, 2=probably, 3=occasionally, 4=probably not, 5=under no circumstances and not possible (see Table 3-9 and Table 3-10).

Table 3-9: Contact point for professional help in connection with dementia / Alzheimer's

	N		Mean	Standard Deviation
	valid	missing		
Specialist neurologist	159	9	1.75	.832
Special centres (e.g. Memory Clinic)	157	11	1.81	.988
General practitioner / Family doctor	161	7	1.98	1.186
Other:	11	157	2.27	1.272
Specialist / Psychiatrist	156	12	2.69	1.174
Clinic / Hospital	158	10	3.25	1.057

Note: N=168, Answering scale: 1=definitely, 2=probably, 3=occasionally, 4=probably not, 5=under no circumstances and not possible (this value has been defined as missing value).

Table 3-10: Difference in preferences of contact points for professional help in connection with dementia / Alzheimer's over age

		N	Mean	Standard Deviation
General practitioner / Family Doctor	Up to 50 years	100	2.22	1.252
	51 years and older	61	1.59	.955
Specialist Neurologist	Up to 50 years	98	1.74	.777
	51 years and older	61	1.77	.920
Specialist / Psychiatrist	Up to 50 years	97	2.65	1.173
	51 years and older	59	2.75	1.183
Clinic / Hospital	Up to 50 years	98	3.18	1.087
	51 years and older	60	3.35	1.005
Special centres (e.g. Memory Clinic)	Up to 50 years	96	1.75	.973
	51 years and older	61	1.90	1.012

Note: N=168, Answering scale: 1=definitely, 2=probably, 3=occasionally, 4=probably not, 5=under no circumstances and not possible (this value has been defined as missing value).

The results indicate that the primary contact points are neurologists, special centres (e.g. memory clinic) and to some extent GPs. The results also show a statistically significant difference with age. People tend to prefer the GP as the main contact point above 50 years (t-test for independent samples, p=.000).

Finally participants were asked if everyone should get a preventive medical check-up (screening) from the age of 55 on for early detection of dementia. Generally asked for preventing check-up for early detection of dementia more than 50% of the participants clearly stated „No“ (see Table 3-11).

Table 3-11: Preventive medical check-up (screening) from the age of 55 for early detection of dementia

		Frequency	Percentage
	Yes	26	15.5
	No	91	54.2
	Do not know	51	30.4
	Total	168	100.0

3.7.3.2 Use of the Internet

Another goal of the survey was to gain information about the usage behaviour of the internet. The following devices were used to access the internet. Participants could select multiple answers. All participated indicated that they use their laptop / PC at home or at the office. 70.8% use their smartphone and 41.7% stated to use a tablet (see Table 3-12).

Table 3-12: Devices to access the internet

		Frequency	Percentage
	Notebook / PC from home or office	168	100.0
	Mobile-/Smartphone	119	70.8
	Tablet	70	41.7
	Other devices	5	3.0

With respect to the question how often they use the Internet the participants stated the following: almost 95% of the participants used the internet on a daily base. In contrast to that more than 60% only look for health and medical topics once a month or less (see Table 3-14).

Participants were further asked to indicate how important sources are to find out about health and medical issues using 5-point answering scale (1=very important, 2=fairly important, 3=important to some extent, 4=fairly unimportant, 5=unimportant).

The participants rated the doctor’s visit as well the internet as fairly important. To some extend important are print media and advice from the family (see Table 3-14).

Table 3-13: Internet use

		Daily	Several times a week	Once a week	Several times a week	Once a month or less	never
I use the Internet …	Frequency	159	8	1			
	Percentage	94.6	4.8	.6			
I find out about health and medical topics on the Internet …	Frequency	4	14	26	14	100	10
	Percentage	2.4	8.3	15.5	8.3	59.5	6.0

Note: N=168

Table 3-14: Importance of sources to find out about health and medical issues

	Mean	Standard Deviation
Doctor's visit	2.26	1.180
Internet	2.27	1.031
Print media (book, newspaper)	2.71	1.027
Advice from family members or friends	2.73	.925
Specialist centres (e.g. Alzheimer's association, diabetes centre)	2.89	1.199
Pharmacy	3.15	.995
TV	3.38	1.109
Radio	3.73	.995
Other Sources	3.81	1.722

Note: N=168, Answering scale: 1=very important, 2=fairly important, 3=important to some extent, 4=fairly unimportant, 5=unimportant

There is a statistically significant difference in the rating of the importance of the following sources with respect to age. The family advice and pharmacists becomes less important for people age 51 years or older, whereas radio and TV are more important for these people. With respect to gender, women (M=2.73, SD=1.180) rate specialist centers more important than men (M=3.21, SD=1.181, t-Test for independent samples, p=.013) (see Table 3-15).

Table 3-15: Importance of sources to find out about health and medical issues with respect to age

t-test for independent samples	Age_2	N	Mean	Standard Deviation
Pharmacy (p=.007)	Up to 50 years	107	3.00	1.037
	51 years and older	61	3.41	.864
Advice from family members or friends (p=.05)	Up to 50 years	107	2.63	.917
	51 years and older	61	2.92	.918
Radio (p=.009)	Up to 50 years	107	3.88	.959
	51 years and older	61	3.46	1.010
TV (p=.004)	Up to 50 years	107	3.56	1.066
	51 years and older	61	3.05	1.117

Participants were asked to rate statements for using the internet to find out about health and medical topic. They were asked to state in how far the statements apply on a five-point answering scale (1=applies completely, 2=applies generally, 3=applies partly, 4=does not generally apply, 5=does not apply at all).

The main arguments for using the internet to find out information about health and medical topics can be summarized as “because it is practical and possible from home” and people can find all sorts of different information. The following results are ordered according to level of applicability (see Table 3-16).

Table 3-16: Use of internet to find out about health and medical topics

	Mean	Standard Deviation
… because it is practical and possible from home.	1.71	.969
… because I can find all sorts of different information.	2.01	1.018
… to learn something about other people’s experiences.	2.84	1.210
… because it is a quick way of doing so.	3.01	1.286
… because it guarantees me the maximum anonymity.	3.18	1.260
… because I trust information from the Internet.	3.29	.975
… to find support.	3.37	1.260
… for financial reasons.	4.10	1.156
… because I have limited access to medical facilities.	4.24	1.028
… other	4.38	1.436

Note: N=168, Answering scale: 1=applies completely, 2=applies generally, 3=applies partly, 4=does not generally apply, 5=does not apply at all

Participants were asked to rate, how often they find out about a number of topics on the internet on a five –point answering scale (1=very often, 2=often, 3=sometimes, 4=seldom, 5=never).

Overall, the internet is hardly used for searching help/health topics on the internet. Specifically participants indicated that they sometimes search for healthy life style, nutrition information and general information on health topics and scientific articles. Topics like psychological illnesses and diseases of the brain are seldom to never searched for (see Table 3-17).

Table 3-17: Frequency topics searched on the internet

	Mean	Standard Deviation
Healthy lifestyle and nutrition	3.09	1.014
General information on health topics	3.30	.953
Scientific articles	3.30	1.203
Medications and side effects	3.38	1.025
Forms of treatment and therapy	3.42	.950
Acute illnesses (up to 2 weeks)	3.47	.941
Precautions and preventions	3.65	.949
Long-term, chronic illnesses	3.67	.879
Health and medical online advisers	3.68	.998
Information on clinical studies	3.72	1.163
Patients' organisations and specialist centres	3.82	.937
(Self-)diagnosis procedures	3.88	.890
Psychological illnesses (e.g. depression, anxiety)	3.97	.892
Medical abbreviations	3.96	.908
Health and care of children	4.07	1.092
Diseases of the brain (cognitive and memory disturbances)	4.13	.856
Health and care of older people	4.26	.911
others	4.69	.766

Note: N=168, Answering scale: 1=very often, 2=often, 3=sometimes, 4=seldom, 5=never.

Participants were asked how they check information that they find on the internet on health and medical topics. As shown in Table 3-18 only a few participants indicated that they do not check the information.

Table 3-18: Not checking information

	Frequency	Percentage
because I have no time	33	19.6
because I trust the sources I find on the Internet	20	11.9
because I only use websites that my doctor recommends to me	10	6.0

Note: N=168

Almost 75% of the participants stated, that they check the information they find on the internet on health and medical topics by searching again in other sources on the internet for confirmation. 50% check the information by asking their doctor (see Table 3-19).

Table 3-19: Checking information

		Frequency	Percentage
	by searching again in other sources on the Internet for confirmation of the information.	125	74.4
	by asking my doctor about it	84	50.0
	by asking my family and friends about it.	75	44.6
	by asking others in a forum.	20	11.9

Note: N=168

Finally participants were asked to rate the difficulties they encounter when looking or information on the internet. The results point out, that the major difficulties encountered when looking for information on the internet are:

- No way of filtering the quality of the search hits
- Poor quality and incomplete information
- Information overload on the internet pages
- Distraction by advertisements
- irrelevant and unspecific search hits
- no trust worth information

3.7.3.3Attitude toward Online Navigation and communication

Participants were asked how often they use the following forms of online communication. As listed in table 21, they actually use only email and text messages for their communication. Sometimes to seldom they use Skype, YouTube, wikis, Facebook and internet radio (see Table 3-20).

Table 3-20: Use of online communication forms

	Mean	Standard Deviation
Email	1.14	.384
Text message	1.95	1.188
Skype	3.47	1.243
Video casts (i.e. YouTube)	3.73	1.256
Wikis	3.76	1.346
Facebook	3.86	1.385
Internet radio	3.95	1.223
ICQ	4.90	.333
Windows Live Messenger	4.86	.528
iMessage	4.29	1.359
Google Talk	4.83	.544
AIM	4.95	.314
Webblogs (Wordpress, Moveable Type)	4.67	.809
Social Blogs (Twitter)	4.66	.780
Internet forum	4.10	.989
My Space	4.90	.367
Google+	4.08	1.336
Virtual Environments (i.e. Second Life)	4.90	.419
Andere	4.52	1.180

Note: N=168, Answering scale: 1=very often, 2=often, 3=sometimes, 4=seldom, 5=never.

3.7.3.4Attitude toward web gaming

Participants were asked to report on the gaming behaviour. They were asked to state, how often they play a number of games, ranging from daily to never on a 6 point answering scale. As listed in Table 3-21, they do not play a lot. Only quiz, word and brain games are played several times a month.

Table 3-21 Attitude toward various games

	Mean	Standard Deviation
Quiz, word and brain games (e.g. Scrabble, Hangman, crossword puzzles, Sudoku)	4.02	1.553
Card games (e.g. Uno, Solitaire, whist)	4.55	1.167
Learning games (e.g. brain jogging, mental arithmetic)	4.95	1.152
Puzzle games (e.g. sliding tile puzzles, Tetris)	4.99	1.078
Board games (e.g. chess, Monopoly, draughts)	5.07	.870
Strategy games (e.g. Risk, Civilization)	5.27	1.048
Games of skill (e.g. Mikado)	5.30	.740
Sport games (e.g. football, golf)	5.45	.927
Simulations (e.g. SimCity)	5.60	.949
Adventure games (e.g. Monkey Island)	5.63	.793
Action and shooter games (e.g. Moorhuhn, Call of Duty)	5.64	.800
Jump'n'Run games (e.g. Temple Run)	5.70	.722
Music games (e.g. Karaoke, Beatmania)	5.82	.460

Note: N=168, Answering scale: 1=daily, 2=several times a week, 3=once a week, 4=several times a month, 5=once a month or less, 6=never).

Concerning devices used to play the games the participants stated that they sometimes use traditional media to play games (see Table 3-22). Finally participants were asked to indicate applicability to the following statements. Main aspects to play games are to recover from everyday efforts, to improver theirs skills and get to the next level as well as that they like to try new things (see Table 3-23).

Table 3-22 Devices used to play games

	Mean	Standard Deviation
Traditional media (cards, board games)	2.92	1.250
PC or Laptop	3.35	1.272
Smartphone	3.89	1.245
Game console (Xbox, Sony Playstation, Nintendo Wii, etc.)	4.61	.726
Mobile game console (Gameboy, Sony, etc.)	4.80	.520

Note: N=168, Answering scale: 1=always, 2=often, 3=sometimes, 4=seldom, 5=never.

Table 3-23 Motivation to play games

	Mean	Standard Deviation
I can recover from my everyday efforts.	2.93	1.376
I like improving over time.	2.97	1.315
I like to try out new things.	3.00	1.322
I feel good when I manage to move up to the next level.	3.09	1.353
I want to improve my skills.	3.24	1.332
I want to reach the next level as soon as possible.	3.50	1.184
I enjoy discovering game worlds.	3.51	1.354
I like to work as part of a group.	3.67	1.274
I like to belong to a group.	3.68	1.327
I like to measure myself against other players.	3.72	1.213
I can immerse myself in the fantasy world of the game.	3.73	1.275
I am bored otherwise.	3.93	1.179
I can forget my everyday problems.	3.99	1.137
I like to eliminate other players.	4.30	.926
I can make new friends.	4.33	.939
I am not trapped by the limitations of real life when I play.	4.31	.966

Note: N=168, Answering scale: 1=applies completely, 2=applies generally, 3=applies partly, 4=does not generally apply, 5=does not apply at all

3.7.3.5 Conclusion

In this report only preliminary results from an on-going survey are summarized and the results lack representativeness and allow only bounded assumptions (less education, age, gender sensitive so far).

However, we can learn from this small sample that e.g. the gaming behaviour and motivation is below expectancy. This needs to be verified with the broadened dataset. It is also interesting to learn that people more or less rely on Email and text message as their online-communication tool. Once found information people would check for information on further pages or go and see their doctor for verification. Most people seek to verify online information then. For the M3W of interest is that people hardly look for health issues concerning brain problems or psychological problems.

People seem to be relaxed with respect to a dementia diagnosis; expect burdens for their families but would not be concerned about going public with the diagnoses. Maybe specific for the Swiss context is that people clearly expect disadvantages with respect to insurances when it would become known. And with more than 50% people clearly expressed opposition against a mental check-up above 55.

People out of this sample only sometimes search for health issues online; this we need to evaluate with respect to the age average though. Age is also relevant when it comes to the question whom to first contact in case of mental health problems. The older people are the more they tend to see the family doctor first. More people though would go and see the specialist in any case first. This is a key observation and needs to be verified namely whether people in general give priority to specialists and specialized centres rather than family doctors.

To summarize, some first interesting observations can be made however the sample size is too small and too selective to generalize from it.

4 Business Domain Description

With the ageing of European population probably the most important social challenge for the home care services is how to provide a variety of applications for the elderly people in both physical and mental aspects in order to preserve them as active and independent as they can be while living in their own home environment.

Chronic diseases, due to the increase of the ageing population, are the majority of the clientele of the home care services. As far as it concerns dementia, right now there are over 6 million people with dementia in Europe, while the total number of people with dementia worldwide is projected to almost double every 20 years, to 65.7 million in 2030 and 115.4 million in 2050[1].

In the domain of mental and cognitive training, this demographic change paves the way for significant challenges of the home care services to be addressed at different levels:

- Social: the main challenge is to preserve for as long as possible the **mental wellness** of ageing people, allowing them to remain socialized and cooperative, and relieving their relatives and caregivers. Some research shows that brain stimulation can help prevent age-related cognitive decline, and reverse behavioral assessment declines in dementia and Alzheimer's[2]
- Economic: Frontida Zois as homecare provider aims to increase its market share by incorporating M3W platform into its daily business routine among other ICT applications, creating this way various care giving packages depending on the needs of the patients. As a consequence its clientele basis will increase without analogous increases in the staff costs which represent the major cost of the company.
- Personal: **cognitive problems,** have a very negative effect on the elderly person's life and health and they rapidly lead to significant deterioration of the living quality of the patient and consequently of the quality of the care services. But, overall, the

[1] http://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=412

[2] de la Fuente-Fernandez, Ra?l (2006). "Impact of neuroprotection on incidence of Alzheimer's disease". *PLoS ONE* **20** (1): e52. doi:10.1371/journal.pone.0000052.

most beneficial side is to prevent or even to eliminate further deterioration brought on by depression or similar sentiments, which are themselves MCI risk factors and the main cause of a diminished quality of life.

Our business partners, exemplified by Frontida, vision is for deploying **M3W** as an effective way to increase elderly people quality of life, and to support elderly people's independent living. For home care agencies is significant the smooth and unobstructed communication between the patient and the carer. The mental state of the patient is one of the major factors that affect this communication. By preserving and training the patient's mental state, Frontida seeks for the optimal combination between the regular visits of the caregiver and the capacity of the patient to remain autonomous in his own environment. For Frontida Zois it is crucial to keep up with new applications that assist and improve the quality of life of the elderly in order always to find the best and more fruitful way to combine such kind of services with the beneficial presence of the caregiver.

Except of that, M3W provides beneficial for the caregiver time and space, helping him to remain active and productive during all his working time, avoiding burn out and other deteriorating factors that could jeopardize his caring performance and the elderly person's well being. M3W project will also help Frontida Zois in the continuous effort for better understanding and serving the elderly persons and to gain better knowledge about their behavioral patterns in their own domestic domain.

Frontida's primary users that will be benefitted by the M3W platform are:

- Elderly people with need for social interaction and active participation
- Elderly people with chronic diseases
- People with MCI that need mental training to prevent deterioration of their status
- People that want to test their mental abilities or the mental abilities of their relatives

At the same time, the secondary users are the carers that will have the responsibility to introduce the platform to the end users and many times to help the patient make the tests. According to the October issue of Neuropsychology, which is published by the American Psychological Association (APA)[3], simple, systematic memory training can help some people with early-stage Alzheimer's disease (AD) and can also lend some urgency to early diagnosis, when patients who still have the ability to learn can use it to sharpen their memories and reduce disability.

Business requirements are firmly related with the integration of the M3W into the everyday routine of Frontida's services:

- The system should be easy to be installed and integrated in to the existing care schedule of the patient (e.g. not specific preparation, flexibility on required time)
- It should be easy to comprehend and clear at its structure
- It should have variety on the play modes and kinds of games

[3] APA Public Affairs Office at http://www.apa.org/journals/neu/press_releases/october_2002/neu164538.html

- It should activate and/or increase the quality and quantity of elderly people's social interactions with other members of the ageing society, as well as with relatives and family.
- It should be running in pc's and tablets
- It should provide for the player first level non discouraging results
- It should enable the flexible customization of the system to different target user groups (including their medical background, demographic and cultural characteristics, root causes, etc.) and a resulting fully personalized and configurable solution to the target customers

For Frontida Zois the major benefit is the strengthening of the social profile of the company and the opportunity to accompany its existing services with applications that enhance the vitality and motivation of the beneficiaries favoring in this way better synergy with the other personal care services, and resulting in more complete and effective caring systems. This integrated service will act as a catalyst in maintaining favorable living conditions, enhancing the level of cooperation and interaction of services and thus creating further development and deployment of innovations.

The dynamic situation of the elderly persons will allow the continuity and expansion of its services and will give the feeling of satisfaction and tranquility in the family to see the results are worth the effort and money. Taken under consideration that the major impediment for a lot of people to use ICT services remains the economical difficulties, the combined services of the home carer and the M3W platform will give the opportunity for all in one offer. This way far more incidents will occur something that will lead Frontida Zois to increase the number of employees while decreasing the price of our personal care services.

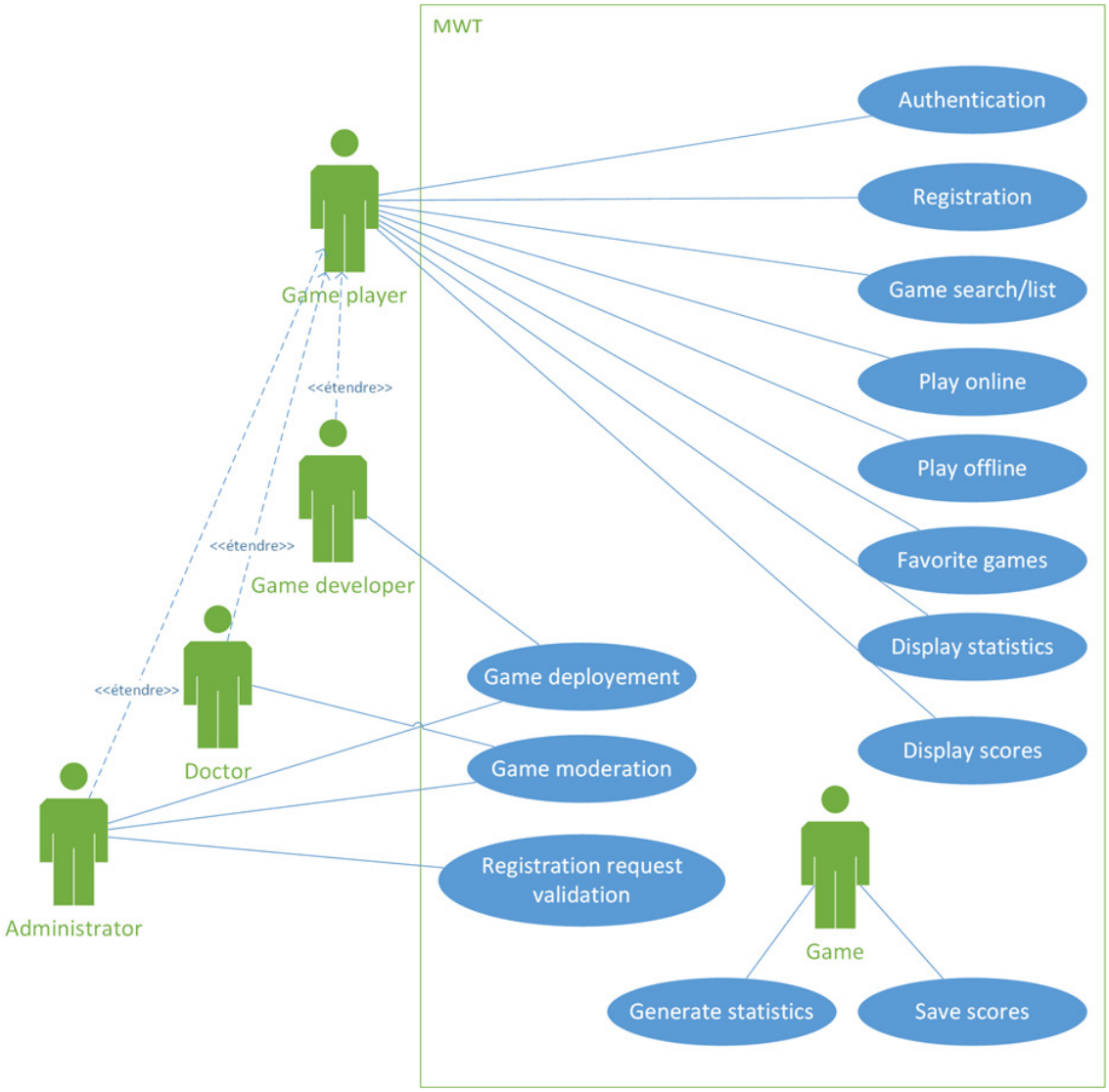
Also this project will contribute to finally resolve a significant number of social problems and to benefit a large number of people who have no family or social environment and need an always present supportive network to preserve their physical and mental health and prevent social exclusion.

4.1 Summary and further findings

The M3W consortium, in acknowledging the business interests in his product, has started an extensive review of the market to define the M3W position in respect to the actual business market offering. This report, ***M3W-D22-Annex-02-Business and Market Analysis-v5.doc,*** is part of the non-public variant of this deliverable as an annex.

5 Non-Function and Functional Requirements Description

1. Use case

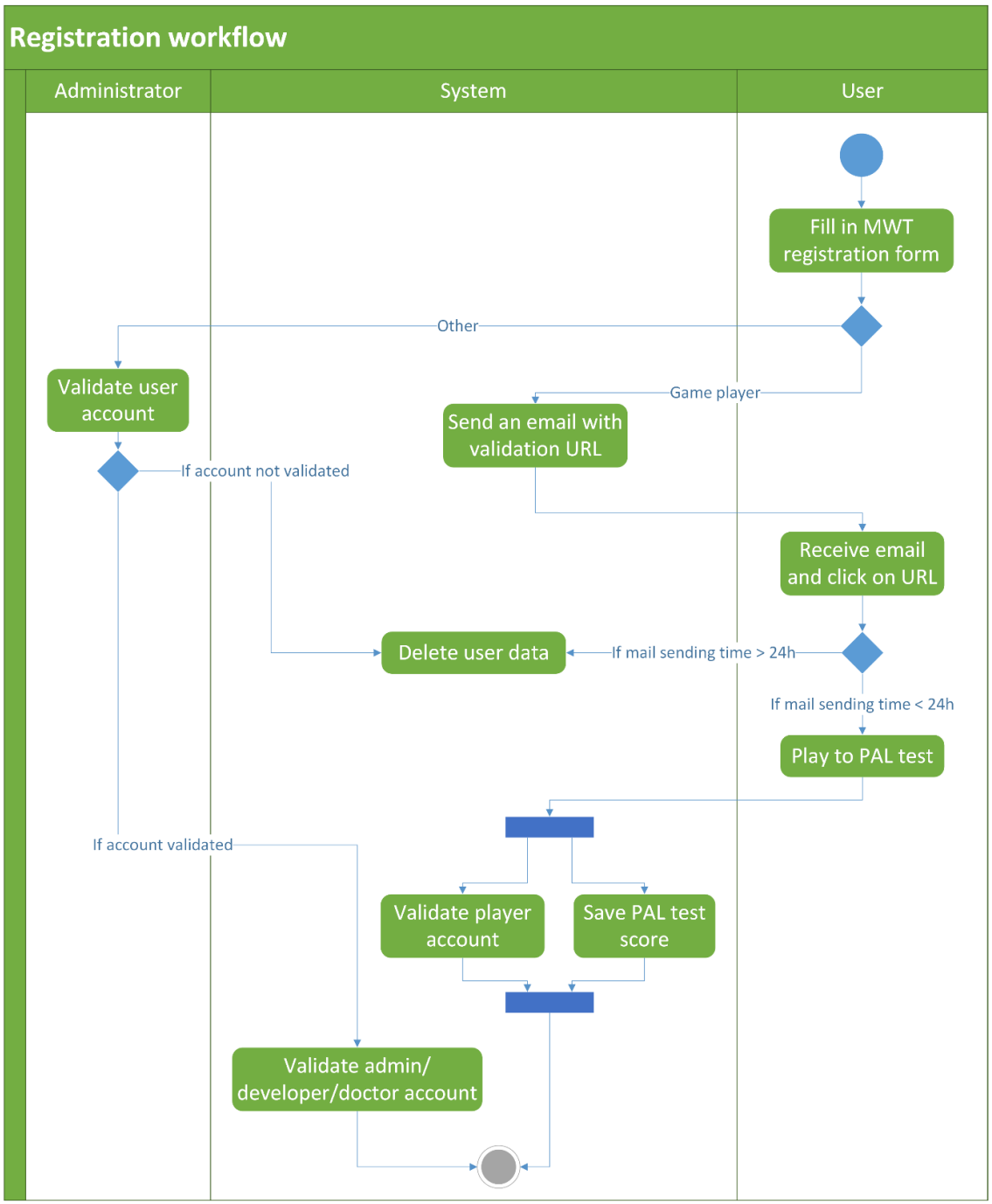


This use case represents the available functionalities per user. As can be seen, 4 main types of authenticated users are available:

- Game player
- Game developer
- Doctor
- Administrator

The system is represented as “Game”: he deals with the game score saves, and generates statistics depending on scores (for example, it can be the average score for a given game).

2. Registration



A user can register by filling a registration form, or by directly login in using OpenID authentication.

The registration on M3W presents two distinct paths, as can be seen on the following scheme.

While completing the registration form, the visitor can choose which roles he would like to have on the platform: player, doctor, game developer, or administrator. Upon this choice, his registration follows one of the two processes.

a. Player workflow

When the registration form is completed, the player account is not validated yet. The user will receive an email with a link to login and complete a PAL Test. As long as the PAL Test is not completed yet, he will not be able to navigate on other pages. Moreover, if the user has not completed the PAL Test within 24h after his registration, his account will be deleted.

As soon as the PAL Test is completed, his account is activated and he is granted access to all the player features. Meanwhile, data are retrieving from the PAL Test by using an xml file and added to the user scores.

b. Doctor/Admin/Game developer workflow

This workflow is quite simple. When a user chooses one of these three roles while registering, his account is blocked until an administrator manually activates it. Then his account is validated, and he is granted access to all his role's features.

3. Authentication

A registered user can log to the website using his username and a password that he can choose while registering. Three cases must be taken into account:

- If the user has the doctor/admin/game developer role:
  - If his account is validated, he will be logged into the platform
  - If his account is not validated yet, login will be impossible
- If the user has the player role:
  - If his account is validated, he will be logged into the platform
  - If his account is not validated, he will be redirected to the PAL Test so that he can complete it

4. Registration request validation

This feature is available for admin only. They can activate/block any user account, and check user information before validating his account (for example, check a doctor information before granting him access to the platform).

5. Games search/list

A list of playable games is available for all users. Playable games are games which have been enabled by administrators and doctors (see Games moderation functionality).

Any user can search a game among this list with a classic search button.

6. Games moderation

Game can be moderated by administrators and doctors. A new game that has just been submitted by a game developer is not enabled: only doctors and administrators have access to it and can play it. They then will decide to enable (or not) the submitted game; for example, if the game does not suit the game portal needs, or is somewhat questionable, it may never be available for classic players. Then, the game can still be disabled if needed.

7. Favorite games

Any user can chose among the available games which one he prefers, and set them as “favorites”. He then will be able to find them inside the list of his favorite games.

8. Display scores

Scores are game results after they have been saved by the system. Scores can be displayed on a chart form. Any player will be able to display own scores. However, a given player can’t see the scores of another player.

Only some specific roles are allowed to do so, such as administrators that are allowed to display any user score.

<u>Special case: patient/doctor relationship</u>

A special relationship can be built between a player and a doctor. This relationship can be called a patient/doctor relationship. A doctor can analyze his patient’s scores, contact him if needed (for example, if he notices a sudden drop in his patient’s scores). To do so, he must be allowed to display his patient’s results. In a nutshell, a doctor will be granted access to all of his patients’ scores, but will not be able to display other players’ scores.

9. Display statistics

Statistics derive from scores: for example, it can be a player’s average score on a given game and on a given month.

The display statistics functionality follows the exact same rules than the display scores one.

10. Game deployment

Game deployment is a functionality dedicated to game developers only.

Game developers will be able to submit a new game to the platform. Game developers will add this game as a classic content, giving url, name, description, and all other information needed to actually make the game available. The game will then be subject to game moderation, as explained on the dedicated functionality.

11. Play online

When connected and logged in the platform, a user can play games which are available on the portal. His score is then saved by the system, and the user can then display it.

12. Save scores

This functionality actually concerns the system. When a player completes a game, his score is produced by the game itself and saved into the database.

13. Generate statistics

Statistics derive from scores; they are generated by the system using the previously saved scores. The statistics can be of different forms: a chart representing a player scores on a given period, average score on a given game for all players… The system retrieves related scores on the database and processes them as needed.

14. Play offline

Playing offline can be useful if, while playing a game, the user loses his internet connection. He can then complete the game as usual, and the results will be locally saved. When the user will be able to reconnect, the locally saved results will be sent to the system, so that they can be saved.

6 User Requirements Catalogs

A catalog of requirements, based on all the findings from this report, will be made available in the course of the project. Here, we only state the format, structure and precise content format for their evaluation during the implementation and testing phase of the M3W System.

6.1 Numbering

User requirements are numbered for reference purposes. We distinguish between functional and non-functional requirements. Functional requirements are typically phrased with subject-predicate constructions, or noun-verb. E.g. "The system prints invoices." Non-functional requirements may be found in adverbs or modifying clauses, such as "The system prints invoices *quickly*" or "The system prints invoices *with confidentiality*".

"Functional" refers to the set of functions the system offers, while "non-functional" refers to the manner in which such functions are performed.
IEEE Definitions:

> **Functional requirement**: A system or software requirement that specifies a function that a system/software system or system/software component must be capable of performing. These are software requirements that define behaviour of the system, that is, the fundamental process or transformation that software and hardware components of the system perform on inputs to produce outputs.
> **Non-functional requirement:** In software system engineering, a software requirement that describes not what the software will do, but how the software will do it. For example, software performance requirements, software external interface requirements, software design constraints, and software quality attributes. Non-functional requirements are difficult to test; therefore, they are usually evaluated subjectively.

Functional requirements are numbered with **[FR1]**, [FR2], Non-functional requirements are numbered with **[NFR1]**, [NFR2], etc.

Functional requirements can be classified with different types: **obligatory**, **optional**, and **wishes**. Non-functional requirements are separated in: boundary, usability, security and quality. Furthermore we distinguish the following subtypes:

Boundary

- Standards
- Laws
- Physical environment
- Process
- Duration

Usability

- Language
- Ease-of-learning
- Controllability
- Error robustness
- Task Adequacy
- Anticipation conformity

Furthermore the knowledge objects must be numbered in addition. This enables to reference the material within the business process model descriptions. Knowledge objects are numbered with **[KO1]**, [KO2]

Table 6-1 Function Requirements

Ref #	Function	Type	Comment / Constraints
R1	*Access and search from the inspection sites, back office, or owner representatives to the Project's Database (search criteria is inspection contract number).*	*Generic*	*Response time*
R2	*Update from the inspection sites, back office, or owner representatives to the Project's Database (search criteria is inspection contract number).*	*Generic*	*Level of synchronization between what the different participants view each moment*
R3			
R4			
R5			

Function Category:

a. **Obligatory:** Should Perform, necessary
b. **Optional**: Not obligatory but it may be implemented depending on the cost (CPU or bandwidth consuming) or how realistic is.

Table 6-2 Non Functional Requirements

Ref #	Description	Type	Subtype	Comment
NFR1	The mobile device must work without any problem under heavy dust conditions	Boundary	Physical Environment	
NFR2	All textual shown information has to be presented in the user's language	Usability	Language	Conformity with user expectation

7 Bibliography

Chei, S. L., & Dion, H.-L. G. (2011). Understanding Playability and Motivational Needs in Human Computation Games. In F. C. C. Xing, *LNCS 7008* (pp. 108–117). ICADL 2011.

Moores, T. T. (n.d.). Towards an integrated model of IT acceptance in healthcare.

Reßin, M., & Christoph, H. (2007). Human-Centered Design of Interactive TV Games with SMS Backchannel. In P. C. al., *EuroITV 2007, LNCS 4471* (pp. 37–46). EuroITV.

Sánchez, L. G., Gutiérrez Vela, F. L., Simarro, F. M., & Padilla- Zea, N. (2012, 10 31). Playability: analysing user experience in video games. *Behaviour & Information Technology* , pp. 1033-1054.

Tanner, O., Procci, K., & Bowers, C. (2011). Serious Games Usability Testing: How to Ensure Proper Usability, Playability, and Effectiveness. In Marcus, *Design, User Experience, and Usability, Pt II, HCII 2011, LNCS 6770* (pp. 625–634). Heidelberg: Springer-Verlag Berlin.

Tolentino, G. P. (2011). Usability of Serious Games for Health. In *Third International Conference on Games and Virtual Worlds for Serious Applications.*

Venkatesh, & al., e. (2008). User Acceptance of IT. *MIS Quarterly Vol. 27 No. 3.* , 425-478.

Yusoff, A., Crowder, R., & Gilbert, L. (2010). Validation of Serious Games Attributes Using the Technology Acceptance Model. *Second International Conference on Games and Virtual Worlds for Serious Applications.*

ZHANG, N., GUO, X., & CHEN, G. (2008). DT-TAM Integrated Model for IT Adoption. *TSINGHUA SCIENCE AND TECHNOLOGY* (pp. 306-311, Volume 13, Number 3). ISSN 1007-0214.