



Multimedia Authoring and Management using your Eyes and Mind

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D5.3

Final design and implementation of the prototype interface applications

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Abstract:

This report describes the persuasive design of the MAMEM system (to be employed in Phase II field trials). It shows how this persuasive design is targeted at training and motivating the users of the MAMEM system to start using the MAMEM system, and at motivating users to use the MAMEM system for social inclusion activities.

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Executive Summary

Building on extensive analyses of the scientific literature (D5.1), and detailed proposals for implementation of persuasive, personalized strategies into persuasive and personalized design (D5.2), and evaluations of their actual effectiveness and user experiences the Phase I field trials (D5.4), and also based on extensive analyses of the MAMEM system's target behavior (social inclusion behavior, see D7.1 and D7.2), the current report describes how the users of the MAMEM system (to be employed in Phase II field trials) will be trained and motivated to start using the MAMEM system, and use it for social inclusion activities. Therefore, the current report describes the persuasive and personalized design of the interfaces of the MAMEM system to be used in the Phase II field trials. More specifically, first, this report describes how the persuasive design of the MAMEM training tasks was improved (Chapter 2). Next, the report describes how the MAMEM system and its users were focused on increasing social inclusion by measuring (and logging) the participants' digital social inclusion behavior (Section 3.1), and how this data are used to steer the persuasive and personalized strategies that stimulate social inclusion activities (Section 3.2). Finally, this report describes in detail the persuasive design in the MAMEM Persuasive Design (PD) Dashboard/ Home page (Chapter 4) and the persuasive design of the GTW browser (Chapter 5).

Abbreviations and Acronyms

AD	Assistive Devices
DBS	Deep Brain Stimulation
EEG	Electroencephalography
NMD	Neuromuscular Diseases
PD	Parkinson's Disease
SCI	Spinal Cord Injury
SUS	Standard User Satisfaction questionnaire
ADL	Activities of daily living
SMA	Spinal Muscular Atrophy

Contents	
1 Introduction	7
2 Training to use MAMEM	8
2.1 Improvement based on D5.1 Update	8
2.2 Improvement based on D5.1 Update	10
2.3 Final prototype of MAMEM training software	15
3 Using MAMEM to stimulate social inclusion	17
3.1 Monitoring social inclusion activity	20
3.1.1 Logs through social activity tracker	22
3.1.2 Logs through Facebook	24
3.1.3 Logs through GTW browser	25
3.2 Stimulating social inclusion activity	25
3.2.1 PD strategies for Dashboard/ Home Page	26
3.2.2 PD strategies for GTW browser	29
3.2.3 Further persuasive design elements in the MAMEM system	29
4 Final prototype of MAMEM Homepage	31
5 Final prototype of persuasive design in GazeTheWeb	35
6 Multimodal Tetris	36
6.1 The design and the sensors	36
6.2 Initial classifier for playing MM-Tetris	37
6.3 Multimodal play-testing	38
6.4 Bidirectional training through gamification	38
6.5 Future Plans	39
7 General discussion	39
8 References	41
Appendix A	43

1 Introduction

The current report presents the final design and implementation of the MAMEM prototype interface applications (Training system, GazeTheWeb, and the MAMEM dashboard pages). In general, it incorporates the final implementation of the prototype interface applications for managing and authoring multimedia content through the user's eyes and mind. Different from earlier deliverables in WP5, the current deliverable emphasizes more the development side and the integration with existing tools for managing, creating and sharing multimedia content. Moreover, this report implements the proposal for improvement of the MAMEM persuasive design as described in D5.4 [1] (the update of D5.1), which was based on an evaluation of the first stage pilot trials and an additional lab study.

That is, based on extended analyses of the Phase I pilot trials and an additional lab study, the previous report of WP5 (D5.4) [1] presents updates, ameliorations and extensions of the user profiles and personas, the requirements for personalization, and the requirements for the persuasive design (as they were described in D5.1, [2]) to be incorporated into the MAMEM system in the Phase II trials. Overall, that report (D5.4) concludes that the persuasive personalized design elements in the MAMEM system training tasks improve user performance accuracy, while user evaluations could be further improved. Therefore, D5.4 proposes improvements of the persuasive and personalization design elements of the MAMEM system to improve user acceptance (evaluations) and use (performance), which will be implemented into the persuasive design of the MAMEM interfaces in the current deliverable.

The current report will first of all describe how the MAMEM system trains user to start using the system: Chapter 2 (in section 2.1) describes how the training tasks included in the MAMEM system were improved based on D5.4 (i.e., an evaluation of Phase I field study and an additional lab study). Also, Chapter 2 (in section 2.2) presents the final implementation of the MAMEM training tasks.

In Chapter 3, the current report will describe how the MAMEM system stimulates social inclusion activities. For this, Chapter 3 will first describe the conclusions of the MAMEM report (D7.2, [3]) that identifies the relevant social inclusion behavior and its determinants. Then, this report describes (in Section 3.1) how to monitor (assess and measure) whether users perform these behaviors. For this MAMEM monitors social inclusion behavior in two ways: through monitoring social media use behavior (for which we build the Social Tracker software, see Section 3.1.1), and through monitoring browsing behavior (logged through the GazeTheWeb browser, see Section 3.1.2).

Next, Chapter 3 describes how MAMEM stimulates users to perform these measured behaviors more. For this, Section 3.2 describes the general approach, and shows (in Section 3.2.1) how persuasive design strategies were incorporated into the MAMEM Home/ Dashboard page, and (in Section 3.2.2) into the GazeTheWeb browser.

Then, Chapter 4 presents and delivers the final prototype of the MAMEM Home/ Dashboard page, and Chapter 5 presents the final prototype of the persuasive Design in the GazeTheWeb browser.

Additionally, chapter 6 presents a hybrid approach for playing Tetris, which is designed as a

gamified interface for the users to train their SMR signals. Three distinct types of physiological signals (gaze coordinates, EEG and GSR signals) are exploited in order to make, the all-time classic videogame, Tetris, available to those lacking voluntary muscular control although their cognitive functions remain intact. By playing this classic game, they can master their imaginary motor skills in a fun and interesting manner.

Finally, Chapter 6 closes this report by drawing general conclusions.

2 Training to use MAMEM

To make the users get accustomed to the way that GazeTheWeb browser works through eye tracking, a series of training tasks have been created in the form of a game, employing persuasive design strategies and gamification techniques. These training tasks have been evaluated in two earlier studies: In the Phase I field trials (described in D6.2 [4], analyzed in D5.4, [1]), and in the additional lab study (described in D5.4).

As D5.4 concluded, evidence from these two empirical research studies shows that the persuasive and personalization design elements of the MAMEM training tasks are effective for improving user's effectiveness in using the computer system for social inclusion tasks [1]. Also, based on these findings, we conclude that the perceived ease of use of the training software could (although not mandatorily) be improved. For this, the included persuasive and personalization design principles, could be screened for elements that limit the implementation of persuasive strategies (e.g., the hierarchical group membership) in the extent to which they rely on and demand user memory capacity, processing capacity, visuo-spatial capacity and the extent to which they might cause frustration, or might otherwise lower perception of ease of use. Also, D5.4 argues that only to a very limited extent should the persuasive and personalization design of the MAMEM training tasks be changed, because of the more important advantages these design elements show to have for the performance of users of the MAMEM system [1].

Based on these two studies and these analyses, D5.4 presented updates, ameliorations and extensions of the user profiles and personas, the requirements for personalization, and the requirements for the persuasive design (as they were described in D5.1) to be incorporated into the MAMEM system in the Phase II trials [1].

Overall, this chapter aim to improve the persuasive training software by diminishing the unnecessary cognitive load needed during its use. The 2.1 subsection briefly discusses the theoretical framework, from which the requirements for improvement are derived, while the 2.2 subsection describes how the theory is applied to improve elements of the training software. The 2.3 subsection includes the technical aspects of the training software and sources on where the software can be found.

2.1 Improvement based on D5.1 Update

Cognitive Load Theory (or CLT) is a theory that aims to understand how the cognitive load produced by learning tasks can impede learners' ability to process new information and to create long-term memories [5]. Cognitive load is typically increased when unnecessary demands are imposed on a learner, making the task of processing information overly

complex, such as using inadequate instructional method or a plethora of distractive elements. When cognitive load is managed well, learners are able to learn new skills easier than when high cognitive load interferes with the creation of new memories.

Overall cognitive load takes one of three forms (Figure 1): it may be intrinsic, extraneous or germane:

- Intrinsic cognitive load: refers to the demand made of a learner by the intrinsic quality of information being learnt (for example the level of task complexity). This form of load is difficult to eliminate since complex tasks are more difficult than easier tasks.
- Extraneous cognitive task: produced by the demands imposed on learners by the teacher, or the instructions that they are asked to follow. This type of cognitive load is extraneous to the learning task, and is increased by ineffective teaching methods, which unintentionally misdirect learners with distracting information or make a task more complex than it needs to be. It is suggested that effective presentation methods can help reduce the extraneous cognitive load imposed on a learner, instead freeing them to rehearse and remember a lesson.
- Germane cognitive load: It is produced by the construction of schemas, which are defined as the conceptualization of a particular idea or object which tells us what to expect when we encounter it in the future. So, germane cognitive load can be considered to be desirable, as it assists in learning new skills and other information.

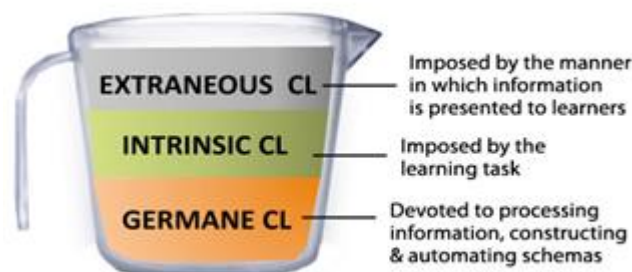



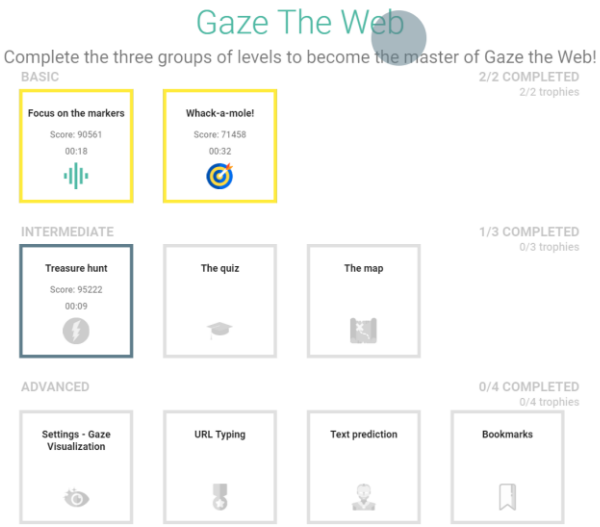
Figure 1. The three forms of cognitive load


Thus, the updates of the MAMEM training software (subsection 2.2) aim at minimizing the extraneous cognitive load imposed to users and encouraging a germane cognitive load. In other words, the requirements for improving the MAMEM training is: 1) to reduce decorative elements (i.e., seductive details that are not core elements for learning) and, 2) to optimize elements that facilitate users' information processing (i.e., core learning elements). Such improvements aim at influencing users' perceptions of ease of use of the MAMEM system as also to improve their task performance.

2.2 Improvement based on D5.1 Update

Based on the Cognitive Load Theory and the requirements that derived from this theory we updated various elements of the persuasive training software.

<p>OVERVIEW PAGE</p>	
<p>Main function:</p>	<p>Present the user with an overview of the training. Conveys information about the relative difficulty of each level, as well the levels that the user has/has not completed yet.</p>
<p>Purpose of the updates:</p>	<p>The purpose is to improve users' information processing with presenting information more visually rather than textually.</p>

<p>Updates:</p>	<ul style="list-style-type: none"> ● State the purpose of the training app; for example: “Complete the three levels to become the master of GazeTheWeb”. ● Rewards: Show the rewards to be earned next to each level. Use color to make the distinction between the rewards that are earned by the users and the ones to be earned (i.e., earned rewards are colored and “to be earned” rewards are grey). ● Show the rewards per task on the overview page ● Remove unnecessary text (i.e., 2/4 completed tasks, number of trophies) and show it visually (blue for completed, yellow for completed with reward vs grey for uncompleted tasks).
<p>Updated overview page:</p>	 <p>The screenshot shows the 'Gaze The Web' app interface. At the top, it says 'tasos' in the corner and 'Gaze The Web' in the center. Below the title, it reads 'Complete the three groups of levels to become the master of Gaze the Web!'. The interface is organized into three levels:</p> <ul style="list-style-type: none"> BASIC: Shows two tasks: 'Focus on the markers' (Score: 90561, 00:18) and 'Whack-a-mole!' (Score: 71458, 00:32). Both are highlighted with yellow borders, indicating they are completed with rewards. To the right, it says '2/2 COMPLETED' and '2/2 trophies'. INTERMEDIATE: Shows three tasks: 'Treasure hunt' (Score: 95222, 00:09) with a blue border, 'The quiz' with a grey border, and 'The map' with a grey border. To the right, it says '1/3 COMPLETED' and '0/3 trophies'. ADVANCED: Shows four tasks: 'Settings - Gaze Visualization' (grey border), 'URL Typing' (grey border), 'Text prediction' (grey border), and 'Bookmarks' (grey border). To the right, it says '0/4 COMPLETED' and '0/4 trophies'.

<p>FINAL PAGE</p>	
<p>Main function:</p>	<p>Present the user with insights of his/her overall performance per task (through feedback), as also it provides a comparison between his performance compared to other users.</p>
<p>Purpose of the updates:</p>	<p>To reduce redundant elements and/or replace them with more meaningful ones.</p>
<p>Updates:</p>	<ul style="list-style-type: none"> ● Remove emoticons and text boxes. ● Remove redundant information from the textual feedback (i.e., <i>you gained a trophy</i>) ● Present the rewards in a meaningful way instead (increase in size so as to be more visible) ● Remove the reward list from the top players' ranking. ● Optimize the way that the scoring system is presented, so as to be meaning for the user (is total score= time + accuracy).

Updated final page:

◆ BASIC - 01 Focus on the markers tasos

🕒 00:18

Congratulations on completing the level, tasos. Score better next time, and the trophy is yours!

SCORE		TIME		ACCURACY	REWARDS
CURRENT 90476	BEST 90561	CURRENT 00:18	BEST 00:18	62.5%	Unflinching! Clear the level focusing on the markers only once.

RANKINGS - TOP 3

#	Name	Score	Time

Overview Replay Next >

3. TRAINING TASKS

INTERMEDIATE - 01 Find the wizard

← Previous Page/Level / Challenge Scroll up

Find the wizard

He is hiding somewhere along the river.

Scroll through the level to find the wizard using the scroll controls in the auto scrolling, and use the click emulation button to select the place where he is hiding!

Start

Scroll down

Click emulation

Auto scrolling

B.3 Level intro & tutorial

WIZARDS TOWER

Select me using

<p>Main function:</p>	<p>Every task of all three levels consists of 2 pages, 1) Introductory page 2) the action page (user performs the task).</p>
<p>Purpose of the updates:</p>	<p>The purpose behind the two pages are not clear. The same information is presented in both two pages. Thus, we identified the essence of each page as follows: Introductory page: provide explanations; Action page: provides instructions while a user performs the task.</p>
<p>Updates:</p>	<p>For introductory page:</p> <ul style="list-style-type: none"> ● State only the purpose and the task to be executed by the user; ● Remove detailed instructions; <p>Remove emoji and text boxes.</p> <p>For action pages:</p> <ul style="list-style-type: none"> ● State only the purpose and the task to be executed by the user; ● Remove detailed instructions; ● Remove emoji and textbox.

Updated training tasks:



2.3 Final prototype of MAMEM training software

The previous section described the improvements of the persuasive design of the MAMEM training tasks. The final prototype of the MAMEM training software that incorporates these improvements can be found on the following web address:

<http://augreal.mklab.it/gr/mamem/gtw-game/index.html>

This final prototype can only be accessed correctly through the GazeTheWeb browser, which enables authentication of users. To view the software through a conventional browser use this link [see 9].

In this final prototype, the hover state of the browser is (by default) enabled so that the users can learn which basic components are interact-able, without having to always enable the GazeTheWeb click button functionality. In the training tasks, the gaze of the user is always shown on screen as a dark blue circle, so that the user can get feedback on where he is looking at all times and gain more confidence in using the browser with an eye-tracker.

The source code of the training software is freely available as open source through the GitHub page of the MAMEM project [10]. It consists of regular HTML paired with the JavaScript library createJS [11], to create geometric primitive shapes and transitions using an HTML canvas element. All user data are saved and uploaded into Google's cloud database Firebase [12].

3 Using MAMEM to stimulate social inclusion

This chapter describes how the MAMEM system stimulates social inclusion activities. For this, Chapter 3 will first describe the social inclusion indicators MAMEM will stimulate, their determinants and how to measure these, as described in detail in two earlier MAMEM reports (D7.1 and D7.2; see [6] and [3]). Then, this chapter describes (in section 3.1) in detail how to monitor (assess and measure) whether users perform these behaviors. That is, the MAMEM system monitors social inclusion behavior in two ways: through monitoring social media use behavior (for which we used the Social Tracker software, see Section 3.1.1, see also Section 3.1.2), and through monitoring internet browsing behavior (logged through the GazeTheWeb browser, see Section 3.1.3).

The focus of the **Phase I** field trials was on system acceptance and use performance and evaluation. As D5.4 concluded, the persuasive and personalization design elements of the MAMEM training tasks are effective for improving user's effectiveness in using the computer system for social inclusion tasks [1]. Chapter 2 described how the MAMEM training tasks were further improved to increase training effectiveness and also to improve the perceived ease of use of the training software.

The focus of the **Phase II** field trials is broader. That is, in the Phase II field trials the MAMEM system will be installed in the user's home for an extended period of time (4 weeks) to be used for real-life tasks. Thereby, first of all, the Phase II field trials allow the MAMEM system to stimulate the user to start using the MAMEM system and to use it well (as for performance and user evaluations). Importantly, in addition, the Phase II field trials allow the MAMEM system to stimulate the user to use the MAMEM system for what it was intended to: use it for social inclusion behavior.

Therefore, closely tied to the persuasive design of the MAMEM training tasks, we developed additional persuasive design that is aimed at directly stimulating social inclusion behavior. These persuasive design elements are included in two elements of the MAMEM system: In the GazeTheWeb browser (to influence social inclusion behavior while browsing), and on the Dashboard/ Home page with which the GazeTheWeb browser starts up (to influence specific social inclusion behaviors).

At the same time, the lessons learned about the persuasive design of the MAMEM training tasks (as described in D5.4) were also applied to the development of the persuasive design additions to the GazeTheWeb browser and the Dashboard/ Home page [1]. That is, following the recommendations of D5.4, the newly included persuasive and personalization design principles were developed so that they contained no elements that limit the implementation of persuasive strategies (e.g., the hierarchical group membership) in the extent to which they rely on and need user memory, processing capacity, visuo-spatial capacity and the extent to which they might cause frustration, or might otherwise lower perception of ease of use. Also, D5.4 showed that the persuasive strategies included in the MAMEM training tasks were effective in improving user performance. Therefore, we included in the persuasive design of the GazeTheWeb browser and the Dashboard/ Home page strategies (for influencing and personalized influencing) that were related and comparable to the persuasive strategies used in the MAMEM training tasks (which were proven to be effective in D5.4).

Focus on digital social inclusion behavior

As was described in detail in D7.1, WP7 identified (based on literature research) three domains of social inclusion, each of which is an indicator for a person's general social inclusion (see Figure 3.1). Also, it identified activities (behaviors) that contribute to the extent to which a person is socially included, and experiences social inclusion, for each of these three domains. These behaviors can take place in the real world, but they can also take place in the digital world (online). For example, communicating with friends might happen in the real world (e.g., through a physical visit), but also in the digital world (e.g., through sending an email) and both types of behavior contribute to the person's social inclusion.

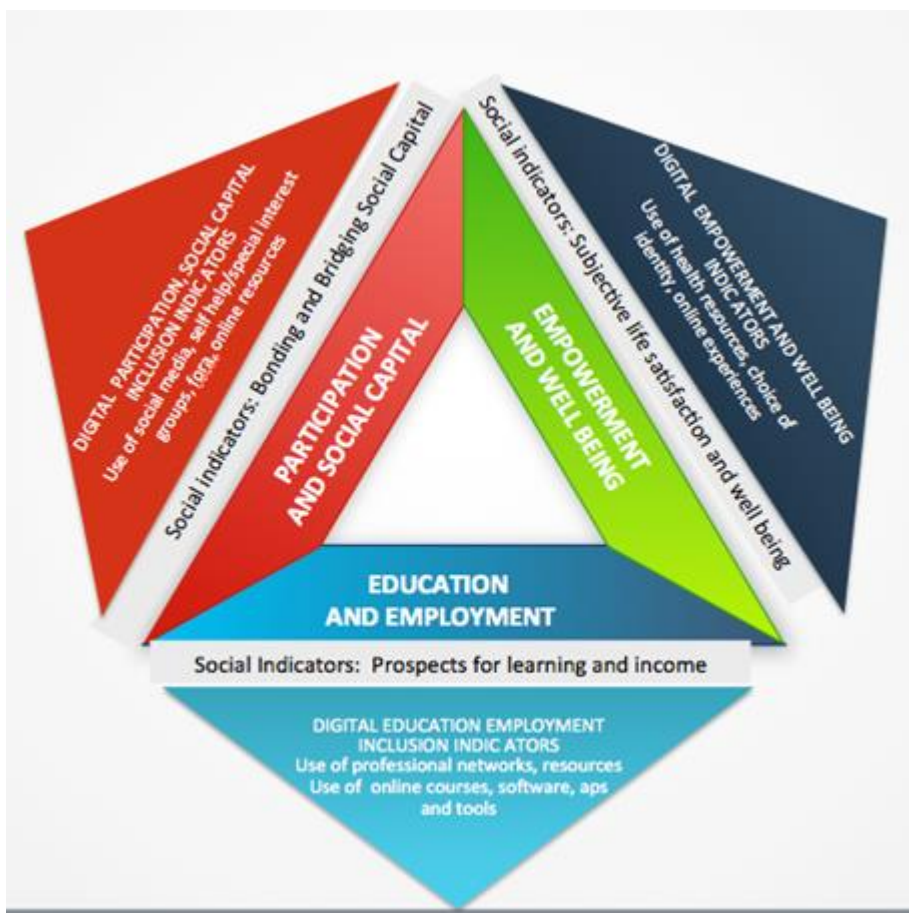


Figure 3.1. The three domains of digital social inclusion and related indicators (from D7.1).

More specifically, WP7 distinguished three indicators of social inclusion:

- The Education and Employment indicator axis,
- The Participation and Social Capital axis, and
- The Empowerment and Well Being axis.

For each of these three indicators, (as identified in D7.2) people can perform certain activities that contribute to social inclusion in that domain (for that indicator). For example, the activity of sending out an email contributes to social inclusion in the domain of 'Participation and social capital'. Table 3.1 below presents a table showing the three digital social inclusion indicators and related digital activities (as described in detail in D7.2).

DIGITAL INCLUSION INDICATOR	DIGITAL ACTIVITIES
PARTICIPATION AND SOCIAL CAPITAL	Mail exchange Skype SMS exchange Mobile access Social media account Frequency of interactions with friends online Participation in groups and fora Content generation +time spent online ¹
EMPOWERMENT AND WELL BEING	Gaming Entertainment Access to health related resources, groups, advice, information +time spent online
EDUCATION AND EMPLOYMENT	Participation in e – learning Participation in professional social media Business website owned Client and job search online +time spent online

Table 3.1. The three digital social inclusion indicators and related digital activities (from D7.2)

¹ In general (as explained in D7.2 in detail) spending more time online is related to more social inclusion on all three domains (participation and social capital, empowerment and well being and also education and employment). However, in the PD used in the Phase II trials we aim to stimulate specific social inclusion behavior. Therefore, this indicator (time spent online) does not help identifying which social inclusion behavior specifically was spent time on, and therefore this variable can not be used to steer persuasive design.

Targeting the persuasive design

The most important goal of the Phase II field trials of the MAMEM project is to increase participant's social inclusion, and based on the insights generated in WP7 this means that participants should perform more (more frequent and also for longer periods of time) the digital activities listed in Table 3.1 and thereby increase their social inclusion (on the three indicators). Therefore, the persuasive design for Phase II field trials focused on increasing the frequency and duration with which participants performed these behaviors.

As proposed already by Fogg (2003; see [7]), persuasive technology should clearly be focused on specific target behavior to be able to be successful. For the MAMEM system in Phase II trials, the target behaviors were indeed identified in WP7: that is, to increase social inclusion, users of MAMEM should perform the identified social inclusion activities more.

Therefore, for each of the three target groups (NMD -- Neuromuscular Diseases, PD -- Parkinson's Disease, and SCI -- Spinal Cord Injury) we identified the specific internet behavior related to each of the digital social inclusion activities. That is, for each of the three groups, in their own cultural context, we listed, for each social inclusion activity, which websites this group could visit as an indication of performing digital social inclusion activity of that particular category.

To list these websites (indicating social inclusion activities), we collected for each of the three patient target groups, for each activity, as many URL's as possible. We collected these URL's by asking doctors and patients of each group for input, filling out a spreadsheet listing the various activities (for the three indicator domains). This led to a collection of activities, one for each patient group. For example, for the activity 'Mail exchange' (part of the social inclusion indicator Participation and social capital), our database lists for the three patient groups:

- NMD (Greek context): gmail.com, windowlive.com, yahoo.com, hotmail.com
- SCI (Israeli context): mail.google.com, mail.ru, hotmail.com, mail.walla.co.il, live.com
- PD (Greek context): cosmote.gr, gmail.com, skype.com

This way, for each of the social inclusion activities listed in Table 3.1, we collected URL's for each of the three target groups.

The next section (Section 3.1) describes how these specific social inclusion activities will be monitored and logged by the MAMEM system during the Phase II field trials. After that, Section 3.2 will describe how we will use that data about a participant's social inclusion activities to influence his or her behavior while using the MAMEM system through the persuasive design of the interfaces.

3.1 Monitoring social inclusion activity

The MAMEM system monitors and logs the users' digital social inclusion activities in three

ways:

- Logs through Social Activity Tracker
- Logs through Facebook
- Logs through GazeTheWeb

This data is used for evaluating the MAMEM system in the Phase II field trials, and also as input for the persuasive design of the MAMEM system (in the Dashboard / Home page and in GTW). That is, the data about GTW browsing behavior stored in this way in the Firebase database, was used by the MAMEM Dashboard/ Home page to make evaluations of the digital social inclusion behavior of a user to be able to stimulate these behaviors in an interactive, personalized way. This is described in detail below in Section 3.2.1.

All data was stored in an online database (Firebase), using secure connections between local clients and online databases. During the field trial, both the MAMEM Dashboard/ Home page and the MAMEM training tasks use this data. Figure 3.2 shows an overview of this data storage.

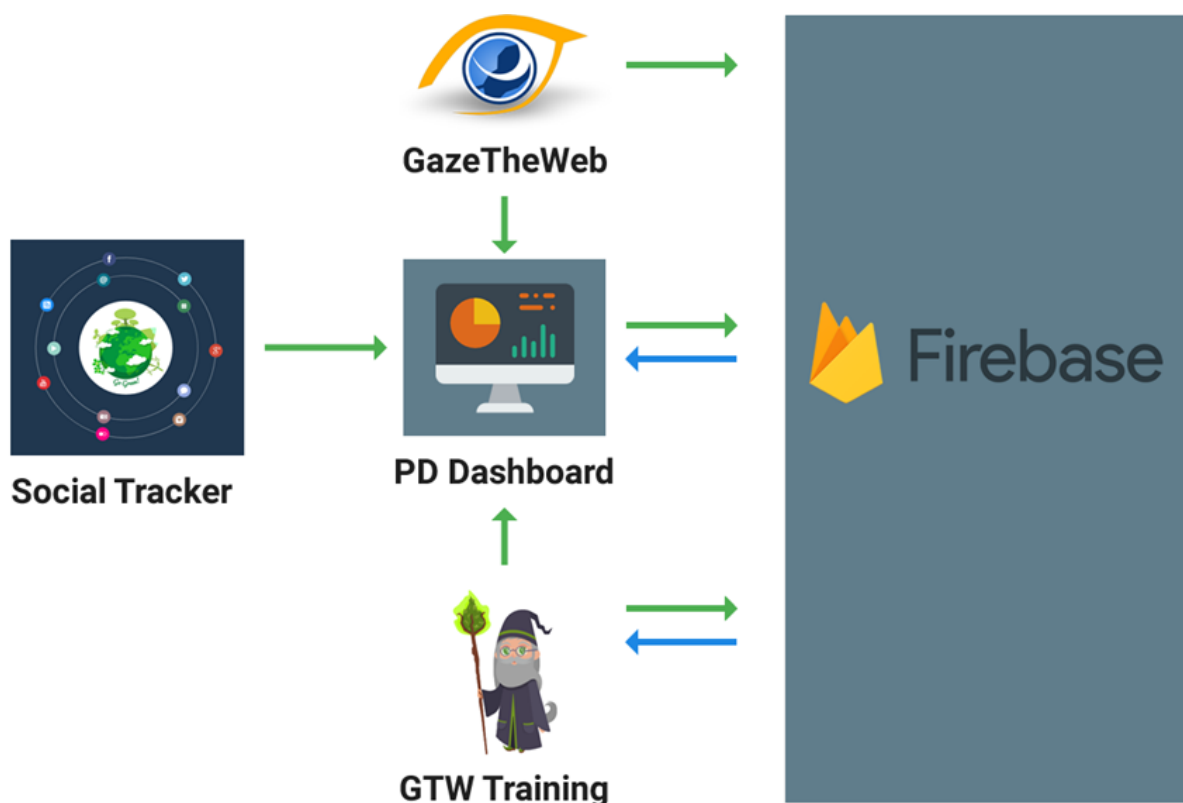


Figure 3.2. Data storage in the online MAMEM elements.

So, we collected data about the user's social inclusion activities in three ways, and used these data for two purposes:

- Pre- post evaluation: The collected data was also used for a purpose that is somewhat out of the scope of the current report. That is, we used these data also to

evaluate the effectiveness of the MAMEM system in the Phase II field trials in stimulating social inclusion behavior. This analysis took place after the Phase II field trials, and also incorporated other data like answers to the various questionnaires.

- PD Dashboard/ Home page: We used these data to influence user behavior while using the MAMEM system. This was done through the persuasive design of the PD dashboard/ home page (as described later).

Table 3.2 (below) summarizes how the data collected through these three channels was used:

Channel	Pre- post evaluation	PD Dashboard / Home page
Social tracker	✓	
Facebook logging	✓	
GTW logging	✓	✓

Table 3.2. The three channels of data collection, and the two purposes for which this data was used.

Below, we will describe in detail how digital social inclusion behavior was monitored and data logged through these three channels.

3.1.1 Logs through social activity tracker

To log details about social network activity of the user, Social Tracker [13] was used, an open-source monitoring, search and analytics over social media software, that crawls various user contributed content from social media networks. The social tracker software is described in detail in D7.2, section 3.2.2. Social Tracker logs each participant’s digital social inclusion behavior, to the extent that Social Tracker is able to access it.

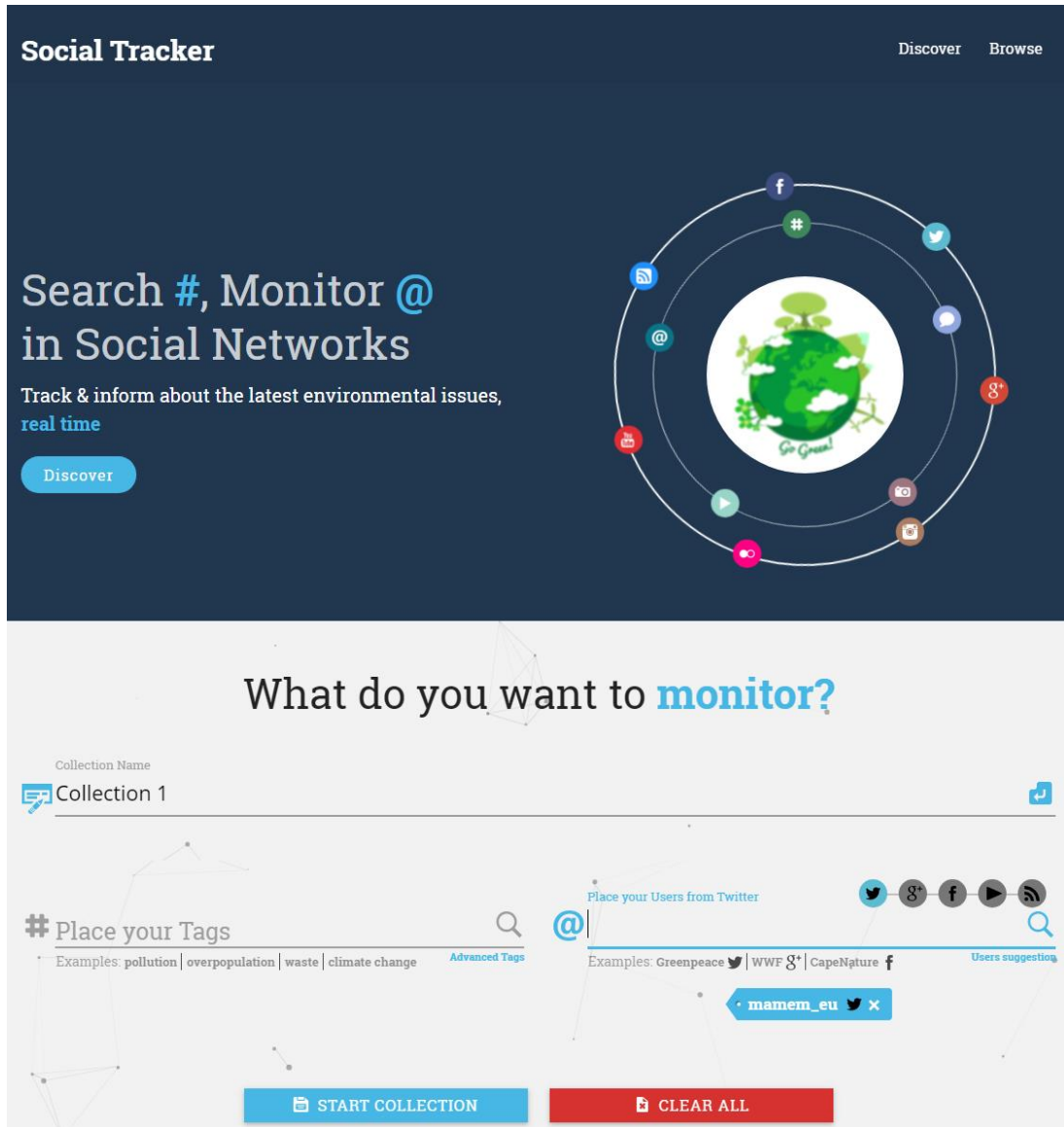


Figure 3.3: Social Tracker initial interface

To access the Social Tracking software, first of all, the person installing the MAMEM system creates a collection that handles the saving of all the social media content (see Figure 3.3). To access the page, the user inputs a new user-id when typing the link in the browser address bar (*http://augreal.mklab.iti.gr:81/ui/index.html?user_id=******). In the page that loads, illustrated in Figure 3.1, the user must add a Collection name and the usernames or handles of any Social Network he actively uses. Supported social networks are Twitter and Google Plus. Clicking on the Start Collection button, the Collection is effectively saved under the user-id that was provided, and the social network activity crawling initiates. The user can see any collection he creates as illustrated in Figure 3.4.

COLLECTIONS

Browse all created collections, Inform on latest trending topics

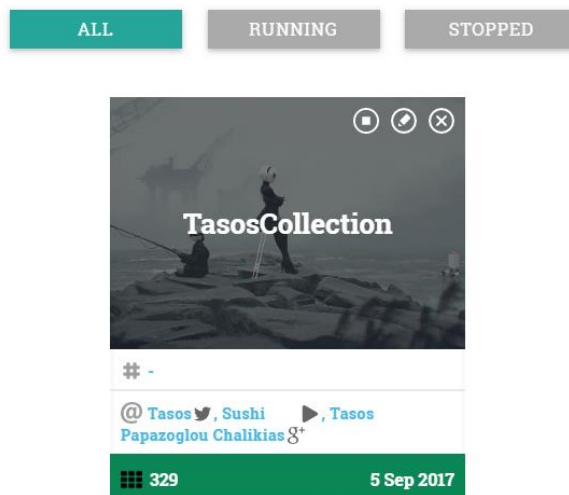


Figure 3.4: Saved Collections

The user can also edit a collection, adding or removing social network handles or delete it altogether at will. Data crawled is tweets information for Twitter and posts for Google Plus. Thereby, we set up an implementation of Social Tracker that follows the relevant social behavior of our participants.

3.1.2 Logs through Facebook

Most of the social media usage data that we collected were collected through the social tracker. Additionally, we also used the more direct collection technique of collecting Facebook activity data that was performed by the MAMEM Dashboard/ Home page directly.

That is, our platform also directly logged Facebook activity but in order to do so, some necessary preparatory steps were needed. The person installing the MAMEM system must first go into the MAMEM Statistics Facebook application, which is accessible through the Facebook Developers webpage. Inside the Roles subsection the person installing the MAMEM system adds as a Tester the user, so the MAMEM Facebook app can crawl through his Facebook data.

The actual crawling happens each time the Persuasive Design Dashboard (described in Section 3.2) is loaded. Data crawled is any information that is part of or complementary of each Facebook post, comment or like the user has performed.

3.1.3 Logs through GTW browser

Finally, the GTW browser stored information about browsing behavior in an online database (Firebase). That is, all URL's visited, the date/time at which the visit took place, and also the length of the visit were logged into this database. This data storage is performed through a strongly secured connection. Appendix A shows which data is stored and in which format.

The data about GTW browsing behavior stored in this way in the Firebase database, was used by the MAMEM Dashboard/ Home page to make evaluations of the digital social inclusion behavior of a user to be able to stimulate these behaviors in an interactive, personalized way. This is described in detail below in Section 3.2.1.

3.2 Stimulating social inclusion activity

In the data about a user's digital social inclusion behavior collected through the GTW browser and stored in the Firebase database (as described in the previous section), the MAMEM system had clear information of the extent to which a user performed the system's target behaviors. That is, these data represent the extent to which the user was using the MAMEM system for the specified social inclusion activities.

To stimulate social inclusion activity, the MAMEM system aggregated these data to calculate specific variables representing a participant's social inclusion activity levels. Closely connected to the learning curve concept explained in D5.2, Section 2.1, the MAMEM system (through the PD Dashboard/ Home page) used the internet behavior data monitored and logged by the GTW browser (as described in Section 3.1.3), to assess a participant's social inclusion activity for each of the social inclusion indicators (as described in the introduction of Chapter 3).

Scoring the target behavior

This assessment was done by counting, all activities for each of the three digital social inclusion indicators (see Table 3.1), whether and how long a user visited the related URL's. As described in the introduction of Chapter 3 above, for each of these activities we had available a list of URLs for each of the three target groups. To calculate whether a participant increased or decreased his or her social inclusion behavior (for each specific behavior) we compared a participant's amount of social inclusion activities (for a specific behavior, e.g., visiting email related websites) to the same behavior of that same participant, but in the preceding time period.

In general, this formula consisted of the following comparison:

$$\frac{\text{Sum (Visits_to_URL * Length of visit)}_{\text{current time period}}}{\text{Sum (Visits_to_URL * Length of visit)}_{\text{previous time period}}}$$

So, for example, for the activity of 'Mail exchange' (part of the social inclusion indicator

Participation and social capital), we counted for each of the three patient groups how often and how long they visited the email related websites (that our specialists have listed, as described in the introduction to Chapter 3 above). This would mean that for:

- NMD (Greek context): The MAMEM PD Dashboard counted how many times and how long a participant visited gmail.com, windowlive.com, yahoo.com, and hotmail.com
- SCI (Israeli context): Whereas for the SCI group, the MAMEM PD Dashboard counted how often times and how long they visited mail.google.com, mail.ru, hotmail.com, mail.walla.co.il, and (or) live.com.
- PD (Greek context): Likewise, we calculated such a score for PD patients, assessing their visits to cosmote.gr, gmail.com, and skype.com.

This score was calculated for

- the current day (today), and for
- the preceding time period of maximum 7 days.

And the ratio between these two scores functioned as our score / measure for a participant's performance as to that particular social inclusion behavior.

This way, for each of the social inclusion activities listed in Table 3.2, we calculated a score. This score was stored, and used in post-trial analyses, but more importantly: This score was used in the persuasive design of the PD Dashboard / Home page and also the PD included in the GTW browser.

3.2.1 PD strategies for Dashboard/ Home Page

To stimulate the target behaviors (social inclusion behavior) as identified above, and as measured above, the MAMEM Dashboard/ Home page contained a variety of persuasive strategies. These persuasive strategies were identified and described in detail (including their theoretical and empirical underpinnings) in D5.1. Below we describe these persuasive strategies, all of which were incorporated into the MAMEM Dashboard/ Home page. Figure 3.5 below shows the Dashboard/ Home page, although it is described in detail in Chapter 4.

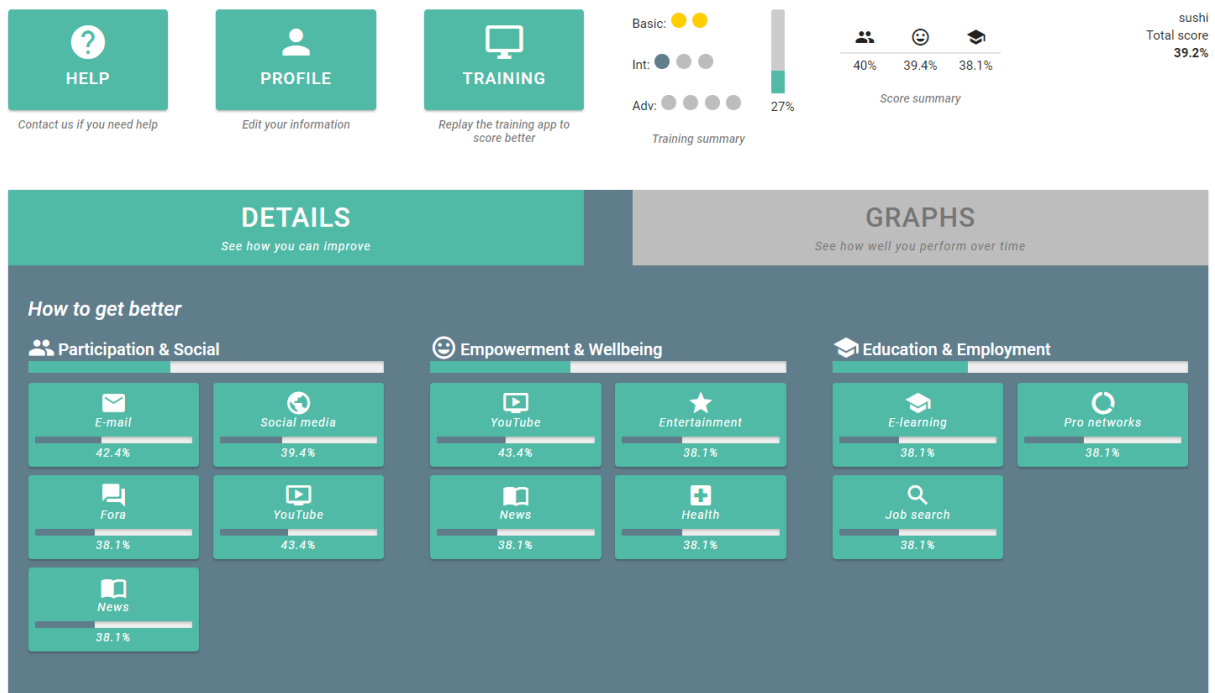


Figure 3.5. The MAMEM Dashboard/ Home page

In the MAMEM Dashboard/ Home page we incorporated the following persuasive strategies:

- Giving incentives: Participants were given rewards in the form of scores (in percentages).
- Giving evaluative feedback: Participants were given various forms of feedback about their social inclusion behavior, both at the specific and at a general level.
 - A multitude of different feedback scores about the participant's performance on each of the social inclusion activities specifically. As can be seen in Figure 3.5, for all social inclusion activities, the dashboard showed the participant's score. This score was calculated using the formula described earlier.
 - Feedback about the participant's performance on each of the three digital social inclusion domains: Participation & social, empowerment & wellbeing, and education & employment. These three scores were simple averages of the scores of a participant on the social inclusion behavior scores in that domain.
 - This feedback was presented twice: both as a bar right above the list of activities in each particular domain, and
 - As a number (percentage) at the top of the page (e.g., 40%, 39.4% and 38.1%)
 - Feedback about the participant's total social inclusion score. This general score was presented in the top-right corner of the dashboard, and consisted of the average of the participants social inclusion activity scores over the three domains.
- Goal setting: Incorporated into the feedback score representation was the indication of a performance goal. That is, most feedback scores were represented by a bar

presenting the feedback, ranging from 0% to 100%. This representation includes both the participant's performance score, but also an indication that this score could be higher (i.e., 100%, the full bar). Relatedly, the formula used to calculate the feedback score consisted of a comparison of the participant's current activity level to the participant's earlier activity level, thereby including the motivation of performing at least as good as good and preferably better than in the preceding (maximum 7) days.

- Make behavior easier: The MAMEM Dashboard/ Home page made performing the social inclusion activities easier in two ways:
 - By showing participants which social inclusion activities they need to spend more time on, the MAMEM Dashboard/ Home page makes it easier for them to perform these behaviors.
 - The feedback score was incorporated into a button (see Figure 3.5). Thereby, participants could press that button for each of the feedback scores, which opened a small window showing a list of the URL's to be visited. Participants could click one of these URL's, and thereby performing the focal social inclusion behavior was made very easy. For example, after clicking the E-mail button, a list (personalized to the three patient groups) was presented, and participants could e.g. click on 'www.gmail.com'.
- Tailoring: The interactive structure of the MAMEM PD Dashboard/ Home page created an overview of which activities need more attention from the participant. Thereby, the whole page was tailored (comparable to the overview of training activities, see D.5.2) to the individual goals of the participant him or herself.
- Activate social norms: By including the target behaviors, the three domains of social inclusion, a participant's scores, and behavioral options on this very central dashboard page, a very clear social (injunctive) norm was activated: You should use the MAMEM system for performing specific social inclusion behaviors.
- Personalization: The MAMEM PD Dashboard/ Home page also contained personalization and personalized persuasive strategies:
 - The name of the participant was presented at the right-top corner of the page, personalizing the whole page, aiming at increased motivation, and increasing the strength of other persuasive strategies (see D.5.1)
 - The social inclusion behavior on which the feedback was based differed for each of the three patient groups. That is, as described in the introduction of Chapter 3, we identified for each of the three patient groups the related URL's (for each social inclusion activity), and these URL's were used in the calculation of the feedback scores.
 - The 'Profile' button allowed participants to change certain personal settings (e.g., nickname, age, etc.), thereby increasing the feeling that the MAMEM system and its setting were specific for the participant him- or herself.

Through incorporating these persuasive and personalization strategies, the persuasive design of the MAMEM Dashboard/ Home page turns the MAMEM system into a piece of persuasive technology serving in the tool role (see Fogg, 2003). Thereby the MAMEM system allows people to perform behavior that without the technology they would not have been able (so easily) to do.

3.2.2 PD strategies for GTW browser

To even further stimulate the user to perform digital social inclusion activities, also the GTW browser contained persuasive design. Chapter 5 describes in detail the final prototype of persuasive design in the GTW browser. As can be seen in Figure 5.1, the GTW browser shows participants in its top-right hand corner a bronze, silver or golden badge. This badge represents the participant's performance level in using the MAMEM system for its intended use: social inclusion behavior.

As presented in D5.4 (and described in detail in D5.1), the following list of persuasive strategies was incorporated into the GTW interface to stimulate social inclusion behavior:

- Feedback & Incentives: The hierarchical group level membership represented by the bronze, silver or gold badge present to the participant both feedback about their social inclusion behavior performance level, and also provides them with an incentive for that behavior.
- Consistency (showing consistency in attitudes and behaviors): Participants have indicated to be willing to use the MAMEM system, know that it is mainly meant for performing social inclusion behavior, and thereby will show consistency in performing behavior consistent with those attitudes.
- Reciprocation (responding likewise when receiving something): Participants received a group membership of a certain level, in return for which they should perform the relevant social inclusion activities.
- Social validation (doing what others do): The hierarchical group level membership represents a system of social values, in which performing social inclusion behavior is very much valued. To do what others do in which environment, participants will increase their social inclusion behaviors.
- Theories of discrete emotions (people are sensitive to specific emotional appeals): The hierarchical group level membership makes clear that the MAMEM system appeals of the participant social inclusion behavior. Performing this behavior allows the participant to satisfy this sensitivity.

These persuasive strategies were combined to form the concept of 'hierarchical memberships'. The strategy here is that MAMEM introduces a set of hierarchical memberships into the system. Users are given different memberships based on to their levels of online activity. The more active a user, the higher their membership level.

3.2.3 Further persuasive design elements in the MAMEM system

Next to the interactive (social inclusion data driven) persuasive design strategies incorporated into the GTW browser and the MAMEM PD Dashboard/ Home page, we also used the following, additional persuasive strategies in the MAMEM system to influence the user's behavior stimulating social inclusion behavior. That is, in the general introductions and explanations given when the MAMEM system was introduced to participants (when the

system was installed in their homes), many different persuasive strategies were used:

- The general aim of these introductions, next to explaining the MAMEM system from a more technical user perspective (e.g., how to turn it on), was to make clear what the MAMEM system was to be used for.
- General goal setting was used when explaining what the MAMEM system was for
- Social norms were activated
- Relevant concepts were primed (e.g., social inclusion, explaining what that is).
- The 'stop monitoring' button reminded the user of the target behavior of MAMEM. That is, the button allows the user to stop the MAMEM system from monitoring their behavior, reminding them that indeed it monitors their behavior while focusing on social inclusion behavior.
- The 'Help' button on the MAMEM PD Dashboard/ Home page increased the persuasive strategies of social norm setting and consistency: contacting MAMEM assistants for help, would be contacting them with questions about how to use the MAMEM system for its intended purpose (social inclusion behavior).
- Relatedly, the person explaining the MAMEM system and what its main use should be (social inclusion) indicated that he or she (or a colleague) would be returning after the four week period to pick up the system, thereby further strengthening the persuasive strategies (e.g., consistency and social norm setting).

Thereby, the MAMEM system contained a multitude of persuasive strategies. How these were embodied into the MAMEM PD Dashboard/ Home page, and into the GTW browser is described in the next two chapters.

4 Final prototype of MAMEM Homepage

To stimulate the intended digital social inclusion behavior and to assess if our system is helping the user on performing every day digital tasks like sending an e-mail or reading news websites in a more easy and efficient way, a Dashboard / Home page has been created that shows this activity to the user in a meaningful way. A score system has been implemented that is based on the activity of the user and measures how much he has improved over time.

To be able to access the MAMEM Homepage, the users must be registered.

On the registration page (<http://augreal.mklab.iti.gr/mamem/gtw-home/register.html>; also shown in Figure 4.1), the person installing the MAMEM system must fill in some basic information about the person using the MAMEM system. This information will be used to identify each user from each group and country. This information includes:

- A valid e-mail and password pair,
- The participants first name,
- A number or a nickname that will be used instead of his real name to any multi-user activity,
- The participants gender & age,
- A Social Tracker user id,
- The participants group type,
- Language,
- A checkbox that when used, the questions of a training software level are translated to the participant's local language.

Participant registration

User information

E-mail

e.g. user@mail.com

Password

6 characters minimum

Re-enter E-mail

e.g. user@mail.com

Re-enter Password

6 characters minimum

Participants number
(Nickname)

e.g. GS016 or Colibri

First Name

e.g. John

Gender

Male



Female



Age

e.g. 34

Social Tracker User ID

Leave empty to disable

Participant group

Parkinson's
Disease



Neuromuscular
Disease



High
Tetraplegia



Language

English



Greek



Hebrew



Translate Quiz questions to local language

Register

Figure 4.1: User registration page

The MAMEM Homepage is automatically loaded each time the GazeTheWeb browser is launched because it is set as the default first page. Also, when the user clicks the MAMEM medal icon in the GazeTheWeb browser (see Chapter 5) the MAMEM Homepage is loaded into the GTW browser. This Homepage consists of a row of buttons and indicators and a Tabbed area as shown on Figure 4.2. Every time the MAMEM Homepage loads, there is a mechanism that loads in the background, which gathers all data saved from the Social Tracker and Facebook, calculates scores and updates the Firebase database with the new information.

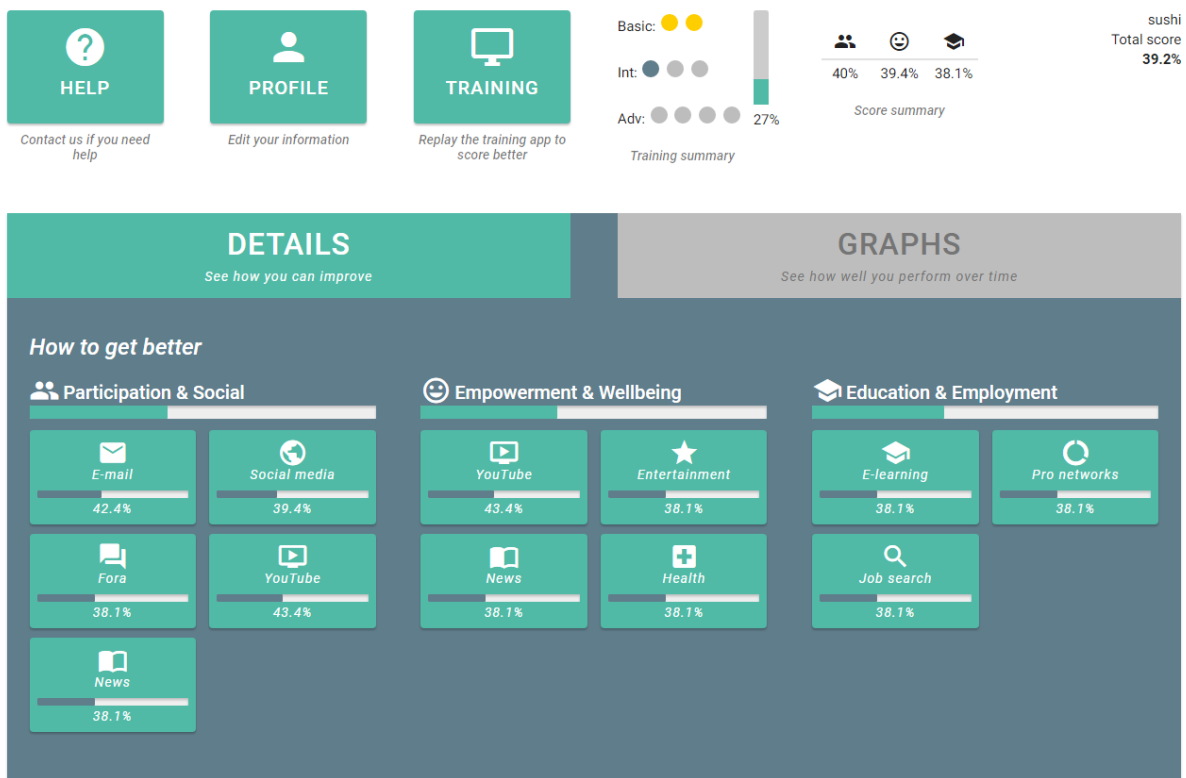


Figure 4.2: Homepage Dashboard

At the top of the page there a help button. When it is clicked it reveals information of a contact person that the user can contact if he/she has run into any problems with anything related to the MAMEM project. Next is a Profile button that when clicked displays all the information that was provided during the Registration process. The user can change this information except for the email and password. There is also a Training button, which serves as a link to the MAMEM Training software. Right next to the last button there are some indicators that illustrate the completion status of the training levels for the current user. Gray color means it is incomplete, blue that the level has been completed and yellow that the level has been completed and the trophy is gained. The next item in this row is the Score summary that provides the current score of the user for the three basic categories of tasks in a numerical form with the accuracy of 1 decimal point. Last is the Total score indicator which is an average of the three previous values. Also, in the rightmost top, the nickname of the user is shown.

The tabbed area consists of two sections, the Details tab, where the user can see how well he/she is performing today over a past period of days and the Graphs tab. In the Details tab, there are three columns, each for every category of Social Inclusion indicators, that is further broken down into tasks. The score is calculated for each of these tasks and is aggregated into an average for the three basic categories. In the Graphs tab there is a Line chart that outlines the user's score for each day, toggling between the three basic categories and all tasks (see Figure 4.3).

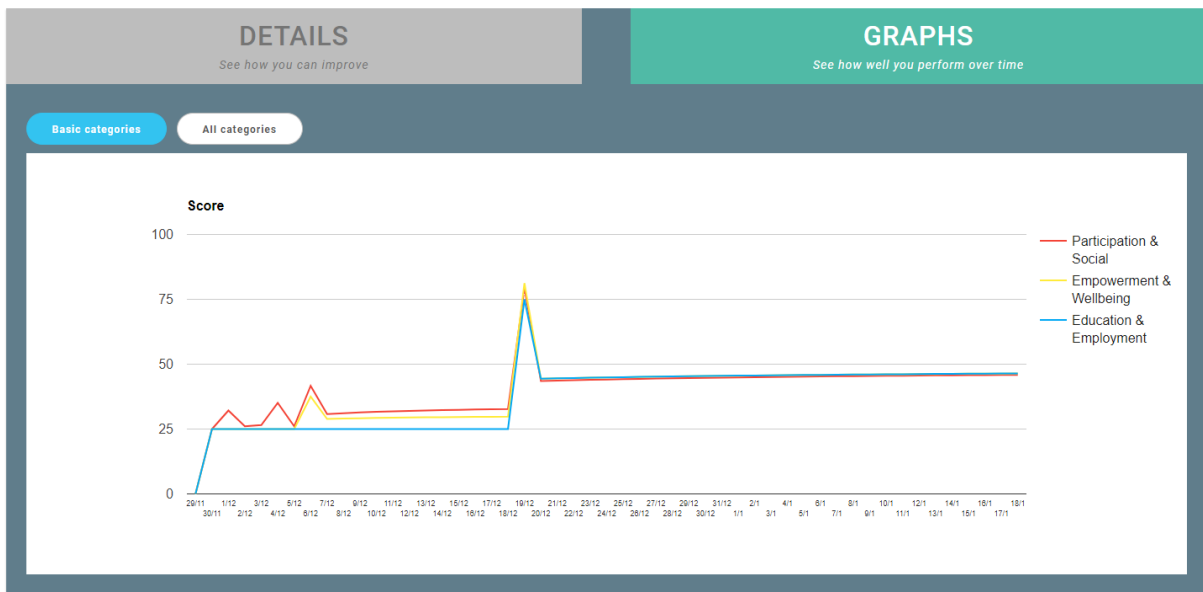


Figure 4.3: The Graphs tab on the Homepage

The source code of the MAMEM Homepage Dashboard software is freely available as open source through the GitHub page of the MAMEM project [14]. It consists of a regular HTML file, that leverages JavaScript to calculate scores, the Google Charts JS API [15] for the Line graph, the Facebook API [16] to crawl information about the Facebook social activity of users and the Google Firebase API to authenticate users and read and write data to the database.

5 Final prototype of persuasive design in GazeTheWeb

Implementing the persuasive strategies described in Chapter 3 (and more specifically Section 3.2.2), we included in the GazeTheWeb interface a group membership indicator. Figure 5.1 below shows this medal, in the top-right hand side of the interface. Using the code presented in Figure 5.2, GazeTheWeb was instructed by the software behind the MAMEM Dashboard/ Homepage which of the three medals to show.

Furthermore, the prototype of GazeTheWeb (including the persuasive design) is delivered in D3.3 [8], and all specific details about the software can be found there.

More specifically, the MAMEM Dashboard/ Homepage calculates the total user score, averaging the scores for each category and saves it in the Firebase database. GazeTheWeb then reads this data back and if the score is between 0 and 3.3 values then it features a bronze medal. If the score is between 3.4 and 6.6 then GazeTheWeb features a silver medal in the top-right hand side. Finally, if the score is bigger than 6.7 then the medal shown in GazeTheWeb is the Gold one.

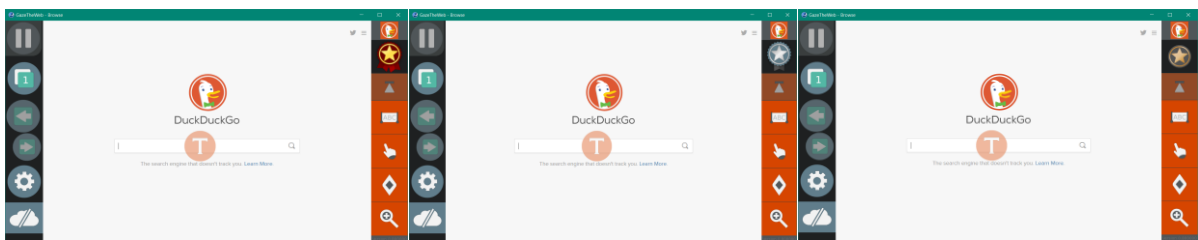


Figure 5.1. The GazeTheWeb interface with the **Gold** medal (left picture), **Silver** (middle picture) or **Bronze** (right picture) shown in the top-right hand side.

```
// Retrieve info about user award and wait for it
Award GetUserAward()
{
    // Retrieve score
    float score = 0.f;
    std::promise<nlohmann::json> scorePromise; auto scoreFuture = scorePromise.get_future(); // future provides score
    bool pushedBack = FirebaseMailer::Instance().PushBack_Get(FirebaseJSONKey::SCORES_TOTAL, &scorePromise);
    if (pushedBack) { score = scoreFuture.get().get<float>(); };

    // Decide on award
    if (score <= 3.3f)
    {
        return Award::BRONZE;
    }
    else if (score <= 6.6f)
    {
        return Award::SILVER;
    }
    else
    {
        return Award::GOLD;
    }
}
```

Figure 5.2. The GazeTheWeb code connecting the representation of the medal to the digital social inclusion scores as processed in the Dashboard/ Homepage software.

6 Multimodal Tetris

In this section, we propose a modification to the popular TETRIS game in its hands-free version by employing signals from the three sensors. In this new version of Tetris, gaze input is able to control the horizontal movement of the Tetris tiles [17, 18], EEG signals are used for tile rotation through the detection of imaginary movement in the sensorimotor rhythm (SMR) brain waves [19], while GSR readings are used to adapt the speed of the game based on the stress levels of the user [20].

Our motivation for re-inventing Tetris, is that in the context of BCI applications (and especially the ones relying on Senso-motoric Rhythms - SMR) it is imperative to not only train the system to recognize but also the user to produce distinguishable signals. In this respect, the use of an application that will allow users to train themselves needs to precede the actual use of a BCI interface. Typical training approaches consists in presenting the user with arrows as cues to indicate what type of movement they are asked to perform mentally, while providing feedback as to what movement the system has detected. This feedback allows the users to adapt their mental strategy by optimizing their mental movement command in order to maximize the detection performance of the feedback mechanism. However, this is a tedious process and the users get bored and frustrated before mastering their Sensor-motoric Rhythm to a sufficient extent. Alleviating this problem, we reinvent the popular Tetris game to serve as an SMR training application that will engage the user to keep training themselves. However, the integration of the rather strict protocol for SMR-training in the game-play of Tetris comes with a number of technical and conceptual challenges.

6.1 The design and the sensors

The design of MM-Tetris (Figure 6.1) incorporates the three sensors in the following way so as to implement the required controls of the game (for the preliminary tests of the game the devices in parentheses have been used):

- Eye-tracking (MyGaze [21]) provides the gaze coordinates of the user - Horizontal movement of the tiles.
- EEG signal recorder (ENOBIO 8 [22], 8 wet electrodes placed on the CP1, CP2, C3, C1, C2, C4, FC1, FC2 sites of the 10-20 international system) provides the SMR signal of the user upon imaginary movement - The user can asynchronously rotate the tiles right-wise by imagining a limb movement and thus producing SMR signals.
- GSR measurements (Shimmer [23]) provide information for the stress levels of the user - Automatic adaptation of the tiles' falling speed.

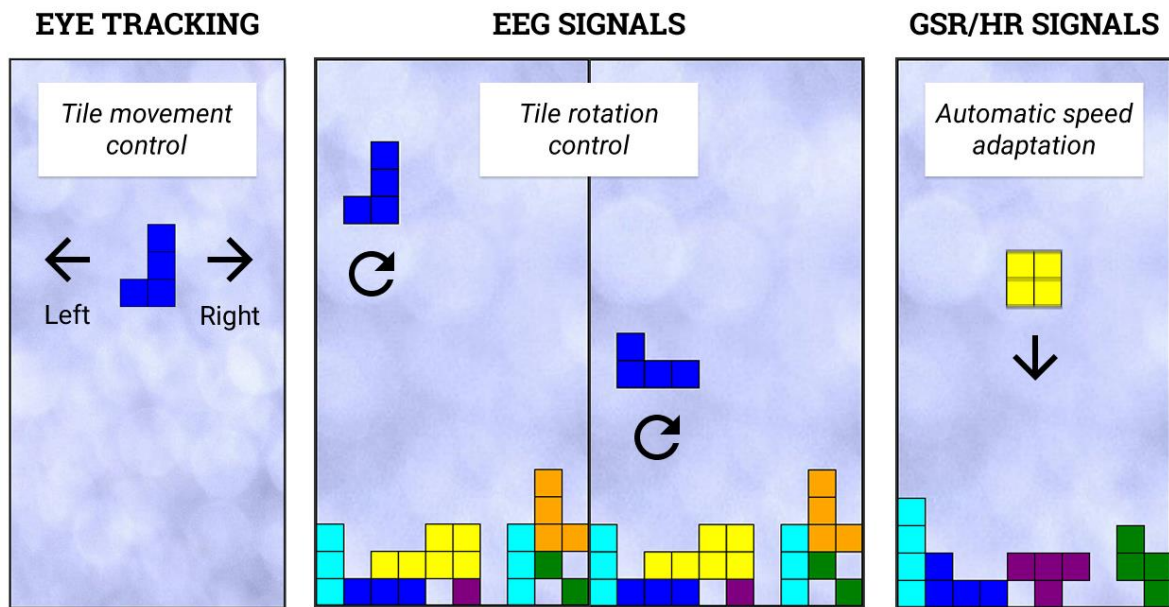


Figure 6.1 The MM-Tetris interface and commands.

The controls of the game are treated as timed events (i.e. move the tile to x coordinate, or rotate the tile, or decrease game speed), based on the signals that are sampled at a frequency of 30Hz, 500Hz and 32Hz from the three devices, MyGaze, ENOBIO 8 and Shimmer+ respectively. In order to have a universal timing reference for the identified events, the three signal streams and the events are synchronized through the LabStreamingLayer [24] (i.e. software-based synchronization).

6.2 Initial classifier for playing MM-Tetris

MM-Tetris should be operated using only the activity of the eyes and brain. The rationale of the presented approach is to train a participant specific classifier to recognize the execution of an imaginary movement in order to perform the rotation of the tetrimino, whereas, as soon as the suitable rotation has been accomplished, eye tracking technology is used for the tetrimino navigation across the TETRIS board.

In order to develop a subject-specific classifier a specifically designed experiment for prompted imaginary movement was conducted. In particular, the experimental session starts with a black screen that lasts for 40 seconds during which the participant is asked to remain calm without imagining any movement in order to use the respective recording as a baseline signal. Afterwards, an iteration of 40 trials is initiated consisting of 20 trials for the imagination of left hand movement and 20 for the imagination of right hand movement. Each trial is initiated by a green cross that lasts for 1 second and allows the participants to get prepared for the execution of imaginary movement. Subsequently, a red arrow pointing towards the left or right direction instructs the participants to imagine the respective movement. After a 5-second period the arrow disappears and a black-screen period that lasts for a random duration of 5 to 20 seconds follows. The whole duration of the experimental session is approximately 20 minutes.

Afterwards another imaginary movement experiment is conducted in order to train the

subject to control the sensorimotor rhythms via imaginary tasks. Thus, by using the trained SVM classifier the subject is asked to perform the mental imagery task at will in order to control a feedback bar on a screen, SVM classifier is used to recognize imaginary movement or no movement. The length of this feedback bar indicating the strength of the participant's mental imagery skill (sensorimotor rhythm activation) is based on the classification score. The feedback bar was colored green or red based on whether the EEG input was classified as movement or no movement. The purpose of this short session was to train the user on performing the mental imagery task and to find the best technique that will allow her/him to play the TETRIS game. This training session lasted until the participant felt confident enough in controlling the feedback bar.

6.3 Multimodal play-testing

At the final stage, the participants are given instructions on how to play the TETRIS game using their mind and eyes. The eye-tracker is first connected and a calibration procedure is performed during which the participants are asked to fixate their gaze on 9 dots appearing on multiple locations on the screen.

Next, the game starts with the first tetrimino appearing at a locked position (tetrimino is not moving) on the top of the screen. A few seconds period is dedicated in order for the subject to rotate the tetrimino at the desired angle by brain activity during imaginary movement. The exact duration of the locked position is determined based on the imaginary task classification output. Classification runs simultaneously on the background. Specifically, the participant-specific classifier, as explained above, is used to classify the EEG signals online and the corresponding scores are communicated each second to the TETRIS game platform. If the score exceeds a certain threshold the tetrimino is rotated. The tetrimino is unlocked when a decrease of the classification score is observed for 3 consecutive classification iterations since the last time the tetrimino was rotated. Afterwards, the rotation angle of the tetrimino is locked and it starts to drop while also allowing the participants to move it across the horizontal axis using eye gaze (captured by the eye-tracker system). The tetriminos are being moved by constantly following the participant's gaze location on the screen one step at a time. If the participants are looking at the same location for 5 seconds continuously, then the tetrimino becomes completely locked and drops down fast until it reaches the "ground" in the TETRIS board. For visual inspection of the imaginary movements during the TETRIS game, a feedback bar is depicting the strength of the mental imagery task during the rotation stage of the game.

6.4 Bidirectional training through gamification

While SMRs offer an asynchronous interaction capability (i.e. perform an action without a stimuli that determines event onset), they require both training of the system, since each user may provide different signals on the performance of the imaginary movement, and user training, since the user needs to be trained so as to generate signals that can be robustly identified by the SMR classifier. This bidirectional training is facilitated by the proposed gamified interface. On one hand, users are more eager to train themselves for optimizing the SMR detection, by playing a game compared to the usual interfaces with simple arrows or smileys. On the other hand, reinforcement learning for the training of the system is enabled

due to the nature of the game (e.g. tile positions can be identified as correct or error based on the game rules, the best possible moves, etc.). In this way, both the system and the user continuously improve their performance for as long as the user plays, without the need for the typically tedious interfaces that are found in the literature.

6.5 Future Plans

Besides the aforementioned bidirectional training, system training and performance can be improved through the detection of errors during game play. These errors occur both due to SMR detection imperfections and also due to user's wrong decisions for the tiles' moves. Error Related Potentials (ErrPs) [25] offer a natural way to detect and distinguish between these two cases. The incorporation of the SMR-originating-ErrPs in the hands-free Tetris is in our future plans for enhancing the game. More specifically, for the system training, ErrPs can be used to annotate the SMR detection events as correct or error and thus be used in an incremental learning scenario. For the system performance, ErrPs can be also used to cancel the rotations that have been made through erroneous movement detections from the SMR classifier.

7 General discussion

Building on extensive analyses of the scientific literature (D5.1), and detailed proposals for implementation of persuasive, personalized strategies into persuasive and personalized design (D5.2), and evaluations of their actual effectiveness and user experiences the Phase I field trials (D5.4), and also based on extensive analyses of the MAMEM system's target behavior (social inclusion behavior, see D7.1 and D7.2), the current report described how the users of the MAMEM system (to be employed in Phase II field trials) will be trained and motivated to start using the MAMEM system, and use it for social inclusion activities. Therefore, the current report described the persuasive and personalized design of the interfaces of the MAMEM system to be used in the Phase II field trials. More specifically, first, this report describes how the persuasive design of the MAMEM training tasks was improved (Chapter 2). Next, the report describes how the MAMEM system and its users were focused on increasing social inclusion by measuring (and logging) the participants' digital social inclusion behavior (Section 3.1), and how this data was used to steer the persuasive and personalized strategies that stimulate social inclusion activities (Section 3.2). Also, this report described in detail the persuasive design in the MAMEM PD Dashboard/Home page (Chapter 4) and the persuasive design of the GTW browser (Chapter 5).

The implementation of these persuasive and personalization strategies, with a focus on the target behavior of digital social inclusion, needed involvement of the whole MAMEM consortium. In the current report, knowledge gathered in many of the earlier reports of the MAMEM project, and also the contributions of almost all MAMEM consortium partners (CERTH, UKOB, MDA, AUTH, SMC, and TU/e) was combined.

In the Phase II field trials, the effectiveness of the complete MAMEM system will be assessed, and the system and its various components will be evaluated. Next to evaluations of the general effectiveness of the MAMEM system (e.g., for stimulating social inclusion

activities, but also usability of the various elements of the system), this evaluation will also focus on evaluating the persuasive design of the system. Therefore, in the questionnaires to be administered after the MAMEM system has been used by a participant for four weeks will be a questionnaire assessing the persuasive design in detail. Although the individual contribution to the persuasiveness and personalization of the MAMEM persuasive design of the individual (persuasive and personalization) elements cannot be identified, these evaluations will assess whether the general goal of the MAMEM system (to stimulate social inclusion activities) was served by the whole, extensive package of strategies. Using persuasive and personalization strategies grounded in scientific literature and also tested in Phase I field trials and our own lab study (see D5.4) helped develop an assistive technology fully aimed at stimulating the aim of the MAMEM project: increasing social inclusion of the participants from the three target groups.

8 References

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Appendix A

The GTW browser stores data about the user's web browsing (anonymously) in an online databased (Firebase). Below we present the data structure of this Firebase Database. Timestamps not explicitly listed but (often) included.

Formats:

Timestamp: Miliseconds from Epoch

Duration: Relative seconds

Date: DAY-MONTH-YEAR HOUR24-MINUTE-SECOND

mamem-phase2-fall

- users

- <user> // users have only read / write access to their own directory

- general

- start

- count: #starts

- <number> // this is what "startIndex" refers to

- date: date

- recalibration

- count: #recalibrations

- <number>

- date: date

- startIndex: int // tells which application execution this belongs to

- success: bool

- urlInput

- count: #urlInput

- <number>

- date: date

- startIndex: int

- charCount: int

- bookmarkUsage

- count: #bookmarkUsage

- <number>

- date: date

- startIndex: int

- url: string

- bookmarkAdding

- count: #bookmarkAdding

- <number>

- date: date

- startIndex: int

- url: string

- bookmarkRemoval

- count: #bookmarkRemoval

- <number>

- date: date
- startIndex: int
- url: string
- historyUsage
 - count: #historyUsage
 - <number>
 - date: date
 - startIndex: int
 - url: string
- tabReloading
 - count: #tabReloading
 - <number>
 - date: date
 - startIndex: int
- tabClosing
 - count: #tabClosing
 - <number>
 - date: date
 - startIndex: int
- tabCreation
 - count: #tabCreation
 - <number>
 - date: date
 - startIndex: int
- tabSwitching
 - count: #tabSwitching
 - <number>
 - date: date
 - startIndex: int
- goBackUsage
 - count: #goBackUsage
 - <number>
 - date: date
 - startIndex: int
- goForwardUsage
 - count: #goForwardUsage
 - <number>
 - date: date
 - startIndex: int
- pause
 - count: #pause
 - <number>
 - date: date
 - startIndex: int
- unpause

- count: #unpause
- <number>
- date: date
- startIndex: int
- pageActivity
- <platform> (_unkown, facebook, youtube...) // for youtube etc. can be entered synonyms like youtube.com andyoutu.be. All of these will be a youtube session
- sessionCount: #sessions
- sessions
- <number>
- domain: string
- duration: float // number of seconds
- durationInForeground: float // while Tab is active
- durationUserActive: float // while Tab is active and user / gaze is detected
- durationEmulatedInput: float
- startDate: date
- endDate: date
- startIndex: int // tells which application execution this belongs to
- pageCount: #pages
- pages
- <number>
- url: string
- duration: float
- durationInForeground: float
- durationUserActive: float
- durationEmulatedInput: float
- keywords: string
- manualScrollAmount: float
- automaticScrollAmount: float
- clickCount: #clicks
- clicks
- <number>
- coord: vec2 // in page space
- id: string
- tag: string
- time: float // time of event after page loaded
- textInputCount: #textInputs
- textInputs
- <number>
- charCount: int // count of chars finally inputted to text field
- charDistance: int // levenshtein distance between original content of field and input by user
- coord: vec2 // in page space
- duration: float // duration of text input
- id: string

- tag: string
- time: float // time of text input completed (!) after page loaded