



COGKNOW

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Abbreviations

COGKNOW	Project title COGKNOW; Helping people with mild dementia navigate their day
CDN	COGKNOW Day Navigator
CS	COGKNOW Server
CHH	COGKNOW Home Hub
CCA	COGKNOW Cognitive Assistant
CSH	COGKNOW Sensorised Home
FT	Field Test

1. Summary

The objective of the COGKNOW research project was to develop a breakthrough, user-validated cognitive prosthetic device with associated services for people with mild dementia.

Dementia is a progressive, cognitive disabling disease affecting 10% of all persons above 65, and their numbers will increase significantly as the age structure undergoes a major shift in the coming decades. The disease has symptoms involving impairments of memory, speech, thought, perception and reasoning. Needs mentioned by people with dementia and their carers have often remained unmet by professional care and welfare services, or have been addressed by multiple assistive devices, which is complex and confusing to use.

The COGKNOW Day Navigator prototype consists of a touch screen in a home smartened with sensors and computer-mediated controls, and a mobile device to bring along when going out. Both devices offer multiple very easy-to-use functions in validated top priority needs areas: memory support, support to manage activities of daily life, support to maintain social contacts, and to enhance feelings of safety.

The COGKNOW Day Navigator has been carefully designed to provide multi-modal interfaces that are highly adaptable to the cognitive support needs and any perception disabilities of different persons, and as those needs and disabilities change over time. The ability to remotely adjust service settings enables family and professional carers to support persons with dementia from any location.

This ambitious project is among the first to directly involve persons with dementia and their carers, in analysis, development and field testing. The project has developed a multi-disciplinary method and ethical guidelines. 32 persons with dementia used the prototype for one or more days, while 10 persons with dementia used it independently for several weeks. This has confirmed the overall concept and design of the COGKNOW Day Navigator.

Comprehensive human factors impact analyses have shown that the COGKNOW Day Navigator is seen as useful and user-friendly by the users, and with a strong potential to improve quality of life. COGKNOW will help persons with dementia to experience and maintain more autonomy, enabling them to keep living independently in their own homes for a longer period, while giving relief to their relatives and carers.

The COGKNOW project was a selected showcase for the European Commission Smart Home at e-Inclusion Ministerial Conference (2008). It has received national media coverage in The Netherlands, UK, Malta, Sweden and USA. COGKNOW has produced a book [1] and 14 papers [2]-[15] for publication in scientific journals and professional magazines.

COGKNOW partners are embarking on making the COGKNOW Day Navigator available as a commercial offer to care providers for persons with dementia. Therefore pricing information is not yet ready, but a likely renting fee (with support) would be 2400-3600 EUR per year. This is to be compared with current direct institutional care costs for persons with dementia of on average 10 000 EUR per year, so investing in COGKNOW-like systems will pay for itself quickly. With 3.8 million mild dementia sufferers in Europe that might stay longer in their own home, there is huge human and economic potential in integrated assistive technologies like the COGKNOW Day Navigator.

COGKNOW is using off-the-shelf hardware technologies and therefore the fast pace of improvements in performance/price ratios in the IT industry will further increase the attractiveness of COGKNOW-like systems.

It is foreseen needs for further product development and strategic marketing activities. The COGKNOW partners are actively looking for care solutions providers interested in bringing the COGKNOW Day Navigator to market in different countries, and further innovative software development partners.

2. Introduction

Dementia is a progressive, cognitive disabling disease affecting 10% of all persons above 65. The risk of dementia increases with increasing age, and therefore the numbers affected will increase significantly as the age structure undergoes a major shift in the coming decades. For the person with dementia the disease has symptoms involving impairments of memory, speech, thought, perception, action and reasoning, but the disease also impacts negatively by causing major disruption and stress in the lives of the families and carers where the person with dementia lives. Dementia involves having more than one symptom such as memory loss coupled with orientation, language and action difficulties. While dementia is a progressive and irreversible chronic disease it can be treated with medication to slow its effect.

The total worldwide cost associated with dementia care is enormous and is estimated to be \$315 billion with this figure set to rise as the number of people with dementia increases.

The objective of COGKNOW was to develop a breakthrough, user-validated cognitive prosthetic device with associated services for people with dementia. The COGKNOW Day Navigator prototype consists of a touch screen in a home environment imbued with sensors and computer-mediated controls, and a mobile device for the person with dementia to bring along when going outside of their house. Both devices offer easy-to-use functions in validated top priority needs areas in the project: memory support, support to manage activities of daily life, support to maintain social contacts, and to enhance feelings of safety (Van der Roest et al., 2007, 2009). The COGKNOW Day Navigator has been carefully designed to provide multimodal interfaces that are adaptable to the cognitive support needs and perception disabilities of individual persons, and to changes of these over time.

This ambitious project is among the first to involve persons with dementia and their carers directly, in the various stages of analysis, development and field testing. The project has developed a multi-disciplinary overall method, combining mixed-method (triangulating) human factors evaluation methods, with iterative methods for technical development and a comprehensive method for business development.

The project has completed three cycles of development, field testing and evaluation. 32 persons with dementia used the prototype for one or more days, while 10 persons with dementia used it independently for several weeks.

This report introduces in **Chapter 3 the COGKNOW project**, its target group and methodology, and special project challenges that have been overcome. In **Chapter 4, the COGKNOW Day Navigator prototype** is described in terms of architecture, functionality, portability and remote configuration. In **Chapter 5, the user validation aspect** of the project is explained, how field testing followed by human factors impact analysis has underpinned comprehensive evaluations from user, technical and business perspectives. **Chapter 6 covers the outreach results** from the project, including publications, external collaborations, awards and what COGKNOW partners are now doing to make COGKNOW a viable future business. You will have to forgive us for withholding some details of the business planning! **Chapter 7** is dedicated to the **multi-disciplinary research and development method** developed by the COGKNOW project. Finally, **Chapter 8** gives the very **final conclusions** about the project, its execution and results.

Throughout this report, there are references to more detailed public results from the COGKNOW project, including public deliverables, scientific publications, videos and the COGKNOW web site, www.cogknow.eu.

3. The COGKNOW Project

The COGKNOW project was a specifically targeted research European project, from September 2006 to August 2009, with a total budget of 2660 kEUR. The project consortium and project timeline are described in Annex B and Annex C.

3.1. Target Group

Among the elderly population in Europe about 3.7 million people (5%) have been diagnosed to suffer from *mild* dementia (EuroCoDe, 2009). The risk of dementia increases with increasing age, with a prevalence of 25% in people over 85 years and even 50% in women above 95. Life expectancy depends on country and age at diagnosis and is on average about 5 years after diagnosis (www.Alzinfo.org, 2004).

A conservative estimate of the European market potential is 74 000 persons per year, and a realistic economic value of introducing COGKNOW amounts to yearly savings of about 250 million Euro per year, in Europe alone. Obviously there are also huge human values in enabling persons with mild dementia to live in their own homes, longer and better. Earlier diagnosis of dementia has the potential to bring further value to society by reducing the burden also of carers of currently undiagnosed persons with dementia.

Persons with dementia will use COGKNOW as part of their everyday life. The locations of use may vary, for example whether the user is living at his or her own home or is living at an elderly (sheltered) home. Usage may be at one's home, while being on the move (mobile) or when being elsewhere. Whether the user (e.g. person with dementia) lives alone or lives together with an informal carer has a special significance.

The degree of mild dementia is a very important context parameter as it heavily influences the user value of the different COGKNOW services. Also, the service composition may have to change over time.

Potential benefits for Persons with Dementia are continued independence, self-reliance and autonomy, increased self-worth, enhanced quality of life and improved confidence. Other potential benefits include better social inclusion and cohesion, related to the social interaction service category, and enhanced safety related to the safety service category. Finally, increased activity ability is related to the reminding support and daily activity support service categories.

Potential Carer benefits are respite (relief of duty) and peace-of-mind when leaving the home.

Potential Care Provider benefits revolve around increased care quality/capacity, i.e. more flexibility in care offerings, supporting more persons with dementia, more integrated services, and more automated services, and cost reduction, because of less needs for shelter, and also economies of scale and extended scope through more integrated systems.

The COGKNOW target group and critical market factors are further described in D5.7.1 Final Evaluation Report.

3.2. Project Methodology

The COGKNOW project was run according to a comprehensive iterative project implementation plan, with three main cycles of needs analysis, development, field testing and evaluation.

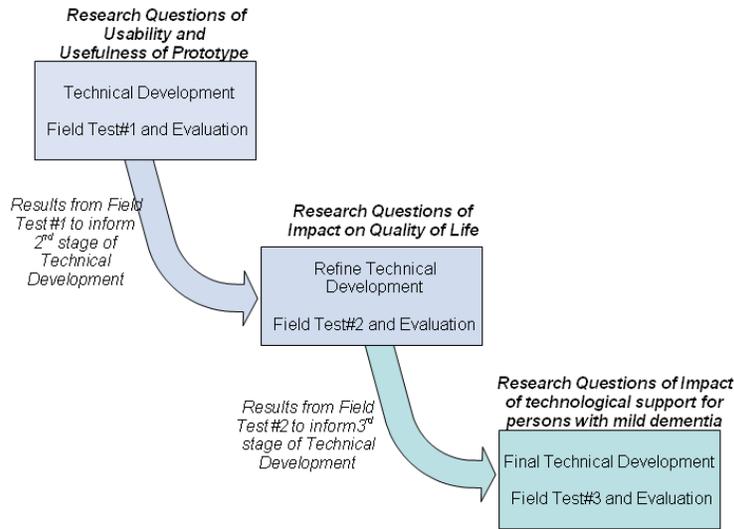


Figure 1: Three main cycles of the COGKNOW project

Below a simplified view of the project work plan is given, annotated with the main significant working models, artefacts and methodologies used.

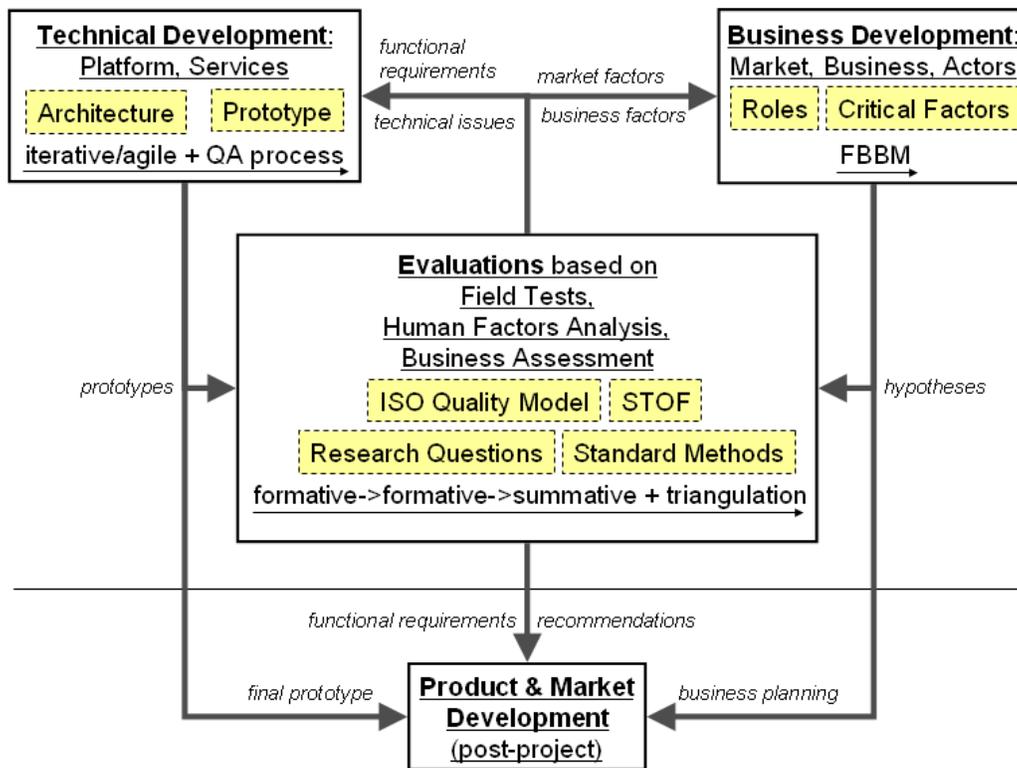


Figure 2: Work plan with main work items and methodologies

The technical development process was split into three phases which allowed for an incremental system development process. The first phase focused on making a prototype suitable for a one day supervised evaluation. The level of technical effort that was used to produce a system for a one day evaluation was significant. The second phase of development ensured that the system being developed could be easily extended for the last

stage, including the development of several new functional requirements. The system was released for site testing at the end of this phase. The third phase of development aimed to improve and add some functionality but also to provide a more stable system for the third field test with an intended duration in the persons with dementia's homes for up to two months.

Evaluations were performed based on field tests each year at three test sites (Amsterdam, Belfast and Luleå), based on an evaluation strategy defined early in the project.

Table 1 Evaluation aims for each iteration

Field Test	Human Factors evaluation focus			COGKNOW DayNavigator functionality focus			
	User friendliness	Efficacy	Usefulness	Remembering	Social contact	Activities Daily Life	Feeling safe
#1 1 day	✓		✓	●	●	●	●
#2 1-5 weeks	✓		✓	● ● ●	●	● ●	● ●
#3 1-2 month	✓	✓	✓	● ● ●	● ●	● ●	● ●

The project process and evaluation aims are further described in D5.7.1 Final Evaluation, that also makes public the quality model and software release process used in the project.

3.3. Project Challenges and Advice

The COGKNOW project was *extremely ambitious*, with wide aims for innovative prototype development, user validation and preparing for commercialisation. This challenge was addressed by including in the project leading dementia experts, technical researchers and developers. Also, some of the project partners were exceptionally productive and committed to the project.

The project schedule called for *three major development and validation cycles* in three years. This challenge was addressed by close follow-up versus the project plan, and adapting the plan as the project got a better understanding on how to best reach its objectives. Notably, in the last year critical activities suffered a delay of about six weeks, resulting in a slightly shorter third field test and a slight overall project delay.

COGKNOW had *11 partners in 8 countries*, and coordinating research and development among several distributed partners is always a challenge. This challenge was addressed by separate coordination of technical, scientific and dissemination/use work, and a close collaboration among the three coordinators. A strong emphasis was made on frequent interaction between the dementia experts and the technologists, helping to direct technical development to the top priority areas for user-friendliness, usefulness and efficacy.

Finally, a *lack of research literature* on how to design ICT systems for persons with dementia meant that the project had to perform a lot of primary research on suitable user interfaces [1][7][10][11][12][13][14].

While successfully pulling through this project, the consortium has produced a book summarising main experiences and advice for future projects' benefit [1].

4. The COGKNOW Prototype



Figure 3: Hardware - touch screen with handset and mobile device

4.1. Architecture

The final COGKNOW Day Navigator (CDN) prototype consists of the COGKNOW Home Hub (CHH), the COGKNOW Cognitive Assistant (CCA), the COGKNOW Sensorised Home (CSH), and the COGKNOW Server (CS).

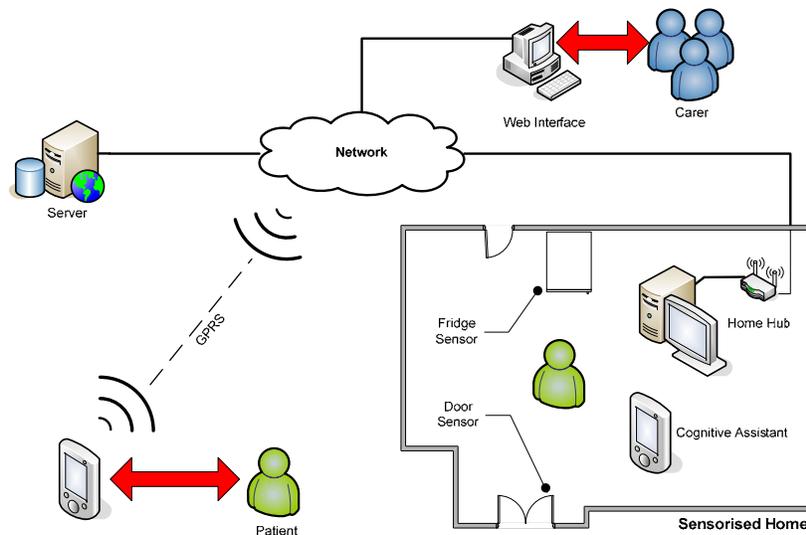


Figure 4: Overall System Architecture of COGKNOW Day Navigator

The functionalities of the final prototype address cognitive reinforcement in four main areas according to the needs identified by persons with mild dementia (Van der Roest et al., 2007, 2009).

4.2. Functionality

In the following table, we present an overview of the functionalities in the final prototype and their testing status.

Table 2. Functionalities in the COGKNOW prototype, with validation status

	Functionality	Validation status¹
General		
	Languages: English, Dutch, Swedish	FT3
	Selectable services	FT3
	Selectable icons, text captions, font sizes, CHH voice prompts.	FT3
Support in Reminding		
	Date & weekday & time indication: analogue or digital, 24-hour or am/pm, possibility to suppress the seconds indicator	FT3
	Pop-up reminders: remotely configurable, one-time or daily, user-defined text/image/audio/repetition	FT3
	Agenda & Quarter Hour Clock	FT3
	Appointment Reminders	FT2
	Find Mobile Device	FT3
	Item Locator	site tested
	Forgotten Keys Warning	unit tested
Support social contact		
	Picture Dialling: priority, photos, landline prefix, using existing phone or voice modem with handset	FT3
	Internet-based telephony (SIP)	integration tested
Support daily activities		
	Radio/lamp control using Tynetec actuators	FT3
	Radio/lamp control using X.10 actuators (unreliable)	FT2 (unreliable)
	Music/story player: Selectable music	FT3
	Activity assistant: stepwise video or image+voice instructions for daily activities	FT3
	Automatic music during lunch (MotivateToEat)	FT2
Enhance feelings of safety		
	Help/emergency: personalised contact/help icon	FT3
	Pop-up safety warnings: doors, household appliances	FT3
	Sensorised night light (NightLight)	FT2
	Navigation when outdoors (TakeMeHome)	FT3
	We-centric navigation when outdoors (TalkMeHome)	mockup

¹ Last development or evaluation stage when it could be tested. FT1-3 refer to the field tests.

4.3. Portability

The mobile device can provide most of the relevant functionality available on the touch screen - adaptable to only provide the functions needed by each user in different situations - is easy to install, and hides most operating system messages. In addition it provides support for navigating home autonomously or supported by the carer.

Some main improvement areas are battery lifetime and reliable wireless communication.

4.4. Remote Configuration

The COGKNOW Day Navigator has a secure interface intended for remote configuration of service selections, personal service settings and look-and-feel settings. This will enable the carers to easily set reminders, update the phonebook, add personalised activity support or changing personal selections of music.

Main improvement areas are adding more support for selecting and configuring individual services, and easier setting of look-and-feel preferences.

4.5. Further Reading

The COGKNOW prototype is further described and evaluated in D5.7.1 Final Evaluation Report, and at a more detailed level in several prototype deliverables (D2.6.2 Development of Home Based Visualisation Service, D3.5.2 and D2.4.2 Multi-modal Interfaces, D2.5.1 Situation-aware services).

A number of technical research papers have been published on the system architecture and methods for developing the COGKNOW prototypes [6][10][11][12][14].

Several videos demonstrating the COGKNOW Day Navigator are available on YouTube and www.cogknow.eu.

5. User Validation

In the COGKNOW project, potential end-users were involved in the development process and in the evaluations, to ensure that user prioritised needs were well understood, taken into account and included in the design of services. Because of this user involvement, and because the four functional areas in COGKNOW were based on a review of the literature (Van der Roest et al., 2007) and a large survey among persons with dementia (Van der Roest et al., 2009), we consider our approach strongly user-driven and user-participatory.

COGKNOW directly involved people with dementia and informal carers as end-users, which provided special challenges in data-collection due to the cognitive impairments of the persons with dementia and the fact that the carers are also burdened by their care tasks [1].

5.1. Field Tests

The field testing activities were conducted by trained researchers working under supervision of test-site clinical managers to ensure that proper practice was followed. A use manual was given to the participants during the field test, and a helpdesk was organised consisting of first line contacts (human factors researchers and local technical staff) and second line contacts (technical specialists on the different CDN functions from COGKNOW technical partners).

The procedures used for recruitment and participation of persons with dementia and their carers in the field tests were based on the ethical guidelines developed for the project. The vulnerability of the persons with dementia was addressed by a rigorous process of informed consent involving the persons with dementia and their carers. The process followed the national ethical approvals for the project at all test sites.

The users that participated in the field tests were community dwelling people with mild dementia of the Alzheimer type (Mini-mental State Examination - MMSE ≥ 17) and their carers. Most of them were living together with a partner carer, but some were living alone and were cared for by a son, daughter or friend. Each field test was carried out at three test sites, Sweden, the Netherlands, and Northern Ireland, with a total of 12-16 user-dyads (persons with dementia and their carers).

Table 3. User characteristics of participants in the three field tests

People with dementia	FT#1	FT#2	FT#3
Age	average 69 range 56 - 78	average 74 range 57-90	average 75 range 57-84
Gender	11 female 5 male	10 female 4 male	7 female 5 male
Civil status	12 married 1 widowed 3 single	8 married 4 widowed 2 single	11 married 1 widowed
Carers			
Age	average 61 range 23-78	average 67 range 40-79	average 71 range 53-78
Gender	7 female 9 male	4 female 9 male	5 female 7 male
Relation to patient	11 spouses 4 children 1 cousin	9 spouses 3 children 1 friend	11 spouses 1 son of sister

All had memory problems and difficulties with orientation in time and place, many had word finding problems, some had problems with handling objects, others with understanding textual messages or pictures. All were recruited from memory clinics and day care centres or meeting centers at three project sites: Amsterdam in The Netherlands, Belfast in Northern Ireland and Luleå in Sweden.

They all voluntarily agreed to participate in the project and were free to withdraw from the field tests whenever they wished. For each field test new participants were recruited, but if couples wished to participate in a following field test they were allowed to when they still fulfilled the inclusion criteria. The majority participated in one field test, seven couples participated in two field tests, and three couples participated in three field tests.

In the first field test the semi-structured interviews and observations were carried out during a one-afternoon test, in the second and third field test they were carried out twice, one session at the beginning of the field test, shortly after installation and explanation of the device, and another at the end of the field test three to eight weeks later.

D4.6.1 Consolidated Field Test Report gives more details on each of the field tests, the COGKNOW prototype versions tested, user characteristics and procedures for testing. It also contains the COGKNOW Ethical Guidelines for researchers, developers and site technicians. D4.3.1 Field Test #1 Report and D5.4.1 Evaluation of Trial #1 give additional details about the first field test and evaluation.

5.2. Human Factors Impact Analysis

The Human Factors Impact Analysis work package analysed user-friendliness, usefulness and efficacy (and indicators for these), focusing on the COGKNOW devices and services to support persons with dementia and their carers. The three field tests in the project tested increasingly complex levels of functionality. The two first field tests had a focus on user-friendliness and usefulness, while the third field test also focused on the impact of the device on the persons with dementia's autonomy and quality of life.

The data were collected from the users who participated in workshops, field tests and evaluations. The data collection procedures consisted of:

- *Pre-test workshops* aiming to ask each Person with dementia and carer about their needs and problems in their daily life (in the four functional areas) and, in the first year workshop, about their preferences for ICT support. In the second and third year workshops, the perceived usefulness and user-friendliness of prototypes of the CDN were assessed and any additional needs and wishes were inventoried. Furthermore, in the second and third year workshops the possibilities to personalise the COGKNOW stationary device were discussed (background colours, icons, and the different functionalities of the CDN).
- *Pre-test interviews and observations*: Approximately one month before each field test, all potential participants were interviewed and asked for their willingness to participate. Information on changes in background and context variables (compared to the initial interview) of the Person with dementia, as well as information necessary to personalise the functions and features of the CDN were gathered. Preferred pieces of music, photos and telephone numbers of relatives were collected. In addition, the placement of the stationary device in the home was discussed. When necessary the cognitive status of the Person with dementia was re-assessed with the Mini-Mental State Examination (MMSE) in order to determine if the Person with dementia still fulfilled the inclusion criteria for participation in the project.
- *Field test interviews and observations*: Semi-structured interviews and observations were conducted using prepared forms adapted to the research questions and available CDN functions in each field test (see D4.6.1 Consolidated Field Test Report). The Person with

dementia form had open questions for each function and also observation items. The carer form had only open and structured questions. In the final field test, a number of (user) benefits and provisioning questions were added, to aid in the evaluation for the business perspective. Also questions were added in the semi-structured interviews relating to the impact of the CDN on actual and perceived autonomy of the persons with dementia and on quality of life of persons with dementia and carers. An extensive evaluation of these impact variables was carried out using several standard questionnaires in individual interviews.. At each evaluation session, prescribed tasks covering key aspects of interacting with the CDN were performed by the person with dementia. Interviews to evaluate the impact of the system were also held twice, at the beginning and at the end of FT #3.

- *Diaries and in-between interviews:* During the first field test a bottle-necks list was filled in, while during the second and third field test persons with dementia and carers kept a diary to record any problems and positive experiences with using the CDN. In the longer third field test, also in-between interviews were conducted, during bi-weekly home visits and telephone calls. Positive and negative experiences regarding the use of the system and on possible problems (bottlenecks) were gathered, and also occurrences of important life events and/or changes in medication were checked.
- *Expert evaluation sessions:* Before and after the third field test, the user-friendliness and usefulness of the system was tested and evaluated by dementia experts to further assist the technical development of the CDN, supported by a demonstration of the different functionalities.
- *Logged in-situ measurement:* Logged in-situ data were collected throughout the field tests with a specifically adapted program called the SeniorXensor. On the stationary device, data were collected with modules for logging basic operation of the device, usage of reminders, use of picture dialling, use of the help function, and use of activity support. On the mobile device, data were collected with modules for logging the performance of the battery, the location of the mobile device, events related to general usage, and usage of the navigation support. In addition several other modules were in use, collecting data about the proper operation of SeniorXensor itself.

D1.7.1 Final Human Factors Impact Analysis gives a comprehensive overview of the user-friendliness, usefulness and perceived efficacy of the COGKNOW Day Navigator in the daily life of persons with mild dementia, including also the results of human factors impact analysis after field test #1 and field test #2 (D1.5.1, D1.6.1).

5.3. Evaluation

D5.7.1 Final Evaluation Report gives a comprehensive overview of the project results from Human Factors, Technology, Business and Methodology perspectives.

The recommendations for future research are:

- The assessment of impact of using the CDN, and assistive technology in general, on daily life should be done for a longer period of time. A randomised controlled trial design in a large sample is the preferred research design. The device should be tested in a varied study sample to gain knowledge about the impact of using an assistive device in different (stages of) diseases, and in people with different background characteristics, such as living alone or together.
- Develop any new devices for person with dementia together with persons with dementia and carers in a multi-disciplinary team consisting of experts in the field of dementia care, technology experts and system developers.

- Persons with dementia and carers should be informed about the possibilities within a research project and about limitations regarding time, finances and technical feasibilities to avoid too high expectations.
- Mechanisms for accurate context reasoning and context prediction should be studied and their suitability for Activity Assistance and Context Predicting Services should be evaluated. Item Locator mechanisms should be further explored, based on RFID or other technologies, and the relevance of item locations for context reasoning and prediction should be evaluated.
- User profiling and stereotyping algorithms should be studied and their relevance for intelligent personalisation of services and multi-modal interfaces should be evaluated.
- Semi-automatic recording of user content (life-logging) should be explored and its relevance for creating highly personalised integrated services for person with dementia and other user groups should be evaluated.
- Reliable and secure home area networking systems encompassing user devices and sensors should be studied, aiming for long range, security and auto-configuration. Ideally such a new home communication infrastructure should support positioning at room resolution, and fast proximity detection.

5.4. Further Reading

D5.7.1 Final Evaluation Report gives a comprehensive summative overview of the user validation done on the COGKNOW Day Navigator prototype. D1.7.1 Final Human Factors Impact Analysis gives many detailed insights on human factors in relation to the use of COGKNOW.

COGKNOW partners have published scientific papers focusing on the user validation aspects of the project [3][8][9][13].

The COGKNOW Book [1] gives useful insights into how to perform user validation activities in projects involving persons with mil dementia.

6. Dissemination and Use

6.1. Publications

The COGKNOW project has been very successful in publishing its results, attracting national media coverage in The Netherlands, UK, Malta, Sweden and USA. 14 articles have been published in journals and scientific magazines ([2]-[15]) and a COGKNOW book is to be published in spring 2010[1]. Several COGKNOW videos are available on YouTube and at www.cogknow.eu.

The project has followed a systematic plan for disseminating its results, as described in D6.1.1 Dissemination Master Plan.

After the project, more publications and presentations at prestigious conferences are planned. www.cogknow.eu will continue to be updated with important events in the after-life of the COGKNOW project. See Annex A for a full list of COGKNOW publications.

6.2. External Collaborations

COGKNOW organises an eInclusion project cluster for joint dissemination[15]: COGKNOW, MonAMi, EasyLine+, i2home, Share-IT and Caalyx. See also D6.3.1 Collaboration Report.

6.3. Nominations and Awards

Already, the COGKNOW project has been awarded, receiving the ACCESS-IT Best Practice label, and further nominations are expected.

The COGKNOW project was a selected showcase for the European Commission Smart Home at e-Inclusion Ministerial Conference (2008).

6.4. Towards Sustainable COGKNOW Business

COGKNOW partners are embarking on making the COGKNOW Day Navigator available as a commercial offer to care providers for persons with dementia. Therefore pricing information is not yet ready, but a likely renting fee (with support) would be 2400-3600 EUR per year. This is to be compared with current direct institutional care costs for persons with dementia of on average 10 000 EUR per year, so investing in COGKNOW-like systems will pay for itself quickly. With 3.8 million mild dementia sufferers in Europe that might continue living longer in their own home with less manual support needed, there is huge human and economic potential in integrated assistive technologies like the COGKNOW Day Navigator.

COGKNOW is using commercial off-the-shelf hardware technologies and therefore the fast pace of improvements in performance/price ratios in the IT industry will further increase the attractiveness of COGKNOW-like systems.

It is foreseen needs for further product development and strategic marketing activities, and some will be performed in already approved follow-on projects MemoryLane (www.memorylane.nu) and AAL Rosetta. The COGKNOW partners are actively looking for care solutions providers interested in bringing the COGKNOW Day Navigator to market in different countries, and further innovative software development partners.

The detailed business planning material (D7.2.1) is project-internal.

7. Methodologies

The project has developed a multi-disciplinary overall method, combining mixed-method (triangulating) human factors evaluation methods, with iterative methods for technical development and a comprehensive method for business development [1], described in D5.7.1 Final Evaluation Report and D1.7.1 Human Factors Impact Analysis..

7.1. Human Factors Impact Analysis

The Human Factors Impact Analysis of the COGKNOW Day Navigator was designed to answer the general research questions on user-friendliness and usefulness of the COGKNOW Day Navigator, and on the impact of the system on the daily functioning of the person with dementia.

The *user participants* were recruited at all test sites, Amsterdam, Belfast and Luleå, with the inclusion criteria: a confirmed diagnosis of Alzheimer's disease (DSM IV-TR), having mild cognitive impairment (Global Deterioration Scale stage 3 or 4, and/or MMSE 17-25), and willingness to participate. An effort was made to include persons with dementia with diverse backgrounds, e.g. gender, age and living conditions. In the first field test 16 couples (persons with dementia and carers) participated, in the second 14 couples and in the third field test 12 couples. However, the variation in the type of carer was rather small: the majority of the persons with dementia was living together with a partner who cared for them.

All *data were collected* according to predefined guidelines that were agreed upon by all test sites, although some variations in execution occurred due to local differences. Despite these variations, comparable research data were collected at the research sites. In-situ data were also collected at the three sites.

Different ways of collecting data allowed us to analyse the results from different perspectives: the persons with dementia, the carers, dementia experts and researchers. Sometimes opinions between persons with dementia and carers differed, which may have been caused by cognitive problems or by real differences in opinions. The opinions of persons with dementia regarding, for instance, their ability to use the CDN were verified by observations made by the researchers during the semi-structured interviews at the start and at the end of the field test and during intermediate visits.

The experiences from the evaluation process confirm that the used mixed methods provided a good understanding of user-friendliness and usefulness of the tested devices from the perspective of the persons with dementia, and a more accurate and complete account than any single method could on its own.

Due to technical problems the evaluation was limited in duration and number of functions tested. This may have influenced the results on user-friendliness and usefulness, and limited the possibility of performing a full impact analysis. The *in-situ* logging data could not be analysed, and therefore could not provide additional information on the reliability of answers given by the participants. Although this leaves the validity of the evaluation results in some doubt, this final evaluation is deemed to provide sufficient information for guiding the future development of the next generation of prototypes.

7.2. Technical Development and Evaluation

The first phase of development focused on testing the system for a period of one day. Less development resources could have been expended in this phase, for example simple executable mock-ups.

The second phase of development ensured that the COGKNOW prototype could be easily extended. Several new functional requirements were implemented, and the system was released for site testing at the end of this phase. An alternative approach would be to release

a new version of the system to the sites as each functional requirement is completed, allowing testing and development to run in parallel and allow for more extensive feedback about individual functional requirements.

The third phase of development aimed to improve and add some functionality but also to provide a more stable system for the third field test with an intended duration in the person with dementia's homes for up to two months. In the end the third prototype could be field tested between three and eight weeks, and with some remaining stability problems.

It is worthwhile to reflect upon how the system development related to best-practice software engineering methods. On the whole the system development process would have benefited from more automated and systematic unit testing at each developing partner, more integration testing, more time for site testing, and separate usability testing with experts.

For the technical evaluation, data were collected by means of observation and experiences of the technical experts and by system error and performance logs that were recorded by the software itself.

- *Observations and experiences*: first in a laboratory based environment, in a second stage while observing the person with dementia interacting with the system or by the technical expert interacting with the system directly, and in a third stage by the technical team observing the system from a remote location.
- *System and performance logging*: The COGKNOW prototype logs various parameters concerning its use, system crashes, software heart beats. These logs were analysed whenever needed throughout the field test. A graphical interface provided information about the performance of the home hub in relation to retrieving schedule information from the server.

7.3. Business Development and Assessment

The project used an established conceptual framework for the description, design and assessment of the COGKNOW business models (see D5.7.1 Final Evaluation Report). The business model is viewed as a blueprint of how a network of cooperating organisations intends to create and capture value from new, innovative services or products.

The critical factors for COGKNOW opportunities and business models are grouped in three categories: *market* factors that relate to the demand or customer side of COGKNOW opportunities, *business* factors that consider supply or provider side issues, and *viability* factors focusing on selected collaborating actors.

Market factors

- Target group: what is the target group(s) for the COGKNOW Day Navigator (CDN)?
- Context of use: In what context is CDN used (e.g. at home/away, living alone or not)?
- Value proposition: what is the value for users (person with dementia, informal carer) and customers?

Business factors

- Business roles: what business roles are required to deliver the CDN and its services?
- Business actors: what actors can fulfil the business roles?
- Business scenarios: what are viable business configurations and propositions?

Viability factors

- Customer reach: how can selected actors reach the target group?
- Profit potential: what are possible revenues sources, and how should (elements of) the CDN be positioned?

- Value network: what are sustainable partnerships between commercial actors?

The business assessment was organised in a series of workshops, involving project partners as well as representatives from a large number of potential stakeholders (health insurance companies, (dementia) patient organisations, care organisations, government, technology providers and IT services companies) from several EU member states. The assessment workshops were organised according to the schedule below.

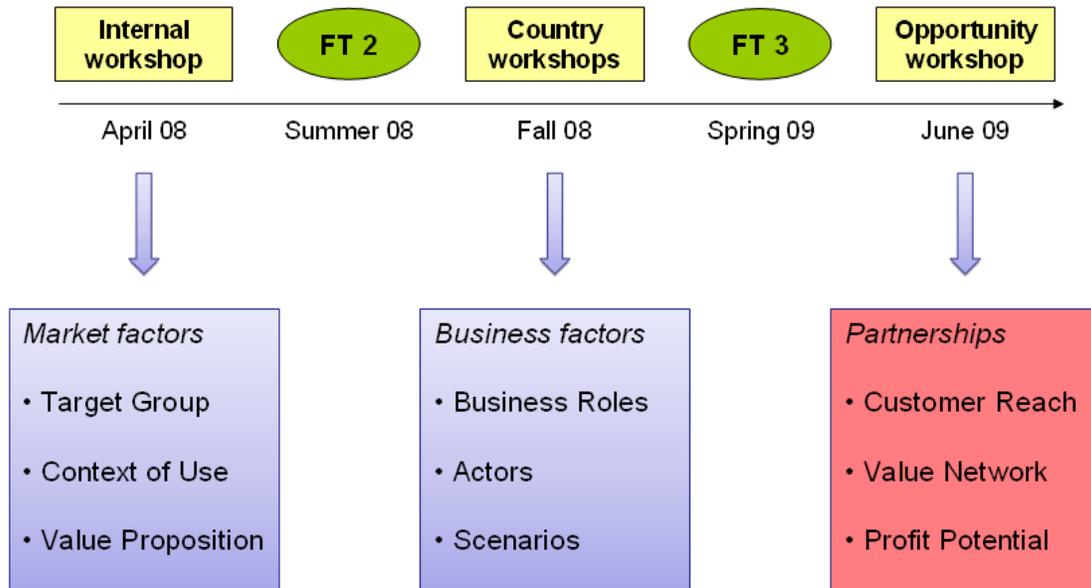


Figure 5: Business assessment workshops, timing and focus

The project internal workshop addressed the value proposition(s) of the potential COGKNOW services in relation to different target groups, and an initial generic business role model showing the required business roles for providing COGKNOW services.

Follow-up country business assessment workshops were held in Northern Ireland, The Netherlands and Sweden. The country workshops took the local health care context into account. The workshops identified different business configurations for each country, i.e. mapping of actors that fulfil certain business roles.

The final European business opportunity workshop, held in Malta, focused on how COGKNOW can move forward towards commercialisation of the COGKNOW results. It focused on how to deal with the viability factors.

The final field test (FT#3) participants were interviewed about their perceptions regarding some of the critical factors.

7.4. Lessons learned

- The mixed-method design provided a good understanding of the user-friendliness and usefulness of the tested devices for the person with dementia and provided an efficient way of collecting diverse data, limiting the burden on user participants where possible.
- The mixed-method design was suitable to measure the impact of the system on the quality of life of the person with dementia, but was hampered by a shortened duration of the field test period due to instability of the system.
- Logged *in-situ* measurements may be valuable for providing additional information in field tests with a longer duration, but a stable system is required to obtain reliable results.
- The user-centric approach of the evaluation process was confirmed suitable for formative evaluation.
- Defining research questions in advance of the field test gives a systematic structure to the evaluation process, and makes it possible to add any needed logging instrumentation to the prototype or preparing other data collection methods. Separate research questions should be defined for human factors, technical and business perspectives.
- Distributed technical development of complex systems is challenging. Software Engineering best-practice should be studied and adapted to the project at an early stage , and the quality process should be carefully communicated to all technical partners and individuals.
- Using the STOF model for defining business research questions has worked quite well for structuring business assessment workshops and evaluation from the business perspective.
- Targeting specific quality characteristics helps to focus on the most significant research questions. The Quality Model for External and Internal Quality [ISO 9126-1] (see Annex B) has been helpful in analysing the research questions and preliminary results.

8. Final Project Conclusions

The COGKNOW project had a very challenging work plan in terms of deliverables and three full cycles of development and validation during just three years. Through lots of hard work, the project has been concluded with a small delay, having developed and user-validated a portable and remotely configurable cognitive assistive device for persons with mild dementia - the COGKNOW Day Navigator (CDN).

The CDN prototype has been confirmed to have the right functionality and overall user interface design to be potentially user-friendly and useful for persons with mild dementia.

The business assessment workshops have confirmed that persons with dementia form a potentially attractive market for offering care-oriented services enabling them to live in their own homes longer and with a potentially higher quality of life. Integrated services in fewer devices appears a compelling service offer, since it gives both ease-of-use and a lower cost than using separate assistive devices for the diverse needs of persons with dementia. It has also become clear that the COGKNOW consortium will need complementary business partners for commercialisation, in particular mobile software providers and care solutions providers in diverse geographical areas.

The project has developed a successful multi-disciplinary overall method, combining mixed-method human factors evaluation methods with iterative methods for technical development, and a comprehensive method for business development. From the human factors perspective, the focus was on user-friendliness, usefulness and efficacy. The technology perspective focused on advancing the state-of-the art primarily within mobile based delivery of reminding services, ubiquitous computing for persons with mild dementia, and use of multimodal services. From the business perspective, the focus was to identify viable business opportunities, and to identify and improve critical market, business and sustainability factors.

The evaluation from multiple perspectives helped researchers from different disciplines gain more understanding of the implications of different design choices and contributed to identification of further research and development. Longer, controlled studies with larger user groups are needed to determine how much the use of the COGKNOW Day Navigator will prolong the ability of persons with dementia to remain in their own homes and positively impact their quality of life. There is a need for further technical research within context reasoning, context prediction, life-logging, item locating mechanisms,, better home area networking systems, user profiling and stereotyping, and personalised multi-modal services.

The project consortium believe that the COGKNOW project is quite unique in that it directly involved persons with dementia and their carers in all aspects of the project, during analysis, development, field testing and evaluations. Ethical guidelines have guided researchers, system developers and site technicians..

The project partners produced a large variety of scientific publications ([2]-[15]) and public reports, as well as several video films, and the project results were (and will be) presented on many symposia and congresses. In 2010 the COGKNOW partners will publish a book[1], titled 'Supporting People with Dementia Using Pervasive Health Technologies', in which many of the lessons learned in COGKNOW will be included. More information on COGKNOW is available on the project website www.cogknow.eu.

The COGKNOW partners have gained invaluable experiences and extensive insight on critical success factors from human factors, technical and business perspectives. We hope to leverage this body-of-knowledge to make our vision come true - integrated cognitive support devices that significantly increase autonomy and quality of life for persons with mild dementia, while enabling enormous savings in dementia care and commercial success. Prototyping and field testing continues in the follow-on projects AAL Rosetta and CDH project MemoryLane (www.memorylane.nu).

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Annex A. Public Results

All COGKNOW publications and other public material is available at <http://www.cogknow.eu>.

A.1. Dissemination To Date

This section is a verbatim copy from D5.7.1 Final Evaluation Report, sections C.1-C.7.

A.1.1. Scientific Journals and Magazines

2006

- Dröes, R.M., Mulvenna, M.D., Nugent, C., Craig, D., Scully, T., Martin, S., Moelaert-El-Hadidy, F. (2006) Research Vision: Helping People with Mild Dementia Navigate Through Their Day. *Journal of Dementia Care*, Volume 14, Issue 2 (March/April), pp.17, ISSN 1351-8372.

2007

- Dröes, R.M., Insight in coping with dementia: Listening to the voice of those who suffer from it, *Aging & Mental Health*, Volume 11, Issue 2, March 2007, pages 115 – 118
- Dröes, R.M., Mulvenna, M.D., Nugent, C.D., Finlay, D., Donnelly, M., Mikalsen, M., Walderhaug, S., van Kasteren, T., Kröse, B., Puglia, S., Scanu, F., Oreste Migliori, M., Uçar, E., Atlig, C., Kiliçaslan, Y., Uçar, Ö., Hou, J., (2007) "Healthcare Systems and Other Applications," *IEEE Pervasive Computing*, vol. 6, no. 1, pp. 59-63, ISSN: 1536-1268
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A.1.2. Book Chapters

2007

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A.1.3. COGKNOW Book, January 2010

Mulvenna, M.D., Nugent, C.D. (Eds.), Supporting People with Dementia Using Pervasive Health Technologies, Series: Advanced Information and Knowledge Processing, 2010, Approx. 250 p., ISBN: 978-1-84882-550-5.

Includes the following chapters:

- MD Mulvenna, C Nugent, F Moelaert, D Craig, R.M. Dröes, J Bengtsson Supporting People with Dementia Using Pervasive Healthcare Technologies, In: Mulvenna, M.D., Nugent, C.D. (Eds.), Supporting People with Dementia Using Pervasive Health Technologies, Series: Advanced Information and Knowledge Processing, 2010, Approx. 250 p., ISBN: 978-1-84882-550-5.

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- M Baumgarten, MD Mulvenna, The Role of Context-aware Computing in Support of People with Dementia, In: Mulvenna, M.D., Nugent, C.D. (Eds.), Supporting People with Dementia Using Pervasive Health Technologies, Series: Advanced Information and Knowledge Processing, 2010, Approx. 250 p., ISBN: 978-1-84882-550-5.
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- J Wallace, MD Mulvenna, S Martin, S Stephens, W Burns, ICT Interface Design for Ageing People and People with Dementia, In: Mulvenna, M.D., Nugent, C.D. (Eds.), Supporting People with Dementia Using Pervasive Health Technologies, Series: Advanced Information and Knowledge Processing, 2010, Approx. 250 p., ISBN: 978-1-84882-550-5.
- S Andersson, AL Andersson, Practical Issues When Planning for Field Trials, In: Mulvenna, M.D., Nugent, C.D. (Eds.), Supporting People with Dementia Using Pervasive Health Technologies, Series: Advanced Information and Knowledge Processing, 2010, Approx. 250 p., ISBN: 978-1-84882-550-5.
- S Sävenstedt, F Meiland, RM Dröes, F Moelaert, Evaluation of Cognitive Prosthetics In: Mulvenna, M.D., Nugent, C.D. (Eds.), Supporting People with Dementia Using Pervasive Health Technologies, Series: Advanced Information and Knowledge Processing, 2010, Approx. 250 p., ISBN: 978-1-84882-550-5.
- F Meiland, RM Dröes, S Sävenstedt, Measuring the impact of Cognitive Prosthetics on the daily life of people with dementia and their carers In: Mulvenna, M.D., Nugent, C.D. (Eds.), Supporting People with Dementia Using Pervasive Health Technologies, Series: Advanced Information and Knowledge Processing, 2010, Approx. 250 p., ISBN: 978-1-84882-550-5.
- Jeffrey Kaye, Technology and Dementia: The Way ahead, In: Mulvenna, M.D., Nugent, C.D. (Eds.), Supporting People with Dementia Using Pervasive Health Technologies, Series: Advanced Information and Knowledge Processing, 2010, Approx. 250 p., ISBN: 978-1-84882-550-5.

A.1.4. International Conferences

2006

- Dröes, R.M. The COGKNOW project; helping people with mild dementia navigate through their day. Lecture at Interdem symposium, Paris, France, 29 June 2006.

2007

- Andersson, A.-L., Andersson, S., Cogknow: Helping People with Mild Dementia Navigate their Day, Tromsø, Telemedicine and eHealth Conference (TTeC-2007), 2007
- Davies, R., Nugent, C.D., Donnelly, M.P., Mulvenna, M.D., Craig, D., Evaluation of a Pilot Study to Assess the Usefulness and User Friendliness of a Cognitive Prosthetic for Persons with Mild Dementia (COGKNOW Project), 2007, British Geriatrics Society Bi-Annual Conference.
- Davies, R.J., Nugent, C.D., Donnelly, M.P., Craig, D., Mulvenna, M.D., Martin, S., Wallace, J.G., Evaluation of a Pilot Study in Northern Ireland to Assess the Utility of Mobile-based Cognitive Prosthetics, 12th Annual Conference & Scientific Symposium, Healthcare Informatics Society of Ireland, November 2007, Dublin, Ireland.
- Dröes, R.M., Lauriks, S., Roest, H. van der, Reinersmann, A., Meiland, F.J.M., ICT- opportunities in the care for people with dementia, Symposium 'Dementia Update 2007', VU University medical centre, Amsterdam, March 2007, pp. 30-33
- Dröes, R.M., Meiland, F.J.M., Moelaert, F., Craig, D., Mulvenna, M.D., Nugent, C., Scully, T., Bengtsson, J. (2007). ICT-solutions for unmet needs in dementia; COGKNOW - helping people with dementia navigate through their day. In: The sound of silence. 17th Conference of Alzheimer Europe, Estoril, p. 76.
- Holthe, H., Developing and Prototyping the Cogknow 'Day Navigator' - A Device Supporting People with Mild Dementia, Tromsø, Telemedicine and eHealth Conference (TTeC-2007), 2007
- Meiland, F.J.M. Reinersmann, A., Bergvall-Kareborn, B., Craig, D., Moelaert, F., Mulvenna, M.D., Nugent, C., Scully, T., Bengtsson, J., Dröes, R.-M., COGKNOW: Helping people with mild dementia navigate their day, 4th International Council on Medical & Care Compunetics, (ICMCC-2007), Amsterdam, Netherlands, 2007
- Mulvenna, M.D., Craig, D., Dröes, R.-M., Nugent, C., Technology & Aging: Telerehabilitation and Technology Assisting People with Dementia, Proceedings IAHSA, St. Julian's, Malta, June 2007
- Nugent, C.D., Mulvenna, M.D., Moelaert, F., Scully, T., Meiland, F., Bergvall-Kåreborn, B., Craig, D., Reinersmann, A., Andersson, A.-L., Drees, R.-M., Martin, S., 2007. Mobile Assistive Technologies. Proceedings Festival of International Conferences on Caregiving, Disability, Aging and Technology (FICCDAT), Toronto, Canada, 2007 Advances in Neurorehabilitation, pp.363, ISSN 1536-1268, June 2007, Toronto Canada

2008

- Bengtsson, J.E., Castellot R., invited attendance, exhibited and selected to demonstrate in the European Commission Smart Home showcase, European Ministerial e-inclusion conference, Vienna, Austria, 30 November 2008.
- Burns, W.P., Nugent, C.D., McCullagh, P.J., Zheng, H., Finlay, D.D., Davies, R.J., Donnelly, M.P., Black, N.D., Personalisation and configuration of assistive technologies, Proceedings of the 30th Annual International IEEE Engineering and Medicine and Biology Society, 2008, pp. 3304-3307.
- Dröes, R.-M., Meiland, F., Sävenstedt, S., Martin, S., Moelaert, F., Craig, D., Bengtsson, J., Holthe, H., Andersson, A.-L., Davies, R., Donnelly, M., Andersson, S., Nugent, C., Mulvenna, M.D., Towards an Integrated Cognitive Prosthetic for People with Mild Dementia; a User Centered Approach, International Psychogeriatric Association European Congress (IPA-2008), 2008, Dublin, Ireland.
- Martin, S., Dröes, R.M., Sävenstedt, S., Meiland, F., Moelaert, F., Bengtsson, J., Holthe, H., Andersson, A.-L., Davies, R., Andersson, S., Lauriks, S., Donnelly, M., Mulvenna, M.D., Nugent, C., Wallace, J., User Validation Of An Integrated Cognitive Prosthetic Device For People With Mild Dementia, International Conference on Aging, Disability and Independence (ICADI-2008), Saint Petersburg, USA, 2008, University of Florida, p.75, ISBN: 0-9754783-0-5.
- Meiland, F.J.M., Lauriks, S., Moelaert, F., Craig, D., Mulvenna, M.D., Nugent, C., Scully, T., Bengtsson, J.E., Dröes, R.M., COGKNOW: ondersteuning van mensen met dementie thuis door ICT, DOMOTICA Congres, Ede, The Netherlands, 14 May 2008

- Mulvenna, M.D., Martin, S., Nugent, C.D., Craig, D., Moelaert, F., Dröes, R.M., Meiland, F.J.M., Providing Reminding and other Services for People with Mild Dementia: Results from The COGKNOW Project, Dementia Services Development Centre (DSDC) International Conference: Celebrating Innovation & Excellence: Making Change Happen, 1-3 September 2008, Stirling, Scotland.
- Mulvenna, M.D., Martin, S., Donnelly, M., Nugent, C.D., Craig, D., User-Validation of a Cognitive Prosthetic for People with Mild Dementia, DSDC-NI, International Conference: Embracing the Challenge: Citizenship & Dementia, 6-8 May 2008, Belfast, UK.
- Nugent, C.D., Smart technologies for smart homes, The Second International Health and Social Care Modelling Conference, Coleraine, 2008, pp. 35, .
- Nugent, C., Davies, R.J., Donnelly, M., Hallberg, J., Hariz, M., Craig, D., Meiland, F., Moelaert, F., Bengtsson, J.E., Mulvenna, M.D., Dröes, R.M., The Development of Personalised Cognitive Prosthetics, 30th Annual International IEEE Engineering in Medicine and Biology Conference (EMBS-2008), pp. 787-790, 20-24 August, 2008, Vancouver, Canada.
- Sävenstedt, S., & Holthe, H., The COGKNOW Day Navigator :An evaluation of the first research cycle, Tromsø Telemedicine and eHealth Conference 2008 - Innovation in eHealth, 9-11 June 2008, Tromsø, Norway.

2009

- Dröes, R.M., Meiland, F.J.M., Sävenstedt, S., Hetinga, M., Moelaert, F., Craig, D., Holthe, H., Andersson, A.L., Martin, S., Davies, R.J., Donnelly, M., Andersson, S., Mulvenna, M., Bengtsson, J., Nugent, C.D. Assistive Technology for people with Mild Dementia; results of the COGKNOW project. 37th Congress of the European Association of Geriatric Psychiatry, 16-18 September Tours, France.
- Dröes, R.M., Meiland, F.J.M. "E-mental health and Dementia" on the first international congress "E-mental health summit 2009." 14-16 October 2009 in Amsterdam.
<http://www.ementalhealthsummit.com/en/programme>
- Dröes, R.M., Mulvenna, M.D. COGKNOW: Assistive Technology for People with Mild Dementia, International Association of Homes and Services for the Ageing's (IAHSA) 8th International Conference - Leadership Beyond Borders, London 19-22 July 2009.
- Meiland, F.J.M., Sävenstedt, S., Moelaert, F., Craig, D., Davies, R.J., Nugent, C.D., Andersson, A-L., Dröes, R.M. Electronic assistance for community dwelling people with dementia; user-driven development of a cognitive prosthetic device. Abstractbook Alzheimer Europe congress, Brussel, België, 28-30 May 2009, P17.2

A.1.5. Workshops

2007

- Andersson, S., Vårdstämman, Sweden, April 2007
- Andersson, A-L., Andersson, S., Vitalis, National Care Congress, Sweden, March 2007
- Bengtsson, J.E., presentation and demonstration at Medicinteknikdagarna, Swedish Society for Medical Engineering and Medical Physics, Örebro, Sweden October 2007

2008

- Andersson, S., Andersson, A-L., presentation at Vitalis, national care congress, Gothenburg, Sweden, May 2008
- Bengtsson, J., Mulvenna, M.D., Moelaert, F., Nelson, J., Bierhoff, I., Workshop on User Involvement in Connected Health and Wellness Design, Workshop Proceedings eChallenges-2008, Stockholm, Sweden, 22-24 October 2008, pp. 62-63.
- Castellot, R., Escriche, Andrés, J.J., Nugent, C.D., Alexandersson, J., Zimmermann, G., Cortes, U., Casas, R., Fagerberg, G., Suarez, M., Kung ,A., Cluster workshop of eInclusion projects to share knowledge and coordinate joint activities, Madrid, 24th June 2008.
- COGKNOW session at ASPROM workshop in Paris, on 13th and 14th November 2008, coordinated by the European Project MONAMI, as a result of the cluster activities.
- COGKNOW Business Assessment Workshop for the Dutch context, Organised with practitioners in Enschede, The Netherlands, 15 October 2008.

- COGKNOW Business Assessment Workshop for the UK/Ireland context, Organised with practitioners in Holywood, UK, 14 November 2008.
- Craig, D., Nugent, C.D, Assistive Technology, CARDI-SPARC Workshop on Ageing, Belfast, June 2008
- Meiland, F.J.M., Lauriks, S., Moelaert, F., Craig, D., Mulvena, M.D., Nugent, C., Scully, T., Bengtsson, J.E., Dröes. R.M., ICT solutions for unmet needs in dementia - COGKNOW - Helping people with dementia navigate through their day, Wetenschapsdag, Vaste Commissie voor de Wetenschapsbeoefening, VU Medisch Centrum, Amsterdam, The Netherlands, 8 February 2008
- Moelaert, F., COGKNOW presentation at SENIOR Workshop, Brussels, Belgium, 6 October 2008.
- Moelaert, F., "Users, Applications & Services and User Centricity", Workshop: Home Based Assistive Technologies for People with Dementia, DKIT, Dundalk Institute of Technology, Dundalk, 11 March 2008
- Nugent, C.D., Cognitive prosthetics and dementia, British Geriatrics Society Spring Meeting, Glasgow, 23rd-25th April, 2008.
- Nugent, C.D., Smart environments to support independent living: non-vision based practical technologies, Thematic Winter School - Understanding Behaviour from video sequences, France, March 2008.
- Nugent C.D., Bengtsson J.E., Moelaert, F., Davies, D., Donnelly, M., Global Village workshop, demonstration, panel and presentation in User Perspective session (chair), Paris, France, February 2008

2009

- COGKNOW Business Assessment Workshop for the Swedish context, Organised with practitioners in Piteå, Sweden, 4 June 2009.

A.1.6. Webs and Videos

- COGKNOW Public Web, 2006-2009, <http://www.cogknow.eu>
- COGKNOW Video, 2006, <http://www.youtube.com/watch?v=EJVpFTAariM>
- COGKNOW Activity Assistance Video, 2008, <http://www.youtube.com/watch?v=nzFWvoDR5ds>
- Nova TV documentary about COGKNOW on Dutch TV, 6 December 2008, <http://www.novatv.nl/page/detail/uitzendingen/6540>
- COGKNOW on National Maltese TV, on EU programme (19:10), 10 February 2009, http://public.di-ve.com/streaming/on_demand_event_library.aspx.
- COGKNOW Field Test #3 Video, June 2009, <http://www.youtube.com/watch?v=UKJTMzpz33Z4>

A.1.7. Other Dissemination Activities and Output

2006

- 11/05/06, Tracer, Magazine of VU University medical center, nr 10, HTML
- 19/09/06, University of Ulster - "Helping People to Navigate their Day", HTML
- 27/10/06, Website of Helpdesk Meeting centers for people with dementia and their carers, HTML
- 09/11/06, Website of Institute for Research in Extramural Medicine of VU University medical center, PDF
- 07/11/06, Luleå University of Technology - "Framgång för norrbottnisk forskning om e-hälsa", HTML
- 01/11/06, Informatiebulletin GGZ-Buitenamstel (information bulletin of the Regional institute for Mental Health Service Amsterdam South/New-West), HTML

2007

- 05/03/07, University of Ulster - "UU Leads Way in European Dementia Research Project", HTML
- 06/04/07, CORDIS News - "European research helps people with dementia to navigate their day", HTML

- Dutch article in magazine of Telematica Instituut: "Geheugensteuntjes: De Day Navigator ondersteunt mensen met milde dementie". Knowhow 4/2007. p13-14
- 11/04/07, Scientist Live - "COGKNOW Project helps elderly with dementia", HTML
- 20/05/07, istworld - "COGKNOW: Helping people with mild dementia navigate their day", HTML
- Halgeir Holthe audio recording from Tromsø, Telemedicine and eHealth Conference (TTeC-2007), June 2007
- Summer 07, Dementia Perspective (Northern Ireland newsletter), PDF
- KRO radio interview with Ferial Moelaert about Cogknow on 07 December 2007

2008

- Presentation at Digital Life Seminar: "Geheugensteuntje: de Day Navigator ondersteunt mensen met milde dementie" Ferial Moelaert. Digital Life seminar – innoveren met MKB. 11 januari 2008
- Bengtsson J.E., COGKNOW material for Paul Timmers' keynote at Annual IT Conference, Hjälpmedelsinstitutet (National Institute for Assistive Technologies), Stockholm, Sweden, April 2008
- Craig, D., Nugent, C.D., Assistive Technologies - How can advances in technologies assist user needs, CARDI Seminar, Dublin, 2008.
- Meiland, F.J.M., Van der Roest, H.G., Dröes, R.M. De ontwikkeling van elektronische hulpmiddelen: voor en door mensen met dementie? Praecox, June 2008, pp. 10-13.
- Bengtsson J.E., Karlsson, E., demonstration at "På äldres villkor", workshop with 400 participants hosted by NLL, Luleå, Sweden, September 2008
- Nugent, C.D., Systems, Services and Devices to Support Independent Living, Neuroscience and Mental Health RRG, Belfast, 2008.

2009

- Dutch popular article in journal: "Huis technologie voor ondersteuning van dementerende ouderen: Een ontluikende Europese markt". Interview with Ferial Moelaert, Telematica Instituut by Marcel Ham. Publisher: Hmf: Health management forum. Tijdschrift voor toekomstverkenning, strategieontwikkeling en innovatie. Thema: zorg over de grenzen. Nr 1 2009. p32-33
- Ferial Moelaert, Ambient assisted support for people with mild dementia, European AAL day, Berlin, 2009
- COGKNOW Stand on the national Congress Innovatieve Technologie in de Langdurende Zorg [Innovative technology in long-term care] in Amsterdam, 10 March 2009
- Exhibition with demonstration and vision video at Socialtjänststämman, national social care congress with 900 leaders and staff, Luleå, 17-18 March, 2009.
- Invited presentation 24th Conference of Alzheimer's Disease International (ADI) in Singapore, 25-28 March 2009.
- Exhibition with demonstration and vision video at Vitalis, national care congress, Gothenburg 21-23 April, 2009.
- Meiland, F.J.M., Dröes, R.M. COGKNOW presentation at Interdem Meeting 2009, Brussels, 28 May 2009.
- Demonstration of COGKNOW at national conference Högskolor och Samhälle i Samverkan (Academia and Society Collaboration) with 300 participants from Scandinavia, Luleå, June 2009. <http://www.hss09.se/>.
- Demonstration of COGKNOW at FIRE and Living Labs conference with 330 participants and experts from Commission and ITU, Luleå, 1-2 July, 2009. <http://www.fireandlivinglabs09.eu/>
- Demonstration of COGKNOW at ICOST 2009, Paris, France, 1-3 July 2009.
- COGKNOW Nieuwsbrief. Meiland, F., Bentvelzen, S. & Dröes, R.M. (eds.), Volume 3, nr 2 august 2009.
- Think Technologically, Act Globally by Michele Hayunga in FutureAge magazine, published by American Association of Homes & Services for the Aging, 2009 (AAHSA)

A.2. Future Dissemination Planning

This list is a verbatim copy from D5.7.1 Final Evaluation Report, section C.8.

- Online article for The Swedish Dementia Centre, <http://www.demenscentrum.se/English1/>, September 2009.
- Coordination Action AALIANCE Newsletter, 2500 copies to leading industrial and research organisations within Ambient Assisted Living, autumn 2009, invited.
- National TV coverage in Sweden, SVT or TV4, autumn 2009, invited.
- Meiland, F.J.M., Reinersmann, A., Sävenstedt, S., Bergvall-Kåreborn, B., Hettinga, M., Craig, D., Andersson, A.L., Dröes, R.M. User-participatory development of assistive technology for people with dementia – from needs to functional requirements. First results of the COGKNOW project. Accepted: Non-pharmacological therapies in dementia, 2010.
- Mulvenna, M.D., Martin, S., Galbraith, B., Haaker, T., Jansson, M., Castellot, R., Melander-Wikman, A., Moore, G., Moelaert, F., Isaksson, L., Wallace, J., Nugent, C., Bengtsson, J., Providing Inclusive Healthcare Services: From Unmet Need to Business Model, International Journal of Computers in Healthcare, Accepted, Q1, 2010.
- Nugent, C.D., Moelaert, F., Davies, R.J., Donnelly, M., Sävenstedt, S., Meiland, F., Drees, R.-M., Hettinga, M., Craig, D., Mulvenna, M.D., Bengtsson, J.E., Evaluation of Mobile and Home-based Cognitive Prosthetics, Special Issue on 'Ambient Intelligence in Smart Homes: Eldercare with Interventions and Activity Modeling, Reasoning & Recognition' in the International Journal of Assistive Robotics and Mechatronics (IJARM), In preparation.
- Dröes, R.M. Invited plenary presentation planned for 25th Conference of Alzheimer's Disease International (ADI) in Thessaloniki, 10-14 March 2010.

In addition, the following European and national dissemination activities have been planned after project-end:

- Bengtsson, J.E. et al, Nomination for ACCESS-IT Awards, September 2009, received the ACCESS-IT Best Practice label.
- Dröes, R-M et al, An Electronic Assistant Helping People With Mild Dementia Navigate Their Day; Results of the COGKNOW Project, E-Mental Health congress, Amsterdam, October 2009
- Egnell, P-O., Presentation of CDH at Japan-Sweden Conference on 'Challenges and Opportunities in Aging Society', Tokyo, October 2009, invited.
- Bengtsson, J.E. COGKNOW Ethical Guidelines et al, contribution to AALIANCE LinkedIn group, October 2009.
- Bengtsson, J.E. et al, COGKNOW Ethical Guidelines, contribution to SENIOR report on good practices in e-inclusion, ethical guidance and designing a roadmap, November 2009.
- Bengtsson, J.E. et al, Assistive technology helps dementia sufferers get through the day, ICT Results (<http://cordis.europa.eu/ictresults>), autumn 2009, draft.
- Andersson A-L et al, presentation at national Health IT conference Vitalis, Sweden, April 2010, submitted.

A.3. Public Deliverables

A lot of the project results have already been published as described above. In addition, the public deliverables of the project are (listed in order of importance):

A.3.1. Overall Project Results

- D0.3.1 Final Report, guiding the general public to all public results of the project, including the post-project web site, journals and scientific magazines, public videos, and public deliverables. It also conveys the main problems encountered in the project and

how they were mitigated, and an indication of the future commercial plans of the consortium.

- D5.7.1 Final Evaluation Report, giving a comprehensive overview of the project results from Human Factors, Technology, Business and Methodology perspectives. It also makes public the quality model and software release process used in the project.

A.3.2. COGKNOW Day Navigator Prototype

- D2.6.1 & D2.6.2 Development of Home Based Visualisation Service, introducing the hardware and software architectures of the COGKNOW Day Navigator.
- D3.5.1 & D3.5.2 Interfaces to support multi modal interfaces, introducing the prototype COGKNOW carer interface for remote configuration of reminders.
- D2.4.1 & D2.4.2 Prototype release of multi-modal interfaces, introducing the multi-modal aspects of the prototype COGKNOW portable user interface.
- D2.5.1 Prototype Release of situation aware services, introducing the COGKNOW Sensorised Home (CSH), with sensors, actuators and simple context-aware service scenarios.
- D2.3.1 Application management system for mobile device.

A.3.3. User Validation

- D4.6.1 Consolidated Field Test Report, giving an overview of the different prototypes, users and procedures of the three field tests. It also makes public the COGKNOW Ethical Guidelines.
- D1.7.1 Final Human Factors Impact Analysis, giving a comprehensive overview of the user-friendliness, usefulness and perceived efficacy of the COGKNOW Day Navigator in the daily life of persons with mild dementia.
- D1.6.1 Human Factors Impact Analysis Test #2, intermediate results after the second field test (covered in later reports).
- D1.5.1 Human Factors Impact Analysis Test #1, intermediate results after the first field test (covered in later reports).
- D5.4.1 Evaluation of trial #1, giving an formative evaluation of the first prototype, from Human Factors, Technology, Business and Methodology perspectives (covered in later reports).
- D4.3.1 Field Test #1 Report, and overview of procedures and experiences from the first field test, including collected research data.

A.3.4. Outreach Activities

- D6.1.1 Dissemination Master Plan, a strategic plan for dissemination stages and measurable goals for dissemination activities in the project.
- D6.3.1 Collaboration Report, introducing the eInclusion project cluster organised by COGKNOW: COGKNOW, MonAMi, EasyLine+, i2home, Share-IT and Caalyx.
- D3.2.1 Report detailing state-of-the-art in services supporting cognitive disabilities, a comprehensive compilation of existing related services from projects and companies.

Annex B. COGKNOW Partners

The COGKNOW consortium has brought together leading stakeholders, researchers and innovators in Europe to address major problems with Social Inclusion using value-adding and effective e-services based upon a strong business rationale.

- Representatives of the ageing and disabled in Europe, including **Vrije Universiteit Medical Center** (multidisciplinary research into dementia and other cognitive dysfunctions), **Belfast City Hospital**, **Norwegian Centre for Telemedicine and Norrbottens Läns Landsting** (through its Geriatric Unit at Sunderby Hospital).
- A leading network operator and IP provider: **Telefonica I+D**
- World-class academic laboratories, including **University of Ulster** (Medical Informatics & N.Ireland Bioengineering Centre), **Luleå University of Technology** (Centre for Distance-Spanning Healthcare).
- Manufacturers of mobile software: **Mobi Solutions** (mobile devices, CCA development)
- Context-aware research and smart home networking infrastructure (CSH): **Institut National de Telecommunication**
- Software design and training expertise including **Telematica Instituut / Novay** (multidisciplinary technological institute with commercially relevant telematics expertise) and **AcrossLimits** (Internet solutions and COGKNOW Server development responsible)

Each participating organisation was chosen for their unique blend of knowledge and expertise in a specific area with diverse skills ranging from telecommunications and software development to end-user trials and requirements gathering.

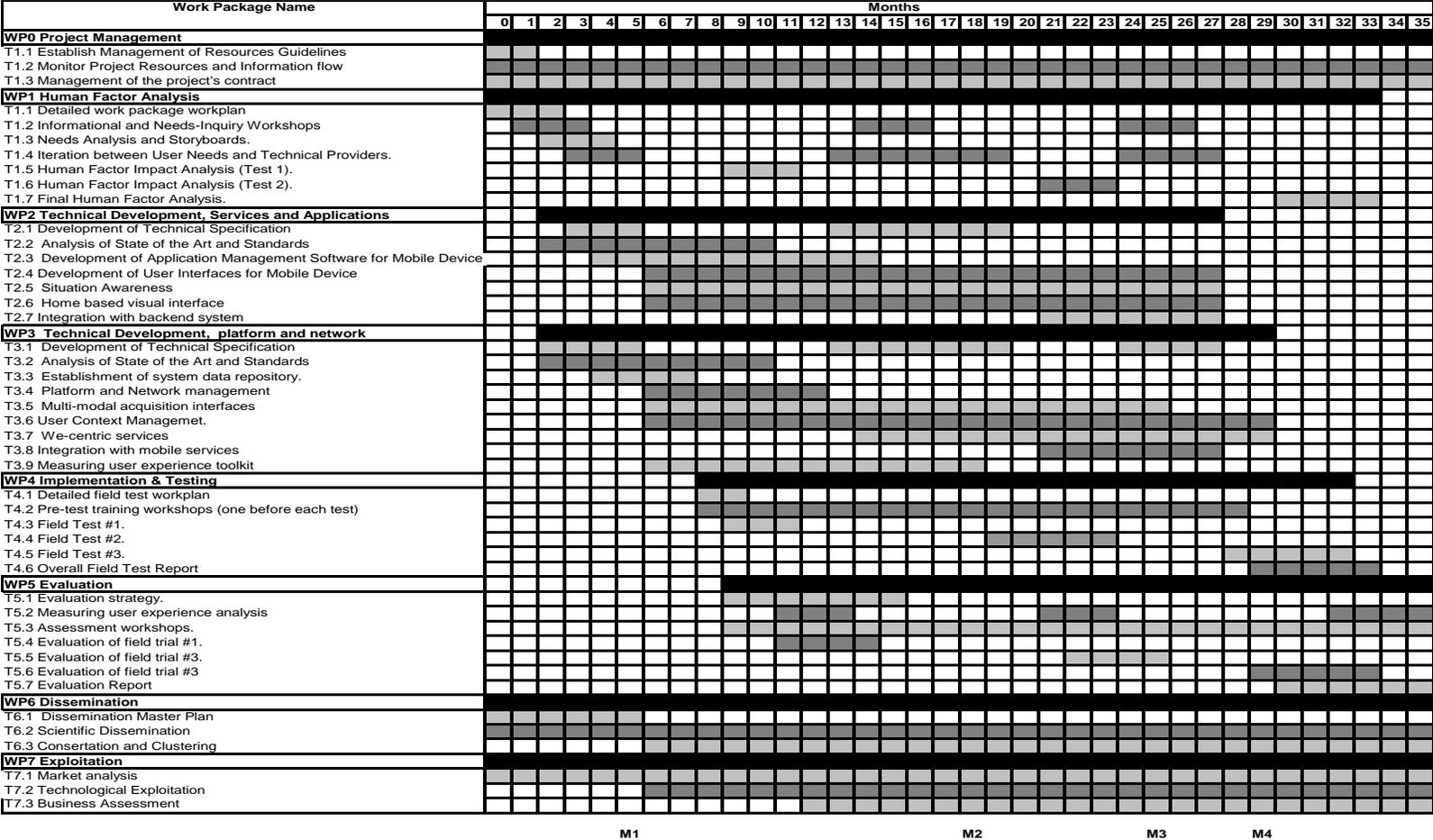
B.1. Contacts

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Annex C. COGKNOW Timeline

The diagram below summarises the COGKNOW workplan along the whole duration of the project.



M1

M2

M3

M4