

Designing an Awareness Display for Senior Home Care Professionals

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Abstract. Home care professionals play a central role in supporting elderly people when they need help to continue living in their own homes. Using awareness systems, caregivers might better be able to consider the actual and changing needs of individual clients, and better be prepared for the home visits. In the present situation, the functional requirements on a awareness systems for professional caregivers are unknown, and caregivers tend to be unaware of the potential use of these sensor-based systems. This paper presents a case study in which the user needs are studied using a working prototype; the prototype is used to make target users experience an awareness system in their everyday work practice, and thereby enable them to better reflect upon the user needs and the potential use of these systems. Whereas caregivers were skeptical at first, they did value the prototype in the evaluation phase. In the exit interviews, the caregivers came up with an interesting list of requirements and design directions for a future awareness display.

Keywords: awareness display, design of interactive products, contextual studies, aging in place.

1 Introduction

Elderly people generally indicate that they would prefer to continue living in their own homes as long as possible [1]. By living independently, elderly people can stay active and involved, and thereby maintain well-being [2], and at the same time they do not burden the nursing homes. In many cases, however, support is needed to continue their everyday living routines. In western countries, home care professionals play a central role in in-home support of elderly people. Without help from these professional caregivers, many elderly people would have to give up their independent situation at an earlier stage.

Clients of home care are generally visited several times a week, up to several times a day. Each caregiver visits a series of clients each day. Since the need for care per client changes in time, and due to incidental needs for extra care, caregivers need to adjust their schedules regularly.

Systems that provide awareness of the actual situation of the clients could potentially support caregivers in providing the care needed at the best time. In the present situation, however, awareness systems are rarely used in a home care setting,

and caregivers are unaware of the potential use of sensor-based systems. The requirements and design directions for awareness systems for professional caregivers are not known. To better understand these requirements, and to explore the design directions of these systems, a case study was conducted. The present paper describes the design steps that resulted in the development of a prototype awareness display for home care professionals, and the findings from a user study in the field. The case study serves as an example of how awareness systems could be used within the home care domain to support professional caregivers, and provides design directions for future awareness systems.

2 Related work

In recent years, products including video communication systems and incident response systems have been developed to improve awareness for caregivers. These products tend to be focused at emergency detection, rather than at supporting caregivers in their day-to-day work.

Several research projects have studied to potential use of awareness displays for caregivers, as a means to enable computer-supported coordinated care (CSCC). The CareNet Display [3, 4] is one of the early examples, in which an interactive digital picture frame was developed to be used in the home setting. The display is based on the Digital Family Portraits project [5]. Local members of the elder's care network, responsible for providing the elder's day-to-day care, use the display to monitor the status of the elder. The CareNet Display includes a shared calendar for sharing appointments and transportation needs. The display depicts seven information clusters: falls, meals, medications, mood, calendar, activities and outings. The caregivers reported that they felt less stressed when using the display, and they were pleased that they did not have to ask the elders for information needed to provide proper care time and time again. For family carers, providing care tends to be a secondary activity, next to their own job and/or household. For professional caregivers, on the other hand, providing care is the primary task. Towards creating an awareness display for professional caregivers, the information need and design directions in the professional home care domain need to be explored.

Whereas CareNet display focused on functional aspects of the situation of the elder, several other projects focused on the social side. For example, Morris et al. [6] developed the *solar display* to visualize social connectivity, in order to raise awareness of social connectedness, and consequently contribute to overall well-being. Using the solar display, caregivers could modulate their caregiving activities.

Another interesting example of sensor-based systems is the unattended autonomous surveillance (UAS) [7] system developed by TNO, which aims to provide a sense of safety and security for elderly people living at home. The system consists of a wide range of sensors that enable automatic fall detection, wandering detection, detection of smoke and fire, video observation and communication, and an emergency response system. In case of an alarm, the system automatically contacts a call center and/or individual caregivers. Even though the system could potentially well support professional home caregivers, it is not clear whether or not the alarming

and alerting approach matches the needs of the caregivers. Whereas technology seems to be in place to support professional home caregivers, the actual information need of caregivers has not been studied before. The present study aims to better understand this information need, and to find out how this information could best be communicated to home caregivers.

3 Domain Analysis

To better understand the present work situation of the caregivers, interviews were conducted with four caregivers of a local home care provider in Delft. The individual, semi-structured 1-hour interviews focused on (1) understanding the present situation, and (2) describing the potential use of awareness systems in a future situation.

3.1 Present Situation

Client population. Home care services are being provided to people of all ages, mostly aging 60 and up. Elder clients tend to suffer from an increasing number of health problems. Older clients tend to be in need of care until they move to a nursing home or until the end of their lives.

Care activities. Most of the care activities are related to personal care, such as washing and bathing clients and helping people get dressed and undressed. When needed, caregivers do make time for social activities. In some cases, caregivers train their clients to deal with their issues independently, e.g., by showing how to administer insulin injections.

Average working day. At 7:30 in the morning, the caregivers discuss the status of their clients during a staff meeting in a local care office. Information from the staff meetings is used to schedule and prepare for the home visits. Next, the caregivers conduct a series of home visits. The afternoon starts with another staff meeting, and continues with a second series of home visits and/or administrative tasks.

Responsibilities. Each caregiver acts as the central contact person for up to twelve clients and their family members; the caregiver is responsible for all care activities for these clients. In some cases, clients are visited by a dozen different caregivers a week, due to working shifts and specializations. The status of clients needs to be continuously communicated between caregivers.

Communication devices. The caregivers use smart phones for phone calls, time registration, and as an address book. All caregivers have access to a desktop computer at the local care office, which can be used for email, Internet access and administrative tasks. The participants were generally skeptical towards using new technology, since technology could create a new barrier between them and their clients.

Information exchange. A week planner is used in the local care office to share information between caregivers. Messages include “Blood pressure of client A needs to be measured each morning!”, and “Client B is hospitalized with a broken hip.” Diaries are used in the homes of clients to share information between caregivers and family members.

3.2 Future Situation

The interviewees were asked to reflect upon the question: “If you could have a look in the homes of your clients from a distance, what would you like to be able to see?” They were encouraged to describe in detail what information they would be interested in, at what time, and how the information would affect their work process. The caregivers mentioned 9 items they would like to see from a distance:

1. **Monitoring medicine intake** was found to be the top-priority request by each of the four caregivers. They would like to know (a) *if* medicine has been taken, (b) if the *right* medicine has been taken, and (c) if the medicine has been taken at *the right time*.
2. **Monitoring food and fluid intake** was mentioned by each of the four caregivers. They would like to know (a) if clients eat and drink sufficiently, and (b) if clients eat and drink at a regular basis.
3. **Monitoring the status of the care tasks.** Based on the actual needs and the status of scheduled tasks, caregivers can better estimate the amount of time needed for a visit.
4. **Monitoring potential emergencies.** Caregivers would like to know about *potential* emergencies, for example, when a client did not get out of bed at the normal time. In these cases, the home care organization by default sends two caregivers at the same time.
5. **Monitoring presence.** Awareness of the presence could help reduce the number of visits when clients are not at home, and caregivers could provide assistance when elderly with dementia are wandering.
6. **Monitoring the availability of supplies.** When the availability of supplies (e.g., medicine) could be checked from a distance, caregivers could pick up extra supplies before visiting the client, and/or visits could be rescheduled in order to provide extra supplies in time.
7. **Monitoring devices.** If the status of devices could be monitored from a distance, problems could be identified at an earlier stage, and time needed to manually check the status of devices could be saved.
8. **Monitoring activity patterns in time.** Caregivers would like to see changes in living routines of clients in time, in order to be able to better assess the care needs of a client, and to assess the ability of clients to continue living in their homes.
9. **Monitoring personal hygiene.** For those clients with reduced awareness of the need for personal hygiene, caregivers would like to know (a) if clients have used the bathroom and/or toilets, (b) if the clients actually washed themselves, and (c) if the clients wash themselves at a regular basis. This way, clients can stay in control as long as possible, whereas caregivers can take over when needed.

When asked for the best time to communicate the information, the participants indicated that they are primarily interested in an up-to-date status overview of their clients before starting the home visits, in order to be able to adjust the schedule of their home visits and to take with them extra materials in case of special needs.

4 Concept Development

The domain analysis showed that caregivers would like to be aware of the actual situation and care needs of their clients. Based on the findings from the interviews, it was decided to build a system which would (1) provide easy access to the status of all clients of a caregiver, thereby enabling caregivers to set their priorities based on actual needs and to visit their clients well-prepared, (2) create an easy-to-use and easy-to-learn solution, (3) provide access to presence and activity-data, a history-in-time, and a shared calendar, (4) enable notifications, and (5) allow client-specific settings. In view of time limitations, it was however decided to focus on the development of the design concept for a desktop-based tool, instead of a tool which could be accessed using both a desktop computer and a mobile device. The main views of the design concept are shown in Figure 1.

The awareness display provides access to all requested information as described in section 3.2. Rather than continuously showing the status of all information categories, it was decided to use a notification-based view of the status. Each notification represents a situation which needs attention of the caregiver. Notifications can be set up to monitor medicine intake (1), food and fluid intake (2), emergencies (4), availability of supplies (6), status of devices (7), and the status of personal hygiene (9). The active notifications are visually presented in the central *overview*.

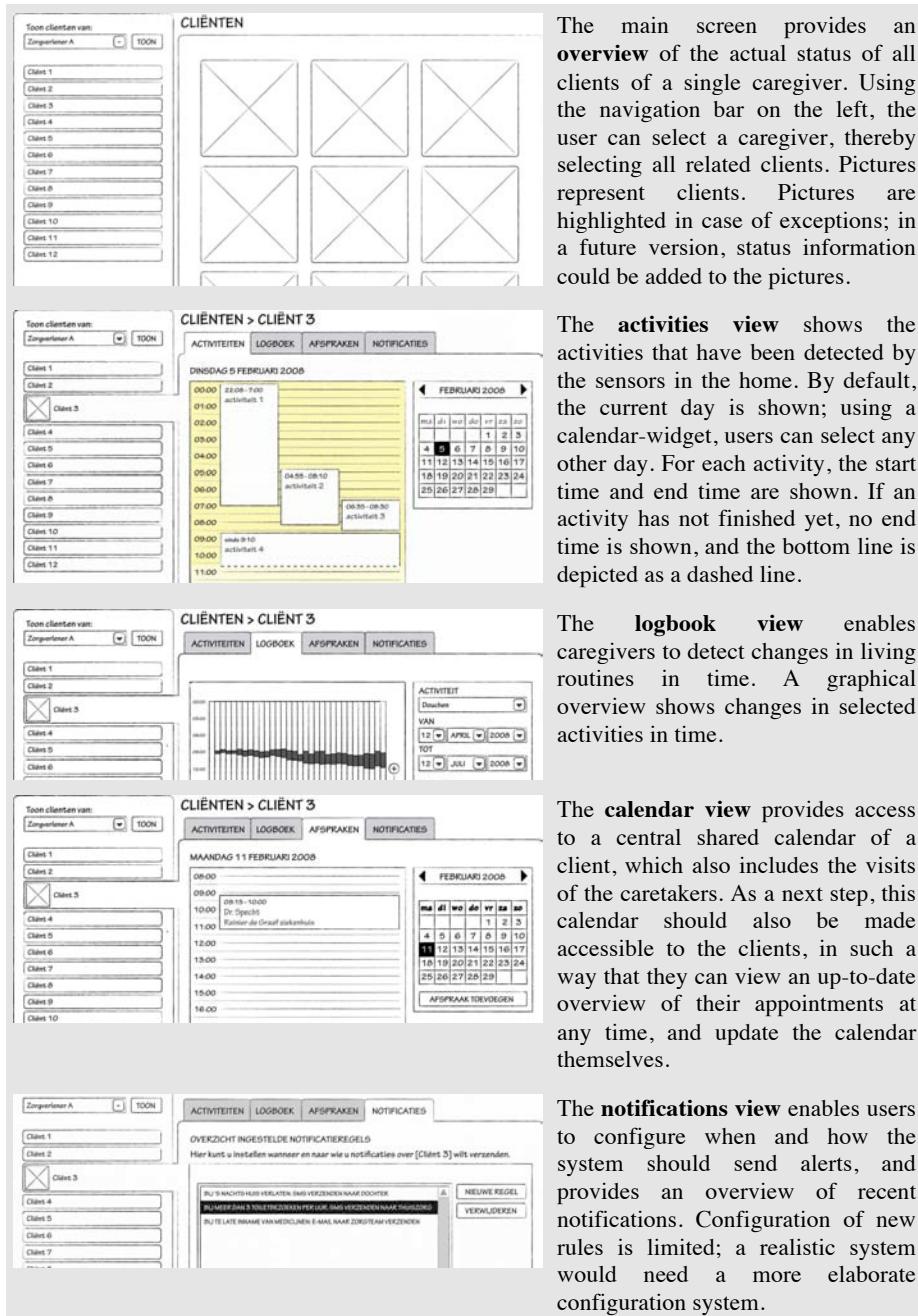
Care tasks (3) can be viewed using the *calendar view*; tasks which have not been completed in time will result in a notification in the *overview*. Presence (5) can be viewed using the *activities view*; this presence information could also be linked to the *overview*. Activity patterns in time (8) can be viewed using both the *logbook view* and the *activities view*.

5 Evaluation

To find out how the prototype was experienced in a realistic setting with real users, and to better understand the user requirements on the system, a small-scale explorative field-study was conducted with three participants. Supposedly, participants would come up with new and more focused requirements and suggestions for a future awareness product, after they were given the possibility to use and experience an awareness product in their work setting.

Participants. Three professional home caregivers from a local care provider were recruited for the user study.

Prototype. Sensors were installed in the homes of three clients, who were living at different locations within the district of the local care office. Infrared sensors were placed in the living room and the bathroom, a pressure sensor was placed in the bed, and a reed sensor was attached to the front door (Fig. 2). Even though only few sensors were used, it was expected based on the interviews that the information provided by the system would be useful for the caregivers. Using the prototype, caregivers could see when the clients were in bed, in the bathroom, in the living room, and when they might be away.



The main screen provides an **overview** of the actual status of all clients of a single caregiver. Using the navigation bar on the left, the user can select a caregiver, thereby selecting all related clients. Pictures represent clients. Pictures are highlighted in case of exceptions; in a future version, status information could be added to the pictures.

The **activities view** shows the activities that have been detected by the sensors in the home. By default, the current day is shown; using a calendar-widget, users can select any other day. For each activity, the start time and end time are shown. If an activity has not finished yet, no end time is shown, and the bottom line is depicted as a dashed line.

The **logbook view** enables caregivers to detect changes in living routines in time. A graphical overview shows changes in selected activities in time.

The **calendar view** provides access to a central shared calendar of a client, which also includes the visits of the caretakers. As a next step, this calendar should also be made accessible to the clients, in such a way that they can view an up-to-date overview of their appointments at any time, and update the calendar themselves.

The **notifications view** enables users to configure when and how the system should send alerts, and provides an overview of recent notifications. Configuration of new rules is limited; a realistic system would need a more elaborate configuration system.

Fig. 1. The overview screen of the awareness display concept displays a grid with all clients. Separate views can be selected for activities, a logbook, a calendar and notification settings.

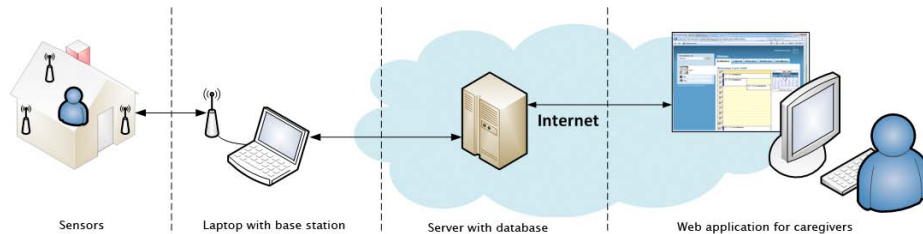


Fig. 2. Data from the homes of three clients was stored in a central database, and could be accessed by the participating caregivers through a web interface at the local care office.

Due to time constraints, only part of the functionality has been implemented and tested in the field study. The prototype included the overview screen and the activities view (Fig. 1). The logbook view, calendar view and notifications view have not been implemented.

Informed consent. The purpose and setup of the study was explained to the participating elderly. The clients agreed with the sensor setup and with the information that would be sent to the caregivers. Both the clients and the caregivers were explicitly told that the prototype is a system under development; the participants should never base their decisions solely on the information from the prototype tool.

Method. The prototype was deployed in the field for seven days. An introduction to the application was given to the three participants. The participants were asked to use the application whenever they liked, but at least twice a day: in the morning just before the morning round, and at noon before the afternoon round. Exit interviews were conducted immediately after the field study. Participants were asked to describe their experiences with the prototype awareness tool (ease of use, understandability of the information presented, usefulness of the prototype in relation to work practice, overall impression), and to describe the ideal awareness tool (dream functions, what should the future system definitely *not* do, dream form factor).

5.1 Findings: Experiences with the Present Prototype

Usefulness and added value. The participants were very positive on using the prototype system. Using the system, all participants felt better prepared when visiting the clients. Two participants indicated that they now better understood the living routines of their clients, and they might want to use this information to discuss issues with their clients.

Changing schedules. According to the participants, using the awareness display would have resulted in changes in their schedules, if only the system would have been validated and the data could be trusted. The participants were aware of the limitations of the prototype system; they did not make decisions based on the information presented by the system.

The participants indicated that in case information would require a change in the schedule, this change would require substantial effort; schedules are set by the

minute, and weighty arguments are needed to deviate from these schedules. Caregivers do not change their schedules themselves; they need to contact a superior to do so. An awareness display could simplify the process of changing the schedules, by making relevant information accessible to the superiors.

Ease of use. Both the visual overview and the possibility to view past activities were appreciated by all participants. Two participants indicated that the activity view needs to be improved; the view was cluttered by partial activities, which could not be merged by the simple recognition module used in the prototype.

5.2 Findings: Towards the Future Awareness Tool

In the exit interview, the participants were asked to describe the dream-functions for a future awareness tool. Table 1 shows the dream-functions that were mentioned by the participants, as well as an overview of what the future system should *not* do. Based on these suggestions, it would be good to focus on creating a networked system that links to other stakeholders in the care-network. Furthermore, mobile connectivity needs to be explored in order to send updates when the caregivers are in the field.

Table 1. Dream-functions for a future awareness tool.

	<ul style="list-style-type: none"> - Show the location and status of the clients at any time of the day. - Show the room-level location of clients when entering the home. - Make the tool adapt to the needs of individual clients. - Send alerts and notifications to mobile devices.
Do's	<ul style="list-style-type: none"> - Link to informal caregivers and family caregivers. - Link to existing emergency response systems; the awareness tool could help reduce the number of false alarms. - Show the location of other caregivers in the district, and make it easier to contact these caregivers.
Don't's	<ul style="list-style-type: none"> - Don't introduce technology at the expense of social contacts. - Don't show incorrect data or too many details. - Don't use cameras (supposedly not acceptable by clients).

6 Discussion and Future Work

This paper has presented the findings from an exploratory study in which the use of awareness systems in supporting professional home caregivers has been studied. A working prototype was developed and deployed in the field at a very early stage of the product design process. Caregivers were able to experience a prototype awareness display at work, and they were able to reflect upon the limitations and potentials of awareness systems in their work. The case study deliberately did *not* take the perspective of the elderly clients into account. Even though product adoption by the elderly is crucial towards creating a system which is accepted in the field, we think a different type of user study is needed in order to capture the client needs and values in relation to awareness systems. It was decided to focus on the information need of the caretakers first, before studying the perspective of the elderly in a future study.

The participants were found to be very positive towards the prototype awareness display. Not only did the study result in an understanding of how caregivers might use an awareness display in their work, the exit interviews also resulted in interesting suggestions for requirements for a future awareness display for home caregivers. These findings can be used as design directions for product developers in the home care domain.

A future awareness system could be a desktop application that provides detailed information on the actual status and the history of clients, combined with a mobile application for displaying notifications and alerts. An awareness display could be made accessible for informal caregivers and/or family caregivers, thereby making it easier to distribute care tasks to people within in the care network. In order to make optimal and efficient use of awareness tools, support from the organizational structure of the care providers involved is needed.

The use of awareness technology does raise ethical questions. For example, people tend to be willing to give up privacy, when in return safety and security are increased [8]. Even though people might be willing to give up their privacy themselves, would it be ethically correct to allow caregivers to continuously monitor the lives of their clients? And what if the use of technology leads to fewer moments of social contact between caregivers and clients? Even though these questions are considered as highly relevant by the authors, they are considered out of scope in this explorative study.

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References

1. Vermeulen, J.: Langer zelfstandig wonen en hoe ICT daarbij kan helpen. PhD Thesis, University of Tilburg, The Netherlands (2006)
2. Holmén, K., Furakawa, H.: Loneliness, health and social network among elderly people - a follow up study. In: *Archives of Gerontology and Geriatrics* 35 (2), 261-274 (2002)
3. Consolvo, S., Roessler, P., Shelton, B.E.: The CareNet Display, Lessons Learned from an In Home Evaluation of an Ambient Display. In: Davies, N., Mynatt, E.D., Siiio, I. (eds.) *UbiComp 2004. LNCS, vol. 3205*, 1–17. Springer, Heidelberg (2004)
4. Consolvo, S., Roessler, P., Shelton, B.E., LaMarca, A., Schilit, B.: Technology for Care Networks of Elderly. In: *Pervasive Computing, April-June 2004*, 22–29 (2004)
5. Mynatt, E.D., Rowan, J., Jacobs, A., Craighill, S.: Digital Family Portraits: Supporting Peace of Mind for Extended Family Members. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Seattle, Washington*, 333 – 340 (2001)
6. Morris, M.E.: Social Networks as Health Feedback Displays. In: *IEEE Internet Computing* 9 (5), 29-37 (2005)
7. Unattended Autonomous Surveillance system, TNO Defense and Safety, http://www.tno.nl/downloads/zelfstandig_wonen.pdf
8. Hoof, J. van, Kort, H.S.M.: Unattended autonomous surveillance in community-dwelling older adults: a field study. In: *Proceedings of ISG'08, Pisa, Italy* (2008)