



Let's Stay in Touch: Sharing Photos for Restoring Social Connectedness between Rehabilitants, Friends and Family

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ABSTRACT

A case study on the use of an existing photo sharing application in a spinal cord lesion rehabilitation centre is presented. The study focuses on enhancing social connectedness through sharing photos between rehabilitants and their families and friends. Four rehabilitants participated in this study for 6-7 weeks. Most photos sent related to sharing things in everyday life and keeping the rehabilitant informed about regular events. The combination of interviews and content analysis reveals that only a minority of the photos lead to follow-up communication about the contents of the photos. Rehabilitants were positively surprised how spontaneous photo sharing simplified the way they could reconnect to their friends and family, without the immediate need or obligation to engage in a (phone) conversation.

Categories and Subject Descriptors

H.5.1 [Information Systems]: Information interfaces and presentation – *multimedia information systems, evaluation/methodology*.

General Terms; Design, Experimentation, Human Factors

Keywords

Social connectedness, photo sharing, rehabilitation

1. INTRODUCTION

After an accident or a disease, the life of an individual can suddenly change dramatically and in a totally unanticipated way, especially when such an event leads to a permanent disability. Not only does the person face hospitalization but often a complete change in lifestyle is needed when returning home. In many cases, an initial recovery period is followed by a long rehabilitation period. During this rehabilitation time, staying in touch with friends and family is often difficult and requires a lot of additional effort from the rehabilitant as well as the social network around the rehabilitant. The importance of social connectedness in relation to an individual's perceived well-being (affectively and cognitively) and health/disease has widely been accepted and documented (e.g. [1] [2]). It contributes to an individual's happiness and contentment [3], and it is an important contributor

to and determinant of an individual's social and psychological well-being [4] and general health/disease [5].

Social connectedness is crucial for well-being and health in general. It provides a buffer against stress, enhances coping skills [6], and leads to higher levels of life satisfaction and self-esteem [7]. Social connectedness fulfils a large number of functions that have a positive effect on well-being. Good social supportive networks lead to higher levels of personal well-being and better health [8]. Low connected people view their surroundings as negative, hostile, threatening, and unfriendly [9]. This is supported by the self-verification theory [10], saying that people will perceive their environments in ways that are consistent with their views of themselves, even if the self-view is negative (e.g. low social connectedness). There is no commonly used or universally accepted definition of social connectedness. In this paper, we define it as 'a positive emotional appraisal which is characterized by a feeling of staying in touch within ongoing social relationships' [11].

Social isolation or low social connectedness is one of the major consequences of mobility limitations of people with disabilities. The Internet has the potential to improve people's independence and social connectedness by enabling them to interact with others independent of distance and time [12]. Most of the research conducted on Information and Communication Technologies (ICT) support for enhancing social connectedness has been around friends and family members who are dispersed as a result of *expected* changes of phases in life. Known examples are supporting elderly parents living alone and their social network [13] [14], or systems designed to inform people about the whereabouts of household family members [15].

Opposite to ICT support for *expected* changes, not much attention has been put on addressing needs of social connectedness after an *unexpected* transition or turning point in life, caused by an accident or sudden disease. Hospitalization leads to an immediate urge of bonding and staying in touch. The spontaneous moments, the exchange of affections and tokens of care, and implicit communication, are all threatened and lost. For these rehabilitants it is challenging to continue to maintain their roles as parent, sibling, child, friend or colleague. ICT can play a valuable role to bridge this physical barrier.

Our aim is to maintain and enhance social connectedness for rehabilitants who are forced to stay for a long period of time rehabilitating in an alienated care environment, and to support and reduce the stress and difficulties for their immediate social network during such an unexpected turning point in life. To facilitate this, we first conducted a user inventory study to identify the needs and barriers of rehabilitants and their healthcare providers in relation to their current social connectedness. The

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study showed that rehabilitants want to share spontaneous moments and exchange affections and tokens of care with their families and friends. We decided to do a case study with four rehabilitants and their families that used digital photo frames and camera phones to share photos. During 6-7 weeks relatives and friends were able to send photos to the rehabilitants. We describe related work on digital photo sharing and the social use of camera phones as well as the design of the case study. Interviews and content analysis of the shared photos were used to evaluate the effect of photo sharing on social connectedness.

2. RELATED WORK

This section presents an overview of related work. Current solutions are described for sharing (digital) photos between friends and families, and the social use of camera phones. In order to be able to analyze our ICT intervention on photo sharing, related work on photo categorization is also discussed.

2.1 Photos and Digital Photo Frames

The photographs of loved ones are typically symbolic of a personal relationship. They provide a constant reminder of the emotional feelings involved at that particular moment of time when the photograph was taken. Photo frames are typically used to display these photos and highlight the value and importance of these images. Photo frames are considered to be part of furniture or decorative objects that blend in the home environment.

The use of digital photo frames for displaying a slideshow of photos is becoming increasingly popular. There are hundreds of them in the market, and most of them provide a simple display of photos that the user uploads to the frame. There are a few companies that provide services to send and receive photos via photo frames. Ceiva Logic is one of the pioneers in this arena. Their main focus is to get photos on the frame via a web-based subscription service. T-Mobile Cameo™ and Vodafone have also started selling digital photo frames with a SIM card which enables delivery of photos taken on a camera phone through the Mobile Messaging System (MMS), in addition to being able to upload them via their website. FrameMedia® offers FrameChannel, a web services platform for delivery of personalized content to wireless photo frames. This platform provides a standardized way to incorporate photos from popular photo sharing sites, such as Flickr and Facebook.

Since we already dedicate photo frames to people we care about, they add a personal touch, and we tend to see them once in a while, it is not surprising that there have been several studies on enhancing social connectedness between two or more remote parties by means of augmenting photo frames. Well known examples are the Digital Family Portrait [13] and the CareNet Display [14]. These augment a digital photo frame with awareness information of the well-being of an elderly parent living alone and at a distance from their children, who want peace of mind and be more involved in their parent's well-being. The Lunitouch system [16] consists of a pair of interactive portraits with which users can convey emotional language. If a user touches the portrait, the other portrait's frame lights up, thus conveying an emotional message in tangible form. Evjemo et al. [17] studied how to support communication in distributed families. They found that grandparents and grandchildren need a common context for conversation. They show that sharing the day's events

by sending photos and drawings to a screen in the grandparent's home would be a well appreciated communication technology.

2.2 Social use of Camera Phones

Camera phones encourage frequent and spontaneous photos of ordinary things like family and friends, kids and travel [18]. The use of a camera phone differs from a traditional camera in the sense that people tend to use the camera phone more frequently to capture small events or scenes in everyday life [19]. Okabe distinguishes four patterns of camera phone usage: (1) visual note taking for personal archiving, e.g. photos of an advertisement or the titles of books; (2) spontaneously taking photos of everyday life, i.e. the photos are not posed or staged but snapped casually; (3) sharing photos with close friends and family who are not present at the time the photo is taken, and (4) capturing and sharing photos of events that are considered noteworthy. For social connectedness the value of categories 3 and 4 is obvious. The photos in category 2 are usually not intended to be sent to others but collected for personal use: to build an archive of personal fragments of everyday life. Nevertheless this category might be interesting for social connectedness. The camera phone is used by people to capture a personal viewpoint on their everyday life. If they are willing to share these kinds of photos with friends and family, it will probably increase social connectedness.

Kindberg et al. [20] present taxonomy on why people capture images on camera phones. In the taxonomy the intentions of people vary along two dimensions: social versus individual intentions and affective versus functional intentions. For our study only the social part of the taxonomy is relevant. Of the four categories in the social part of the taxonomy only two relate to a situation where people are remotely located, like in our context. The first is an affective category with photos intended for communication with absent family or friends. The second is a functional category with photos to support a task by sharing with remote family or friends (e.g. the photo of a choice of sandals; selection discussed by phone immediately after sending). In a follow-up study Kindberg et al. [21] examined the images that belong to precisely these two categories. Indeed their study shows a variety of ways in which camera phones are used to connect people. Photos in the category 'absent family or friends' were sent in order to extend an experience to absent friends (e.g. reaching the top of a mountain), to illustrate a shared history (e.g. familiar food just made) or to tell a story. In the functional category 'remote task' photos were used to convey news or to be discussed later (e.g. choice of sandals).

Van House [22] also studies social uses of photos. In her analyses she refers to Kindberg's taxonomy and uses categories similar to those of Okabe and Kindberg. Extra categories of use she explicitly identifies are self-expression and self-presentation: people made photos primarily for aesthetic reasons or to influence others' view of them, for instance by sending self-portraits or pictures of friends or possessions or the like.

2.3 Photo Categorization

Research on the interpretation and inference of the meaning of photos is not exhaustive. We are particularly interested in the role of photo sharing in social connectedness, i.e. what can the sharing of photos tell us about social connectedness between the sender and receiver.

Existing methods of categorizing photos can fall into three broad types: free-style, nominal, and contextual metadata. The free-style method consists of one's own scoring of a photo, also known as 'tagging'. Flickr for example, allows users to add free-form tags to their photos, constructing their own easy and flexible form of metadata, making photos highly searchable. Tagging is now very popular and widely used in social networks like Facebook and video sharing like YouTube

Nominal ways of categorizing photos are the default photo category lists that are common in literature and photo applications. These types of categories include lists such as vacations, special events, family and friends, art and fun [22] or the categories of Garau et al. [23] that are partly similar: travel, context (e.g. location, activity), portraits of people or animals, visual interests (e.g. landscapes, art), humor, media, events (mundane or special). A taxonomy for consumer photos which expands from the types of indoor photos and the types of outdoor photos has also been created [24].

Next section describes the user requirements inventory aiming at the barriers and needs of rehabilitants and healthcare professionals in relation to social connectedness and photo sharing.

3. USER REQUIREMENTS INVENTORY

The target patients stay at the spinal cord lesion department of a rehabilitation centre. These rehabilitants, with (non-)traumatic spinal cord lesions, stay in the centre for up to one year in rooms with 1, 2 or 4 patients. They reside in the centre to rehabilitate, i.e. functional recovery, using auxiliary tools, and prepare for living in the "real world" with their disability. They have a very busy and strict daily schedule of therapy sessions.

3.1 Set-up of Structured Interviews

User requirements were identified by interviewing both the rehabilitants and the healthcare professionals. Structured interview schemes formed the basis of the interviews. Because of the explorative character of the study, the action type approach [25] was chosen for the interviews; "known" aspects from each interview were checked in the next interview, and when found stable, the interview slightly changed to new or related aspects.

The structured interview schemes for the rehabilitants were prepared based upon the background information of the rehabilitants and family members, the current situation and feelings of social connectedness, and the opportunities to support missing aspects of social connectedness. For healthcare professionals, the structured interview schemes included the background information, the center's philosophy in relation to social connectedness, rehabilitation and belongingness, and the current situation of isolation and connectedness of rehabilitants.

3.2 Results User Requirements Inventory

In total, 5 rehabilitants (4 male, 1 female) and 4 healthcare professionals (a rehabilitation doctor, a psychologist, a nurse and an ergo-therapist) were interviewed. Main results are listed below.

Visitors

People visiting the rehabilitant are important for social connectedness. Most rehabilitants get a lot of visitors during the week, e.g. from family members, friends, and colleagues. The amount of visitors depends upon the phase of the rehabilitation

process (many in the beginning, fewer at the end), their family composition and the distance of their home to the rehabilitation centre, and whether the rehabilitant is able to go home during the weekend. Some rehabilitants get too many visitors, which is too exhaustive for them. Therefore they need to coordinate the amount of visitors by keeping an agenda (delegated to a family member), or a wiki. Direct family members are welcome at rehabilitant discussions with the healthcare professionals. When the physical situation of the rehabilitants allows it and visitors are no longer allowed in the bedroom, they can all gather in the restaurant of the centre, with all rehabilitants and visitors in one big room. This is the beginning of getting used to the "real world". For proper rehabilitation into the real world, rehabilitants have to take control of their own life and start claiming space for themselves.

Virtual contact

Beside physical visits, rehabilitants have several (electronic) communication means for virtual contact. Examples that are used are telephones (wired and mobile), email (news letters), Hyves (a popular Dutch social network site), MSN, and one uses Skype as an awareness system of his partner at home. It was left open all day. However, synchronous contact during the day is difficult because of the strict and busy therapy scheme, and tiredness is often a threshold for rehabilitants to contact people in the evening. Often, asynchronous means for contact are used, amongst others cards, photos and drawings are received by snail mail, and sometimes family members bring memory cards to update a digital photo frame. Most rehabilitants are not always aware of all technological possibilities for interacting. Moreover, some rehabilitants fear for theft of apparatus in the centre.

Virtual contact may never be an excuse for rehabilitants not to be confronted with physical contact; they need to go into the real world. However, the rehabilitation process can be a trigger for people trying new things. For example, a 78 year old man started using Hyves with his grand children. When using devices, strained muscles might not be stressed too much, and in general, usability is important. Some of the healthcare professionals complain about the rehabilitants using mobile phones during their therapy. Excessive use of laptop and webcam is perceived to be annoying, and sometimes considered to invade the privacy of the care personnel. Many of these aspects come down to the general dilemma: is a rehabilitation centre a working place for professionals or a home for rehabilitants?

Available technologies to foster social connectedness

Currently, rehabilitants make use of several existing technologies to stay in touch with their family and friends. These are: a wired telephone which they subscribe for with necessary adaptations, personal mobile phones, a television which they subscribe for, a PC with Internet available in the activity room, personal laptops, and digital photo frames.

Additional results in relation to social connectedness

During the interviews a lot of aspects were mentioned by the rehabilitants and the healthcare professionals that do not directly fit into the previous categories, but that are relevant for social connectedness.

In general, the rehabilitation process consists of various phases, in which the rehabilitant pays different attention to the world outside the centre: (1) In the hospital, the rehabilitant is not fully realizing

what has happened, (2) at the rehabilitation centre, the rehabilitant is confronted with the impact of their disease and experiences an emotional dip, and (3) returning home again, when they are confronted with reality, experiencing another dip. Rehabilitants perceive that a lot of people tend to pay too much attention to their illness, while at a certain point they are open for other information, but their visitors mainly talk about their disease. What they want to hear is information about the everyday and small things in life, e.g. flowers in the garden, neighbor's new car. In relation to this, people try to protect the rehabilitant by not sharing these experiences because of pity, while keeping in touch with colleagues and employment is relevant for reintegration. Moreover, the process of rehabilitation is not only dealing with the handicap, but also continuing living. Often, family members at home tend to sacrifice themselves for the rehabilitant, which results in an abnormal relation, e.g. not husband and wife, but husband and nurse.

3.3 Conclusion User Requirements Inventory

In relation to social connectedness in general, the current situation of physical visits and virtual contact are sufficient for most rehabilitants. Most of them use various kinds of technology to stay in touch with their family and friends. However, they still miss the feeling of being involved in their lives. They not only miss life-time events with their families (e.g., family reunion, swimming diploma), but also the small things in life: *"I want to see the flowers in my home garden"*, *"bring the world back to me"*, *"I want to be part of the normal things again"*. The rehabilitants want to experience the normal things they did before their accident or illness; they want to share spontaneous moments and to exchange affections and tokens of care. The requirements from the professionals state that when a technological intervention is chosen to enhance social connectedness, the technology should be user-friendly, does not take too much effort for the healthcare professionals, and can be controlled by the (impaired) patient.

In summary, rehabilitants want to be involved or "see" the lives of their family and friends. We explore the capture of snapshots of the small and everyday things in life, and the application of remote photo sharing for addressing the needs of these rehabilitants and their significant loved ones. Family and friends should be able to take those snapshots of pictures without much effort and send them to the patient in an easy way.

To study the role of photo sharing in social connectedness, a case study is conducted towards the role of photo sharing in social connectedness between rehabilitants and their friends and family

4. INTERVENTION AND CASE STUDY

4.1 Design of Intervention

For sharing snapshots and spontaneous moments, the rehabilitants were provided with a Vodafone™ 520 photo frame a 7" TFT screen with resolution of 800 x 480 that can receive digital photos sent through a multimedia message (MMS) or uploaded through a website. Family members of the rehabilitant were given a MMS capable mobile phone with a built-in digital camera. This setup enabled family members to take photos from events in daily life that they wanted to share with the rehabilitants. The recipient (rehabilitant) receives the latest uploaded photos, without requiring any computer or Internet connection.

For rehabilitants, this setup provides a natural transition from traditional photo frames, to digital photo frames to connected photo frames. Some patients were already using digital photo frames, but needed to wait for a visit from relatives to get updates on a memory card. These additional steps often provided a barrier to really use the digital photo frame often. Furthermore, due to the delay between taking a photo and sharing a photo, digital photo frames are not perceived by rehabilitants as a very effective means to be part of the normal everyday life of their family and friends.

4.2 Case Study

Four rehabilitants participated in this study, three female (age 29, 45 and 55) and one male (57 years old). They all suffer from spinal cord lesions and stayed in a rehabilitation clinic. They got the digital photo frame for 2-7 weeks (until they were dismissed from the clinic). Three of them got a Sony Ericsson K600i cell phone with a 1.3 MP camera to give to their friends or family to send photos by MMS. Other people could also send MMS to the digital picture frame. One of the rehabilitants was a mother with three juvenile children. She got three cell phones, one for each child. All the rehabilitants got the login name and password of a personal photo web-page to upload photos to their photo frame and to manage them. Management of the photos consisted of editing photos and deleting photos, adding text messages to photos, circulation speed of photos on frame, and so on.

4.3 Measurement

The effect of receiving photos on the feeling of social connectedness is measured in three ways: 1) structured interviews, 2) quantitative analysis of the photos sent and 3) content analysis of those photos. The set-up and the results of the content analysis are described in section 6. The results of the quantitative analysis and structured interviews are described in section 5. The interviews focused on how the rehabilitant experienced the photo frame, i.e. did he or she like getting photos, did it do anything with their feelings of connectedness, and were they able to handle the photo frame. The interviews were conducted at three moments; pre-test, during the test, and post-test.

The pre-test interviews aimed at identifying a kind of baseline of the amount and ways of social contacts and the feelings of social connectedness of both the rehabilitant and their family members.

After two weeks, the rehabilitant was visited and asked how things are going, their first opinions about the photo frame, their experiences, and whether they have any questions about using it.

During the post-measurement interview, questions were posed to identify whether the technological intervention has effected or changed something in the quantitative and qualitative aspects of social connectedness of both the rehabilitant and their relatives. Moreover, the post-test interview also covered usability issues and possible extensions of the connected photo frame.

5. CASE STUDY RESULTS

First, a small quantitative analysis on the amounts of photos sent per person is performed. Next, the main results of the interviews are described, focusing on the effect of the photos sent on the feelings of social connectedness and the use and usability of the photo frame. The section is finalized by a technical evaluation of the photo frame and the mobile phones.

Pre-test interviews were conducted with each of the four participants and their family members. One rehabilitant was dismissed from the clinic within two weeks after the start of the trial, so no follow-up meetings could be organized. The post-test measurement was conducted with three people.

5.1 Received Photos

Patient 1 (P1) is the woman with the three juvenile children. Her daughter (living temporarily in a foster home) was sending the bulk amount of photos. Patient 2 (P2) is a young, unmarried woman. Her two sisters sent most of the photos. Patient 3 (P3) is a man who participated only two weeks in the case study. His photos were taken by his wife and children. Patient 4 (P4) is a woman who only wanted to have photos from her own family (husband and children).

Most photos were sent by MMS, only P1 received photos by Internet upload. The amount of photos the patients received varied a lot. P1 received 146 photos in 6 weeks time (from 11 senders), P2 received 43 photos in 7 weeks time (from 6 senders), P3 received 29 photos in 2 weeks time (from 3 senders), and P4 received 55 photos in 7 weeks time (from 4 senders).

Figure 1 provides an overview of the amount of photos sent per person (based upon MMS number) over time. Only people sending more than 8 photos were included; P1: daughter and 2 sons, P2: Friend and 2 sisters, and P4: husband and daughters. All photos for P3 were sent within two days. Thereafter, the phone was blocked because the wrong pin code was entered too many times. Thus, Figure 1 excludes photos sent to P3.

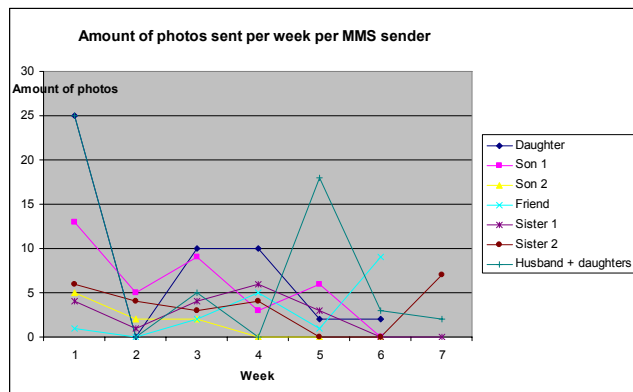


Figure 1: Overview of amount of photos sent over time per MMS-sender

In general, more photos were sent at the beginning of the study and after some time the amount decreased. The case study period was too short to identify whether the amount of photos sent over time will become stable or would extinguish. Besides, the photos were sent in several batches and the amounts varied per week.

5.2 Social Contact and Connectedness

All the rehabilitants liked the photo frame; especially the surprise effect of receiving new photos was appreciated. After the introduction of the photo frame, the amount of social contacts of the rehabilitants did not really change. The same - rather stable - group of people (family and friends) visited them, and the amount of cards, emails, normal photos, and phone calls they received stayed the same. However, two of the three rehabilitants stated that - as a reaction on a received photo - they often called the

sender of the photo by using their personal mobile phone. Such a conversation often started with talking about the photos and thanking them, and proceeded by a more generic conversation. For people, who were not visiting the rehabilitants very often, the photo frame served as a means to lower the threshold for contacting them again.

Before they got the photo frame the rehabilitants only heard stories, which were beyond their imagination. Now they got a visualization of what happened; they felt closer to the stories. Moreover, when receiving photos, it was not only about the content, but also about the feeling that people think about them. This matches with the definition of social connectedness used 'a positive emotional appraisal which is characterized by a feeling of staying in touch within ongoing social relationships' [11].

5.3 Use of the Photo Frame

The rehabilitants used the photo frame in different ways. One used it as a normal photo frame, looking at it once in a while. Another one had a fixed moment during the day when she laid down and watched the photos, and the third rehabilitant selected one photo that she preferred and put it in the frame during the day, and only at some moments she was browsing the photos. They all felt a bit disappointed if they did not receive a new photo each day. Only one rehabilitant told her family about her disappointment when she called them. Two of the three rehabilitants turned their frame black for privacy reasons during the day when they were in therapy sessions. One of the rehabilitants only gave the number of the photo frame to her husband and children, the other two gave it to relatives and good friends, and one of them also gave it to colleagues. Only a few very close relatives received the login name and password of the Internet site.

5.4 Usability Aspects

The size of the frame was found adequate. A bigger frame would become too obtrusive in their room. Despite their impaired hand function, they were all able to use the buttons of the frame. The only problem they mentioned was the length of the cable; because of their impairment two of them were not able to take the frame from the bed table themselves. The rehabilitants all noticed that the quality of the photos was not always very good, especially when the flash was used. However, the quality of the photos was perceived as less important than the idea that someone thinks of them when sending a photo and the general content on the photo. Moreover, the rehabilitants noticed that a lot of friends who were older than 40 years did not have a camera phone.

5.5 Technical Evaluation

All photo frames worked well during the trial, although sometimes it took a while (a couple of hours) before the photos were visible on the frame. The rehabilitants reported that the cleaners sometimes knocked the frame off the nightstand. After the frame was put back and turned on again, everything worked well. The families of the rehabilitants encountered some trouble with the mobile phones. Three (out of six) family members inserted the wrong pin code too many times, so the phones were blocked for a while until they asked us to unblock them.

5.6 Conclusions Case Study

The amount of photos received by the rehabilitants varied a lot, from 29-146. They all received photos from various people. The

surprise effect and the feeling that someone thinks of you were mostly appreciated. The quality and the content of the photos were found less important. Moreover, now they have a picture with the stories people tell them: a new window on the world beyond the rehabilitation centre. Sending photos did not change other social contacts, although sometimes the rehabilitant initiated phone contact after receiving photos, especially with people they hadn't seen in a while. During the case study period, no usability or huge technical problems were reported.

6. CONTENT PHOTO ANALYSIS

To analyze the sent photos we used a nominal categorization method. Similar to Kindberg [20] and Van House [22], we focus on intentions of people who take and send photos, to get categories that are meaningful for social connectedness. Because of the setup of the study, all the photos are in two of the categories in the taxonomy of Kindberg: affective and functional category. Hence we developed a more fine-grained categorization, taking existing nominal categorizations in mind (section 3.3).

6.1 Photo Categorization Used in This Study

To come to a categorization a method similar to the method of Kindberg et al. [21] was used: we independently produced categories and then reached iterative agreement on the coding categories. The categories used (1) messages, (2) greetings, (3) everyday life, (4) regular events, (5) special events, and (6) something funny or aesthetic.

Category 1, *messages*, contains photos that tell or show the rehabilitant something new. Examples are new things in and around the house, a choice of tiles for the bathroom that is going to be adapted or a newborn baby. Photos in this category are meant for notification or discussion: to involve rehabilitants in choices. Sending a message will probably be followed by (synchronous) communication when the time is right.

Category 2 contains photos that show people *greeting* the rehabilitant. Usually this is the first portrait photo of a person in a sequence of photos (sent within a short time-frame) that implicitly seems to convey: "Hi, I am thinking of you, I wish you the best". A greeting does not need to be followed by communication.

The photos in categories 3 and 4 are sent with the intention to keep the rehabilitant connected to everyday life of their family. The category *everyday life* contains photos about normal things in and around the house and typically contains photos of their home environment: kids, garden, animals. Category 4 contains photos of *regular events* (going to school/work, walking the dog). The photos in these two categories are not necessarily followed by communication.

The photos in the category *special events* are meant to keep the rehabilitant informed about and involved in special moments (holidays, birthday parties). This category matches one of the categories of Okabe (2004): photos of noteworthy events. According to Okabe [19] photos in this category are likely to become the topic of conversation among family or friends.

Category 6 contains photos that show *something funny or aesthetic* or a photo of something the rehabilitant likes. These photos are sent to cheer the rehabilitant up and at the same time to tell him or her "I am thinking of you and make some effort for you". The photos in this category are sent with affective intentions only and do not need to be followed by communication.

6.2 Photo Analysis

This categorization was used to analyze the photos sent to the four rehabilitants. Asking the rehabilitants and the relatives of the patients to categorize the photos themselves would have been too much of a burden for them. Instead we split up in two groups of two persons who independently categorized the photos. This resulted in two categorizations, with an inter-rater reliability score of 0.52 (Cohen's Kappa). According to Landis and Koch [26], this is a moderate agreement. We analyzed the differences in our ratings. The main differences were caused by lack of knowledge of the location and situation where the photo was taken. Many of these differences could be resolved by interviewing three of the four rehabilitants after the case study. The inter-rater reliability after the corrections was 0.88. In the remaining part of this section we use the corrected categorizations to describe the contents and size of each of the categories. The photos with remaining differences between raters are treated separately.

Messages

This category contains 14.8% of the photos. Typical examples are photos of new furniture and new wallpaper at home and photos of the daughter's room in the house of her foster parents. The daughter also sent photos of people in her new (temporary) living environment. Another rehabilitant received a photo of her little niece with her arm in plaster to tell her that she had a small accident. Two of the rehabilitants also received photos from a friend they hadn't seen for a while and who used the photo frame to seek contact again. The rehabilitants explicitly mentioned that both messages are very special to them.

Greetings

The percentage of photos in this category is also 14.8%. It typically contains photos of people posing for the rehabilitant, even waving sometimes. The rehabilitant that only wanted to have photo contact with her own family only received greetings from family members. Her husband and children only took photos of each other, the house, its environment and the dog. No photos from category 1 and category 5 were sent to this rehabilitant. The greetings photos of one of the other rehabilitants are mainly from her children and their friends. In contrast, the unmarried rehabilitant received greetings from the members of the families of her sisters but also from colleagues and friends.

Everyday Life In and Around the House

The biggest category (27.3%) is the photos that were taken in the home environment of the rehabilitants. Examples are photos of dogs and rabbits, the garden, young children playing, older children sitting behind the house. Mentioned as being special were photos of a daughter and husband preparing and eating a meal. Another example of a special photo was the one of a son behind the computer "*in a position I have often seen him before*". Photos of the garden made it possible for the rehabilitant "*to see the garden in a season that I otherwise would have missed*".

Regular Events

Regular events (16.9%), the category which is second in size, contains photos taken by the children or husband while they walk the dog or go out swimming. The wife of the male rehabilitant took photos of bringing the grandchildren to kindergarten, an activity she did twice a week. The unmarried person did not get any photos belonging to this category.

Special Events

The special events form the smallest category with 3.8% of the photos. Only two rehabilitants received photos in this category. The unmarried woman got photos of children in the zoo and her families on vacation. The woman with a daughter in a foster home received photos of the vacation of her daughter with the foster parents. The others did not go on vacation in the time of the pilot. No photos of other special events like parties were sent either. This might be because such special events did not occur during the time of the pilot.

Funny or Aesthetic Photos

The category with funny or aesthetic photos contained 12.6% of the photos. In this category we find many photos of people who put on funny faces, the dog looking funny, as well as photos of a nice view of a lake, of a painting or a vase with flowers. These photos can often be attributed to other categories as well, dependent on where and when they were taken. In the final ratings the fact that for instance someone put on a funny face or that a nice scenery was photographed and sent was given preference to the fact that the photo was taken in the home of the rehabilitant.

Unknown/Undecided

In total 9.8 % of the photos were rated differently by the raters and the difference could not be resolved by the interviews only. We decided to analyze these photos separately. In one-third of these differences our ratings were 3 or 4 (everyday life or regular event). Examples are relatives dyeing each other's hair and people on their sailing boat. In another one-third of the differences we did not know if a person or object was new to the rehabilitant so we could not decide between category 1 and 2 or 6. The remaining one-third of differences had other reasons that occurred only once or twice (unknown location, humor or aesthetics interpretation, unclear photo).

6.3 Discussion

From the distribution of photos over the categories we now discuss how the photo frame influenced social connectedness in this study.

Almost half of the photos were classified in categories 3 and 4 that focus on staying in touch by sharing the everyday things of life. From post-interviews we learned that the rehabilitants perceived these photos as very important items that they had not seen for quite a while. In total, almost three quarters (71.6%) of the photos were sent with the intention to raise awareness of everyday life (categories 3 and 4; 44.2%) and of the fact that their family thought of them (categories 2 and 6; 27.4%). These photos are not necessarily followed by communication.

Only a small part of the photos belong to category 5: special events. Although this is the smallest category, rehabilitants indicated that these photos were very important for staying in touch. These photos, together with the photos in category 1 (in total 18.6% of the photos) will lead to follow-up communication, either immediately by phone, or by talking about the photos during a visit. We anticipated that in category 1 also photos of the functional category of Kindberg et al. [20] would appear. For instance, to discuss the choice of new things for the house, since for most rehabilitants alterations of the house are necessary. However, the photos we analyzed were all in the affective

category. This might be due to the fact that these rehabilitants were all in the last stage of their stay in the rehabilitation centre.

7. FURTHER RESEARCH

Our intervention was based on a commercially available digital photo frame. In general, the rehabilitants found the photo frame rather sufficient. As an extension, rehabilitants can receive videos on their frames and experience the feeling of social connectedness even more. Furthermore, the system should be symmetric by having a bi-directional communication/exchange of affective messages. Thus, move rehabilitants from playing a passive role to an active role in the system by further sharing tokens of care.

To allow rehabilitants to easily communicate their mood and exchange affective messages to friends and family we propose to use *Aurama* an augmented light emitting photo frame as shown in Figure 2. *Aurama* is equipped with a state-of-the-art light guide made of transparent material making it look like a typical photo frame, with the addition of emitting colored light 'auras' around the screen. It is equipped with an affective messaging system known as *intelligent photo frame jewelry* as shown in Figure 2. The messaging system allows users to explicitly indicate awareness of their emotions, availability, feelings, affections, or simply convey a message between each other in a playful manner. By holding an RFID tagged object (smiley, heart, etc.) close to the photo frame one of the above could be conveyed as a short affective message or token of care. On the receiving end, a colored aura would provide awareness of the affective message or status of the sender, and a graphical representation of the message would be shown on the display. Thus, both the rehabilitant and the remote family would have an *Aurama* photo frame and intelligent jewelry to decorate it with to exchange affective messages and tokens of care.



Figure 2: Aurama is an interactive photo frame emitting colored light auras and uses intelligent photo frame jewelry that provides explicit awareness of affections, status, emotions

8. CONCLUSION

The aim of this study was to maintain and enhance social connectedness for rehabilitants who are forced to leave their home environment for a while and for their immediate social network. By means of a user requirements inventory we found that these patients missed the everyday things of life at home and being part of their family's and friends' lives. To display snapshots and spontaneous moments, a digital photo frame was placed on the nightstand near the beds of the rehabilitants. Family and friends were provided with camera phones as a low-threshold means to capture small events or scenes in everyday life. The rehabilitants liked to receive photos on the photo frame and especially the surprise effect was appreciated. Though they were disappointed when they did not receive photos, most of the rehabilitants did not tell or show this to their relatives. Unfortunately the amount of photos sent decreased in the second half of the case study. Likely, this is caused by the novelty effect. However, the case study did not proceed long enough to find out whether the amount of photos

sent over time would extinguish or would become stable at a certain level.

More than 80% of the photos were sent to keep the rehabilitants aware of everyday life at home and to let them know that their family thought of them. Less than 20% of the photos contained new information or events that were sent to trigger follow-up communication. The photo frames enabled the rehabilitants and their family and friends to share the normal things in life without the immediate need or obligation for a (phone) conversation.

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