Supporting Reflection and Creative Thinking by Carers of Older People with Dementia

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***Abstract*—This paper reports ongoing research and development in the EU-funded MIRROR project to support and enhance reflective learning and creative problem solving during the care of older people with dementia. The research has designed and implemented apps on mobile devices that support more direct capture of care information in situ and support creative thinking about care in difficult situations from existing cases of good care practice. These devices and apps are currently being trialed in one care home to explore their feasibility.**

Keywords-dementia care, recording care information, mobile apps, reflective learning, case-based reasoning, creative thinking

I. MOBILE TECHNOLOGIES TO IMPROVE THE SUPPORT FOR DEMENTIA CARE

Recent advances in portable computing technologies mean that mobile digital devices are becoming increasing available for use in healthcare settings such as the care for people with dementia. Both existing and bespoke software apps that run on devices such as smart phones and tablets offer new opportunities for care staff to improve their care practices. To exploit these opportunities the EU-funded MIRROR integrated project [1] is exploring how mobile technologies can support care staff responsible for people with dementia in residential care homes.

Studies of current work practices in several UK residential care homes undertaken by the MIRROR project revealed new opportunities that mobile devices can offer when carried by members of care staff during a shift. There was limited use of information technologies. During a shift care staff recorded observations and other types of notes about residents on simple paper-based documents that acted as aide-memoire for documenting the observations and notes later. Most current applications for recording information about residents run on desk PC machines, and enable staff to record care notes about residents, document shift handovers and learn new care practices. Normally staff undertake these tasks during quiet periods and/or the end of their shifts, and complete the resident entries based on prompts from their hand-written notes. Such a process have some clear limitations. The paper-based notes are often incomplete and do not provide sufficient aide-memoires to complete a full record of resident observations and reflections about symptoms, diagnoses and possible improvements to the care of an individual resident. At the end of shifts care staff are under time pressure and often unable to spend as much time as they would like entering the record, and the limited number of desktop PCs available often creates bottlenecks, resulting in the care staff needing to queue to enter their records.

In MIRROR we conjecture that mobile devices can be adapted to support the same tasks but in situ during resident care shifts, thereby reducing the distance between the care tasks and the documentation of these tasks. These mobile devices can also increase the bandwidth of communication between care staff by enabling them to communicate directly more effectively during a shift and gain access to shared good care practices. In particular we have designed prototype mobile apps to encourage two specific improvements to the care process: (i) more reflective observations about residents by care staff, and; (ii) more contextualized support for care staff to aid them with the diagnosis and response to difficult situations. Each is described in turn.

A. More reflective observations about residents by care staff

It has long been a requirement for care staff to record the care they have delivered to an individual and the health status of that person at any point in time. When significant events occur this is a relatively obvious and straightforward activity. The member of care staff must ensure that the information is comprehensive and describes fully both what has occurred as well as the actions and tests undertaken as a result. In contrast, when considering the care of an individual with long term and chronic conditions who is relatively stable, there is an increased risk that care staff describe the current status of a resident as no change for a particular aspect of the condition or care provided, because it can be difficult to identify a very gradual change in the individual's condition which may occur over a longer period. However it is vital to identify that gradual change in order to take effective action and amend the care provided.

One current solution to achieve more effective recording of conditions and care is the framework captured in the acronym *CART* - recording that must be complete, accurate, relevant and timely. Staff are encouraged to use this acronym as a memory jogger to improve the quality of records of care, leading to replacement of statements such as *the individual ate well* by accurate statements of what was eaten at which meal and with or without assistance. However the effectiveness of *CART* relies on successful training and reinforcement to ensure

that care staff record information with all four qualities. Furthermore the current acronym does not directly support reflection about current successful and less successful care so that good practices can be learned and poor practices avoided. Another current solution is to ask care staff to role play the investigator of a complaint about the care of a resident based on their own records. This reflection leads them to appreciate the paucity of information available from an incomplete record. However, this reflective practice has its limitations, and cannot be applied to support all of the care staff on a regular basis.

Therefore, in MIRROR, we are pursuing a different but complementary strategy based on the use of mobile devices running apps that enable care staff to record information about care in situ at the time that it is generated, thereby ensuring that the information is relevant, accurate and complete. In addition the apps support more reflective learning about the care that is given by encouraging the care staff to reflect on and record the information using a different structure designed to encourage reflection. The devices and apps are described in section II of this paper.

B. *More contextualized support for care staff to aid them with the diagnosis and response to difficult situations*

Most adult social care services in England are delivered by 28,000 different services and 1.6 million staff regulated by the Care Quality Commission. The wide diversity of these staff and services makes it difficult to share information about problematic situations encountered only infrequently and/or disseminate good practices known to resolve these problematic situations. More senior staff and staff working in specialized services are known to have strategies to resolve these problematic situations, but this knowledge is not accessible to less-experienced care staff in a timely and effective manner. When faced with a difficult situation staff will need advice and information quickly, delivered in situ to the care to be given, and available around the clock.

Some emerging good practices are available. For example the Social Care Institute for Excellence report prototypical examples of good care practice in the form of case studies composed of the problem situation encountered and the observed good practice that resolved the situation [2]. Each case study is described in 200-300 words. Similar styles of case studies are available in other sources, albeit sometimes in longer form. In MIRROR we conjecture that these short case studies can provide a structure and format with which to capture then share contextualized good practices to care staff in situ. Each example of good practice can be documented by a specialist or senior staff member in natural language on one page of A4 using simple Word templates, thereby requiring no new technologies and only 10-15 minutes to record. Furthermore a member of care staff in situ during a care shift can browse and read each case study relatively quickly on a mobile device, and reach a conclusion about the suitability of the case study to the current problem situation within 1-2 minutes. Moreover, in time, it is hoped that the explicit donation of good practices by care staff will both establish a wider community of practice in which to learn about care practices and reward the staff who donate through explicit recognition in these communities.

Therefore, in MIRROR, we are delivering new apps and services to run on mobile devices that will allow care staff to describe a problematic situation that they are encountering in natural language, retrieve similar case studies automatically in a matter of seconds, read then browse the case studies to select one or more appropriate to the situation, then implement good practice based on the recommendations provided. To be able to deliver these apps and services we are exploiting sophisticated natural language parsing and matching technologies developed originally for software design but well-suited to this challenge. These apps and services are reported in section III of this paper.

The remainder of this paper reports the devices, apps and services developed to encourage care staff to offer more reflective observations about care and retrieve and adopt good care practices from shared repositories, then outlines some initial feedback about the feasibility of these devices and apps in one UK care home.

II. MOBILE TECHNOLOGIES FOR MORE REFLECTIVE OBSERVATIONS ABOUT CARE STAFF

In MIRROR we support more reflective observations by care staff through the use of micro-blogging – in essence each member of care staff micro-blogs each observation in real-time using Twitter. Twitter restricts each blog to a maximum length of 144 characters, thereby requiring the person who is blogging to reflect on the content and structure of each blog to ensure that it is complete and coherent, rather than provide a less structured monologue. It is this length restriction that we exploit in MIRROR to encourage care staff to reflect about the care being given. We then exploit other features of the micro-blogging app to share care staff observations in real-time to other staff using the same system to provide an overview of the care being given during a shift and redirect resources as needed. The following sections describe our use of micro-blogging in more detail.

A. *The Structure of a Reflective Observation*

Each member of care staff is guided to write an observation in three parts: (i) the room number of the resident as his or her unique identifier; (ii) the observation made, and; (iii) his or her own reflection, encouraged by the prompt – *what does this mean?* This prompt was chosen based on discussions with care staff to encourage reflection in language familiar to most care staff. One example reflection in this format is: *23d: washed, brushed hair and provided breakfast but did not eat much. Need to look again at whether diet is right?* Another is: *4: disruptive to other residents during lunch, and verbally abused staff. Need to talk to family about background issues*. Care staff are prompted to use this reflection structure by a visual prompt attached to each mobile device.

Care staff enter these observations directly in situ using the mobile device and Twitter app shown on the left-hand side of Figure 1. In MIRROR the app is implemented on an Apple iPod Touch locked to provide only the capabilities needed by care staff during a shift. The iPod Touch was chosen to be portable by care staff during a shift: it is only 4.4 inches tall, 2.3 inches wide, 0.28 inches wide and weighs only 100 grams. The observation is entered using the device's digital keyboard shown in Figure 1. Unlike regular tweets that can be followed

by members of the public, each observation is posted to a locked account that can only be accessed by the other devices being used by care staff and the shift supervisor. Each tweet can also be encrypted to ensure complete resident anonymity. Unlike the current process with paper notes, each observation is shared in real-time as shown on the right-hand side of Figure 1, thereby increasing communication between the care staff in the residential home and directing support to residents quickly.

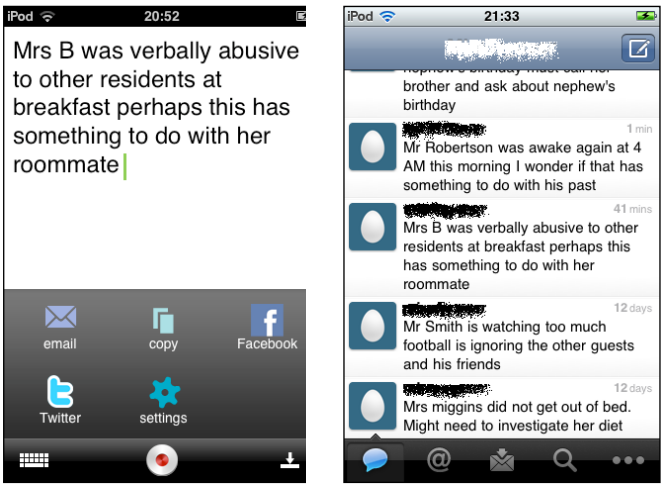

Figure 1. The use of Twitter to document reflective observations (on the left-hand side) and access to previous reflections (on the right-hand side)

B. Capturing Spoken Observations

The effective documentation of reflective observations via a keyboard assumes that care staff have both the time and skill to type their observations. However, our studies of current work practices revealed that this will not always be the case. During observed busy periods there was little time to write observations, let alone type them. Furthermore care staff cover the full age range and there was concern that older care staff less familiar with digital technologies would not want or be able to type observations. Therefore we implemented speech recognition software on the mobile devices to accept spoken observations from care staff then generate text versions of each observation that the staff can review and tweet with minimum effort. We installed the *Dragon Speak* app on each device because of its reliability and interoperability – a care staff member can tweet a text version of a spoken observation with just two clicks – one to end the recording, the second to tweet the parsed text, assuming that it is correct.

C. Training the Observation Collection Apps

Twitter supports predictive text based on built-in dictionaries however these dictionaries lack terms specific to the care for dementia. These terms include real names such as the names of hospitals, locations and ailments, and acronyms commonly used during observations. Therefore we trained the predictive text to include these real names. Likewise the speech recognition lacked real names and acronyms, as well as the local pronunciations in the trial residential care homes, so the speech recognition software will be trained through careful use of mobile devices by the same care staff over a period of time.

III. More Contextualized Support for Care Staff

In MIRROR we also support contextualized support for care staff through a bespoke app called *Carer* also running on the same iPod touch devices. *Carer* enables care staff with these devices to retrieve and browse similar cases of good care practice to the one encountered, then use information about the cases to think creatively about the current situation. The app has three components: (i) a repository of cases of good care practice; (ii) the case study discovery engine (ii) an app to generate queries and explore candidate case studies. Each is described in turn.

A. Repository of Cases of Good Care Practice

The repository contains structured descriptions of case studies in an XML data structure based on the structure of case studies reported by the Social Care Institute for Excellence [2]. Each has two main elements, both expressed in natural language – the problem encountered and solution applied. Each also up to five different facet values describing: (i) the type of observed resident behavior; (ii) the type of treatment applied; (iii) the date and time of the case study; (iv) the type of ailment or disease involved, and; (v) the triggering event. The repository is implemented using eXist, an open source native XML database featuring index-based XQuery processing. The discovery engine queries it using XQuery, a query language designed for processing XML data and data whose structure is similar to XML.

B. Carer's Discovery Algorithm

The algorithm discovers and retrieves descriptions of case studies from problem queries expressed in natural language by a member of care staff. Queries expressed in natural language, although easy to write, can be ambiguous and incomplete, so the algorithm has two important capabilities described at length in [3]:

1. *Query expansion* – the addition of terms in the query that have the same or similar meaning to existing query terms, to make the query more complete;
2. *Term disambiguation* – selecting the meaning, or sense of each term in the query to enable query expansion, thus making the query unambiguous.

For example the query *Mrs. X acted aggressively towards other residents at breakfast. Suspect underlying insecurities to new people* is incomplete because it does not define the *aggressive behavior* observed, and it is ambiguous because it does not define what the meaning of *underlying insecurities*. There are several possible meanings of *insecurity*, for example *the state of being subject to danger or injury*, or *the anxiety you experience when you feel vulnerable and insecure*? To make this query more complete expansion techniques are applied to generate more complete case queries, and term disambiguation techniques from information retrieval are applied to generate unambiguous queries.

The algorithm has the four key components, and the *WordNet* on-line lexicon [4] fulfils an important role for three of them. In the first the query is divided into sentences then tokenized and part-of-speech tagged and modified to include

each term's morphological root (e.g. *acted* to *act*, and *residents* to *resident*). In the second the algorithm applies procedures to disambiguate each term by defining its correct sense and tagging it with that sense by iteratively using context knowledge from other terms in the query (e.g. defining a *resident* to be a *someone who lives at a particular place for a prolonged period* rather than *a who lives in a hospital and cares for hospitalized patients under the supervision of the medical staff of the hospital*). In the third the algorithm expands each term with other terms that have similar meaning according to the tagged sense, to increase the likelihood of a match with a case study (e.g. the term *aggressive* is synonymous with the term *hostile* which is also then included in the query). In the fourth the algorithm matches all expanded and sense-tagged query terms to a similar set of terms that describe each case study in the case study repository. Query matching is in 2 steps: (i) XQuery text-searching functions to discover an initial set of case study problem descriptions that satisfy global search constraints; (ii) traditional vector-space model information retrieval, enhanced with *WordNet*, to further refine and assess the quality of the candidate case study set. The output is a ranked list of matched case studies in more-relevant to less-relevant order.

C. The Interactive Carer App

The *Carer* app that care staff use to generate problem queries and browse retrieved case studies was developed using ASP.NET and the open source iWebKit framework for the iPod touch [5]. A user enters a natural language description of a problem situation using the text box shown on the left hand side of Figure 3, then refine it by selecting one of the observed behavior values such as *Resident is violent* shown on the right. When the user presses the *Retrieve similar cases* button the app automatically generates a query that it fires at the case study repository.

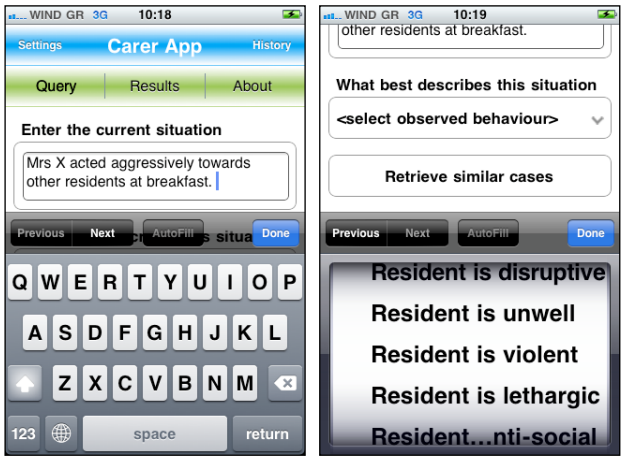

Figure 2. Describing a problem situation with the *Carer* app

Figure 3 shows how the three most relevant retrieved case studies are presented in the app. Then how each case study is presented when selected.

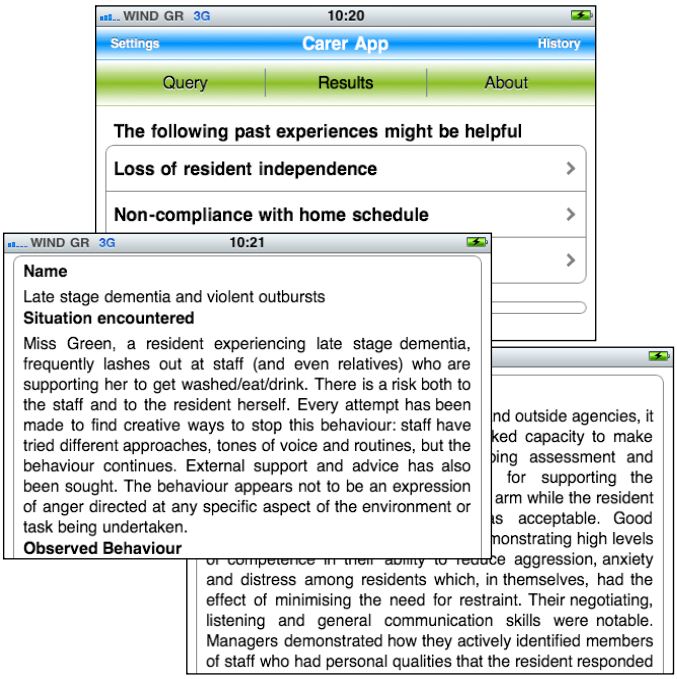

Figure 3. Retrieved case studies as presented to a user by the *Carer* app

IV. Current and Future Research Activities

We are currently conducting feasibility trials with the reflective observation and contextualized support apps at one UK residential care home. Care staff at the care home will be given iPod touch devices to use during their shifts to record their observations and access a first version of the repository containing 20 case studies taken from public sources. Early results indicate that care staff can perceive the potential benefits of the devices, and we are exploring whether these devices can be used effectively in a care home environment.

Acknowledgment

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