

CoasterChat: Exploring Digital Communication between People with Early Stage Dementia and Family Members Embedded in a Daily Routine

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People with dementia living at home experience difficulties in participating in social interactions, while staying in contact with family adds quality to their lived experience. Initiating communication can be challenging for family, since there is a natural disparity between their life patterns and those of people with dementia. In this paper, we present CoasterChat, an exploration in design that embeds asynchronous digital communication in a daily coffee routine to support social sharing between people with early stage dementia and their family. In this preliminary study, the aim is to explore suitable interaction design that provides an opportunity for technology to be embedded in existing individual routines. Initial results show the importance of personalization in digital guidance. Benefit for family who engage in the interaction lies in the flexibility and accessibility of asynchronous communication. Finally, we discuss that these routines enhance social relationships which demonstrates the opportunities of creating a meaningful interaction between people with dementia and family members.

CCS Concepts: • **Human-centered computing** → **Field studies**; *Empirical studies in HCI*.

Additional Key Words and Phrases: dementia, digital communication, daily routine, synchronous interaction, social sharing, empowerment, experience-centered design, suitable interaction design

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Fig. 1. CoasterChat design that embeds asynchronous digital communication in a coffee routine (left: PwD side, right: Family side)

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1 INTRODUCTION

People with early stage dementia, who often live independently [37], have an increased risk of loneliness [14]. They are often less capable of using technology [31] which makes them dependent primarily on in-person social activities. Family members often have busy lives with lots of other commitments, which prevent them from facilitating additional contact and in the long term can cause depression symptoms [32]. Therefore, asynchronous communication might be an opportunity to allow more freedom and flexibility to family members' schedules [21]. Engagement in meaningful activities for both parties can reduce the communication barriers and upgrade the social connections [34]. Considering that people with dementia find it difficult to learn new things, incorporating a meaningful activity into established routines can help them maintain everyday skills and basic interaction capabilities in a structured manner [5, 38]. In this paper, we present CoasterChat, a design exploration into strengthening remote social sharing between a person with dementia (PwD) and family members during their individual coffee routine with the aim to investigate the role of design in facilitating an asynchronous dialogue. CoasterChat consists of a coaster stand interface for the PwD and a spinnable coaster for family members (see Figure 1). Our initial pilot study consisted of 1) an artifact exploration at a daycare facility where three people with early stage dementia and two caregivers participated, and 2) an online prototype evaluation with two family members. This pilot study provides preliminary insights into the role of using an existing routine for a moment of sharing and communication. It also provides the potentiality to guide the person with dementia through an engaging activity interactively. Insights from this exploratory design work present opportunities for future research on the design of communication tools for people with dementia and their social network.

2 DEMENTIA, SOCIAL DYNAMICS AND HCI

2.1 Dementia and its social dynamics

People with early stage dementia have to cope with cognitive changes which interferes with complicated activities of daily life [9, 11, 37]. These changes vary among individuals which is caused by the diversified character of dementia [10]. Moreover, living with dementia brings challenges which potentially disrupts social relationships and often leads to social withdrawal [36]. The current COVID-19 pandemic has upended the social lives and relationships of people with dementia and their relatives even more [19]. "Social distancing" leaves older adults, and specifically people with dementia, in severe social isolation that subsequently causes serious loneliness [19]. A series of studies indicate that maintaining social relationships can add quality to people with dementia's lived experiences [29, 38] and is essential for their well-being and maintaining personal identity [35, 45]. Additionally, it is significant for people with dementia to stay in contact with and maintain access to regular support from family members in their daily routine [15] which can even delay the development of dementia [24]. According to the findings of Strandenæs et al. [2018] people with dementia experience positive attitudes towards activities at day care centers in their regular everyday lives due to the companionship with others [38]. This highlights the importance of having regular social and relational routines in a structured manner.

2.2 Dementia and social technology

There are great temptations for designers and technology developers to utilize state-of-art technology, however, the most advanced technology does not necessarily mean that it is the most suitable solution for people with dementia [20]. HCI-scholars argue that technology should be considered as part of people's lived experiences and that research and design should focus on enriching the quality of life, not only for the cognitive deficits of people with dementia

[27, 48]. An exploration in guided design, to stimulate and support people with dementia, shows promising results to facilitate interaction between people with dementia and design artifacts [13]. The focal point that has been recognized is that design should enrich the individual experiences and encourage social connections of people with dementia [16, 26, 46]. Following this experience-centered approach, research has provided evidence that design can support someone's 'personhood' [44], and thereby contributes to the ability to exert their agency [12]. In order to design for personal and relational experiences, different studies have opted ways to involve and collaborate with people with dementia [17, 29, 43]. Previous work has applied this approach to investigate the role of digital media in supporting meaningful social interactions between people with dementia and social relations [12, 18, 33, 41, 47].

A study by Welsh et al. [2018] found that through various familiar media outlets, different discussion topics can facilitate a meaningful shared moment between young people and people with dementia [46]. Additionally, Brereton et al. [2015] argue that applying a connecting moment into a "habituated object" can be natural for both parties to adopt and by this fosters communication and engagement with a family member who lives remotely [7]. Combining a routine with an asynchronous communication tool might support the person with dementia to remember to use the artifact and lower the burden for family members to initiate contact by not feeling the need to directly respond [21]. The modality of social sharing, which has become a pervasive activity of contemporary daily life [26], could be adapted to the users. This need for personalization is based on designing for different stages of dementia [40] and personality differences of people in general [44]. Therefore we will explore social sharing in an embedded daily routine [4].

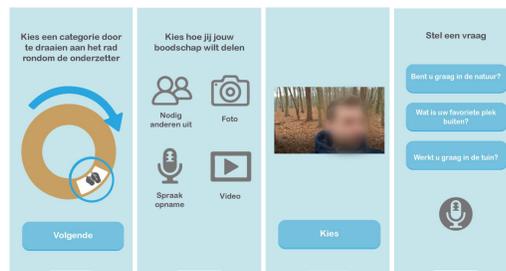
3 COASTERCHAT: EMBEDDING DIGITAL COMMUNICATION IN A DAILY ROUTINE

3.1 Social sharing in a daily routine

CoasterChat invites people with dementia and family members to engage in social sharing during a coffee routine. Drinking coffee has a long history of social engagement [39], which thus provides an excellent daily routine to incorporate social sharing activities in. CoasterChat establishes a remote connection between both users using a familiar redesigned coaster set. For the family side the artifact consists of a spinnable coaster (see Figure 1), which is connected to a mobile application (see Figure 2b). Lights on the spinnable coaster remind the family to send a new message to the person with dementia, while the spinning mechanism helps to decide on a conversation topic. In the mobile application, the family member can choose the digital media they want to share, including pictures, voice recordings and videos. Based on the suggested topic, the app will propose several relevant questions that the family member can choose from, which can be voice recorded and send together with the digital media to the PwD. The questions are included so that the PwD can relate with their past experiences, which can stimulate reminiscence [28].



(a) PwD side, an example of the guided animation



(b) Family side, mobile application

Fig. 2. Interface design to enhance interaction for Pwd and family side

The artifact for the person with dementia consists of a coaster stand (see Figure 1) which includes a set of coasters, a digital screen and a microphone. Each coaster represents a conversation topic, which corresponds to the family side's coaster's topics. By taking out a coaster, the digital screen starts to play the instructions and once the drink is placed on the coaster the received message from the family member starts playing. The two containers in front of the screen are reserved for milk and sugar to create a condensed setting for the necessities of a coffee break. The routine use of CoasterChat to engage in social sharing can contribute to the feeling of connectedness and thereby strengthen the family bonds [8].

3.2 Empowerment through suitable interaction design

CoasterChat provides people with dementia with a joyful and shared coffee moment at home through suitable interaction design. The artifact allows the PwD to be guided through the interaction by three different modalities: 1) feedback lights on the coaster, 2) a visual animation (Figure 2a) on the screen, and 3) audio instructions. Providing multiple guidance modalities might empower the existing capabilities of the person with dementia while using the system [23]. When the PwD receives a message from relatives, the coaster with the corresponding topic will bounce and light up to guide the person to pick up that specific coaster and initiate a coffee break. CoasterChat avoids touch screen interactions and responds when the person interacts with the tangible objects, such as the coaster. As soon as the coffee mug is placed on the selected coaster, the digital media automatically starts playing. This is followed by an animation of the microphone to indicate a moment of answering. The microphone is used for recording a voice reply, in response to the questions sent by family members. The interactions with the physical objects are facilitated by an Arduino that is connected to three pressure sensors, a LED strip and a LED. Processing is used to connect the digital screen to the Arduino circuit in order to evaluate the prototype with participants.

3.3 Flexibility through asynchronous communication

CoasterChat encourages family members to share content asynchronously and communicate remotely with people with dementia. The lights of the family CoasterChat artifact subtly remind the family to take a coffee break and share a life moment with the person with dementia. In case the time of being notified does not fit their schedule, they can pass the signal to the next family member actively through the app or by ignoring it for a pre-set amount of time. The PwD will receive a notification when there is a new message. If the PwD would like to have a coffee moment with CoasterChat when there is no new message, they are able to look at older messages by picking up a coaster with the topic they would like to listen to. This gesture of actively listening to old messages incorporated in a habituated object helps maintaining the existing social relationships [42]. The family can help the PwD to set a preferred time slot for a coffee break which means that the message will only be received during these moments. This enables both sides to communicate at their own convenience.

4 PILOT STUDY METHOD

The aim of this pilot study is to explore the potential of remote social sharing by augmenting a coffee break routine while people with dementia interact with CoasterChat (I) and receive initial feedback on the artifact designed for family members (II). Although research within the corona pandemic contains several limitations, it remains important to explore the engagement and interaction between people with dementia and social artifacts. To facilitate this, the study was conducted at a daycare facility for people with dementia where all safety recommendations including face masks, sanitising gel and a minimum distance of 1.5 meters were covered.

Table 1. Overview of the participants of study (I), including three visitors (diagnosed with Alzheimer's disease) and two caregivers.

Visitor (M/F, age)	Caregiver (M/F)	Dementia's Stage
P1 (F, 89)	C1 (F)	Early stage
P2 (F, 87)	C2 (F)	Early stage
P3 (F, 86)	C2 (F)	Early stage

Table 2. Overview of the participants of study (II), including two family members (diagnosed with Alzheimer's disease) of people with dementia.

Family member (M/F, age)	Dementia's Stage of relative
F1 (F, 49)	Early stage
F2 (F, 53)	Early stage

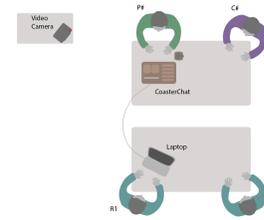


Fig. 3. The study set up (I) consisted of one PwD (P#), one caregiver (C#) and two researchers (R1,2).

The second part of the study was conducted remotely since the benefit of conducting an offline session with family, in which they would have been able to interact with the physical artifact, did not weigh up to the risks of travelling and meeting in person.

In total, three participants with early stage dementia, diagnosed with Alzheimer's disease (P#), and two caregivers (C#) participated in study I (see Table 1). Study II included two participants (F#), who have a family member with early stage dementia, diagnosed with Alzheimer's disease (see Table 2). Prior to the study, all participants were informed about the purpose of the study and the study set up. All participants provided their written consent and were reminded that they could exit the study at any moment without any negative consequences, nor having to provide a reason. Ethical approval was received from the University's Ethics Board, as well as from those responsible for the care home.

During the first study (I), the person with dementia was accompanied by a qualified caregiver at all times to evaluate if the PwD was still contented to participate in the study. The study was performed in a separate room, so that participants could not be distracted, see Figure 3. Moreover, the study set up was designed to provide people with dementia with a pleasant activity to feel comfortable during the research [30]. Study (I) consisted of three stages: 1) initial exploration and introduction of the artifact, 2) interacting and engaging with the artifact and 3) an exit interview. During the exploration of the artifact, the participants were asked to communicate their thoughts regarding their first impression. Although the artifact was fully functioning, the decision was made to use a Wizard of Oz [25] method to ensure that the interaction could proceed without any disruptions. To have a complete interaction, a family side video message was created by the researchers. One researcher (R1) used a laptop to activate the screen instructions based on the initiated interactions of the PwD. The participants were free to interact with the designed artifact, and would only be assisted by looping guidance on a 20 second interval if the requested action was not yet completed. If the action could not be completed without additional help or would cause noticeable frustration, the participants were assisted by either the caregiver (C#) or researchers. Afterwards, to reflect on the interactions and the artifact, an exit interview was conducted with both the PwD and the caregiver. A video recording was captured to document the interaction with the artifact. This video was evaluated on verbal communication, body language, and emotional responses based on the VC-IOE method [22]. A thematic analysis was conducted, where initial coding was done by two researchers. Subsequently the research team as a whole identified themes by analysing and clustering the codes. This inductive approach was used to find preliminary results [6].

The second part of the study (II) was performed via Microsoft Teams (MT), in which two family members (F#) of people with dementia participated. This interview aimed at getting insights in the implementation of the artifact in the daily routines of family members of people with dementia. To provide the foundation for the semi-structured interview,

a video was prepared that showed the interaction of the artifact for both the PwD as well as the family members. The interviews were audio recorded and in its entirety transcribed and analysed. Similar to study I, the results were discussed within the research team.

5 INITIAL FINDINGS

5.1 Empowering technology usage through suitable interaction design

Instructions to use the artifact consisted both of auditory (audio instruction) and visual feedback (through animations and LED feedback). As indicated by P1, visual animations grab attention, however the connection to the prototype where the action had to be mimicked was sometimes missing *"Yes, something moves up every time, that's all I see"*. On the contrary, P3 carefully went through all steps of the interaction with very limited assistance needed. She succeeded in taking out a coaster following the instructions precisely. After the video message was played and instructions were given by the artifact, P3 held the microphone in front of her mouth while answering the question, see Figure 4b. Nevertheless, it was clear that hesitation and insecurity about what to do meant that the participant required more assistance to continue. For example, P2 identified the need to take out a coaster but did not do so before researcher's confirmation *"Can I take it out?"*. These differences in participants clarify the importance of personalized suitable interaction design. The focus should be on the amount of information available at one point (prevent overwhelming), the repetition of the instructions on the appropriate interval and the need for confirmation of correct actions.

5.2 Creating an engaging activity

CoasterChat not only provides a new way of communication, it also facilitates a meaningful and engaging activity. At the start of each session, participants could explore the artifact. Interesting here was the observed curiosity from the participants about the different aspects of CoasterChat. For example, P1 grabbed one of the coasters to have a closer look at it and mentioned, *"Oh, they are all different"*, see Figure 4a. During the interaction with CoasterChat, differences were observed in the level of engagement. This became visible through the re-positioning of participants. P2, for example, moved closer towards CoasterChat, so she could hear it clearly. Furthermore, P3 clearly demonstrated her enthusiasm when the video message started, with an eager *"Hello"*.

It was remarkable how long the participants talked about their memories in all three sessions. When they heard the question that was recorded in the video message and were asked about their lives during the interview, all participants answered elaborately. In the exit interview, both P2 and P3 were enthusiastic. P2, mentioned *"Yes yes, that was nice"* and P3 did not even want to stop *"I like this, go on"*.



(a) Participant explores the artifact and curiously takes out different coasters.



(b) Participant picks up the mic and starts answering elaborately.



(c) Participant smiles while talking about her interactive photo frame.

Fig. 4. Participant interacting with prototype during the study.

5.3 Exploring routines using a redesigned familiar object

CoasterChat aims at improving existing routines by incorporating technology as a means of maintaining social relations. P2 mentioned she likes to have a moment of reminiscence during her coffee break. She explained enthusiastically, while smiling, about an interactive photo frame she enjoyed using (see Figure 4c). This confirms the feasibility to embed an activity into a coffee routine. Furthermore the desired benefits of a habituated object can be disturbed by anomalies in the design. For example, P2 hesitated to take out the correct coaster from the coaster stand due to the unfamiliar exposed wires. Additionally, P2 mentioned that before the corona pandemic she used to have a weekly routine with her grandson *“My grandson, he always came to eat with me on Wednesdays, but now with corona [not anymore]”*. This shows the demand for still having a common routine together with their family. The fact that being physically together is not always possible reveals opportunities for a remote social sharing routine.

5.4 A moment of sharing for family members

Family members describe CoasterChat as a supplementary way of communicating between relatives and people with dementia. F1 and F2 would integrate the coaster prominently in their daily lives by placing it on a table where they would be able to easily notice the light notification. F1 mentioned multiple times the advantage of having a simple shareable activity with their relative *“It is really accessible to just share something” (F1)*. However, F1 was a bit worried about the unnatural situation that was created. *“Now it seems I have to send a message because that light is on. It is no longer [...] spontaneous.” (F1)*. Nevertheless, when talking about what could be sent, multiple ideas came to her mind, *“We have had a dog since October so that’s great fun [...] so it is really nice to share something like that.” (F1)*. This is why F1 also mentioned that she preferred talking about things happening in her daily life rather than using CoasterChat to opt a category. F2, however, acknowledges that she would like to use the spinning option *“Spinning the coaster is kind of an interesting activity during break.” (F2)*, yet she would like to customize the categories. Finally, when discussing the collaboration between family members, F1 indicated she would like to use the function of ignoring the notification of the coaster and send it to the next person. She mentioned the possible interaction with her sister as an example *“Then you might think I just send it to her after an hour and if she does nothing for an hour, it will come back to me.”(F1)*. Having the possibility to collaborate shows opportunities for compensating for different busy life patterns.

6 DIRECTIONS FOR FUTURE RESEARCH

The results from the interactive session at the daycare facility, together with, the interviews with family members show the potential of CoasterChat and demonstrate various opportunities of integrating technology into a daily routine to have meaningful social interactions.

6.1 Asynchronous communication as a means of maintaining contact

Asynchronous communication provides opportunities for connecting people having different schedules by adding a delay in communication. This might add more flexibility considering the distinction in the ways of living between the person with dementia and their family. CoasterChat emphasizes the important roles of family members as their engaged interactions with people with dementia tends to be caring and thoughtful [1]. However, since the contemporary communication can be a burden for family [32], our study showed a possibility of using asynchronous communication to solve this. Future research should consider how asynchronous interaction can further support the long-term social relationships between people with dementia and their family.

6.2 Social sharing embedded in daily routines

Integrating a social sharing activity into the routine of a coffee break brings structure and meaning into the daily activity of people with dementia. As Andersen et al. [2019] indicated, connecting daily routines by means of suggested activities and tools can have a positive impact on people with dementia [2]. The ritual aspect of routines combined with a redesigned familiar object can potentially make it easier for people with dementia to remember the purpose of the technology and how it can help to understand the interactions with the artifact. Conducting a longitudinal study should provide insights on how the artifact will be adopted in an already existing routine in the long term. To get reliable results the study should take into account the individual differences [10], which means that a sufficient amount of participants need to be recruited and the study should be conducted in the home environment of these individuals. Future research should consider how those daily routines can support active engagement from both sides in a structured manner and if there are more daily routines that are suitable for embedded activities.

6.3 Technology to guide people with dementia

With the increasing ubiquity of computing technology in our everyday environment [3], intelligent interactive systems become more humanized and intuitive. CoasterChat provides an example of utilizing multi-modal interaction such as audio and visual modalities, which could be utilized as meaningful guidance, especially for people with dementia. By being able to individually operate CoasterChat, their initiatives and autonomous behaviour is strengthened [12]. Considering the individual differences [10], it would be crucial to further explore how suitable interaction design can be utilized among various dementia cases and other personality traits. Additionally, future research should explore how the interaction with the CoasterChat evolves over time, based on the emerging challenges for the individual.

7 CONCLUSION

CoasterChat demonstrates how routines can provide an opportunity for an accessible, flexible social interaction between people with dementia and their family members. Asynchronous communication requires a carefully designed artifact with suitable interactions that can provide structure to the everyday life of people with dementia. The flexibility of CoasterChat allows family to participate at their own time, while the connection of a regularly occurring activity allows for frequent contact. We encourage future research on social technology for people with dementia to consider existing routines with the aim of solidifying the needs and finding new opportunities for social communication. We see the importance of further design research to alleviate challenges around designing social technology for dementia.

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