

Processes of Reminding and Requesting in Supporting People with Special Needs: Human Practices as Basis for Modeling a Virtual Assistant?

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Abstract. The text reports findings of a case study based on the investigation of reminding activities and request practices in the specific context of supported living. These activities turn out to be highly *adaptive processes* that are embedded in complex assistive networks. The *process of reminding and requesting* represents a central practice deployed by the assistive institutional and social environment. It suggests to provide a consistent structure that meets individual needs in everyday life of cognitively impaired people. In the light of the development and engineering of assistive technologies we discuss if and how human practices could serve as a basis for modeling an Embodied Conversational Agent (ECA) based assistive system for cognitively impaired people with respect to the adherence of their autonomy.

1 INTRODUCTION

People with cognitive impairments as well as elderly people require special assistance in managing their daily routines like household activities or managing the everyday structures when living independently. Cognitive or physical challenges often affect or lead to a decrease of the quality of life. Hence, maintaining an autonomous life in a familiar social environment and home for as long as possible has become a central issue in today's societies [1].

Research on technical assistive systems strives to suggest solutions for this social challenge, e.g., in the realm of Ambient Assisted Living and Social Robotics. To this end, multimodal dialogue systems represented by Embodied Conversational Agents seem particularly suited, as they can be easily integrated in private homes using modern TV sets, allowing for intuitive human-machine interfaces, using means of natural communication when entering and managing appointments and being reminded of individual tasks or events [2].

The question of autonomy arises when considering the integration of an assistive technology to support independent living and in the setting of supported living with distributed actions. Results of ethnographic research in an institution of supported living for people with cognitive impairments, i.e. people with special needs in independent living, presented in this study, reveal practices of reminding and requesting as essential to preserve well-structured everyday routines. Besides the moment of acute reminders, the complex *process of reminding and requesting* practices that precedes the actual reminder is relevant to form an

understandable request-reminder and its accomplishment. These processes are closely interwoven and coordinated with an assistive social and institutional network. Set against this background the integration of an assistive technology into already existing assistive networks carries a strong ethical issue with respect to the preservation of the individual autonomy [3].

This study shows how ethnographic research serves as a valid approach to user centered design respecting the Human Value Approach [4] and to gain deeper insights into the actual needs, practices, daily routines and competences of the potential users. The investigation addresses the following questions:

- A) How could the activities of reminding and the actual requests, i.e. acute reminders, in every day practice be described?
- B) How are reminders established in a meaningful way, so that their intent and consequences are understood and followed by meaningful activities?
- (C) How could the reminding and requesting practices be implemented into an assistive technology and how could an ECA as a daily-assistant be integrated into the social and institutional network that encompasses people with special needs?

2 ETHICS AND TIME MANAGEMENT

2.1 Ethical dimensions of assistive technologies

Based on sociological analyses of human activities and technology, Rammert speaks of “distributed action[s]” [5: 18] and “distributed agency” [5: 5] and describes them as a multiplicity of actions which are distributed over temporal and factual dimensions. In this context technical engineers, have to consider how system influences human relations, hierarchies, competences and the division of work. Winner stresses that “The things we call ‘technologies’ are ways of building order in our world.” [6: 127] and so, they shape society, individuals and their actions. Thus, the design of technical systems always reflects implicit or explicit values and can never be neutral. While the approach of Value Sensitive Design suggests to integrate the needs of human users and values [7] the Human Value Approach [4] goes one step further with the demand not only to consider the users’ needs but also to apply the idea of Human Values to the technologies themselves and the development process and the disciplines involved in the design process. Human values are meant to be “ideas we all hold about what is desirable in different situations, societies and cultural

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contexts" [4: 35]. As these values differ individually it has to be made transparent in the design process of technological and especially assistive systems which of them affect technology.

In the design process of technical systems ethical issues have to be considered not only from the individual perspective but also from an institutional and social viewpoint. The model for ethical evaluation of socio-technical arrangements (MEESTAR) [3] is one approach that is not only taking users' needs into account but also the ethical evaluation of a technical system. MEESTAR suggests seven dimensions for the ethical evaluation of technical artifacts: care, autonomy, security, justice, privacy, participation and self-image. These dimensions are applied on an individual, organizational and social viewpoint to systematically carve out ethical issues and possible areas of conflict.

In the area of assistive living, especially when focusing on assistance in the field of time management and support of temporal orientation by an ECA-based assistant, the dimension of autonomy plays an essential role. Technical artifacts that remind, or request users to perform a task or to keep an appointment, and afterwards check the accomplishment of a task, raise the question of agency and autonomy on the one hand, but also contribute to various levels of individual security and participation.

2.2 Technology & time-management

Human Computer Interaction (HCI) studies on time management support and calendars show how reminders can be designed as requests and argue to design them in a multimodal way to be effective, usable and accessible for a diverse user group [8] [9]. However, the authors stress the right application of reminders to work properly, which includes both the timing and the form of the reminder. Going beyond these considerations, we will show that not only timing and form of the reminder need consideration when modeling an assistive technical system, but also the right level of (increasing) urgency and the need for adaptation to social [10] and interactional circumstances over the course of time.

Though those HCI studies refer to context they do not show the dependencies and fine-grained coordinative practices of an assistive network [10] in the domain of time management. Our aim is to trace how reminders emerge in the context of everyday activities within a highly personalized and complex support network and to raise the question of whether and how a technical assistive system could be integrated into the complex structures.

2.3 Requests in care & supported living

Requests as a subject of research have a long tradition within linguistics and there are several attempts to describe and define requests [11] [12] [13] etc. However, these approaches mostly describe requests from a speaker's perspective not taking into account the interactional situatedness and procedures of production and narrowing requests down to singular utterances. Conversation Analysis (CA) considers the sequential procedures of interactions and reveals insights into the production processes of reminding and requesting and what speakers consider when producing them. Studies from various settings (care, medical, HCI etc.) show that syntactical forms of requests hint at the speaker's understanding of the recipient's capability to accomplish the request. Yet the syntactical form itself also reflects the entitlement of the speaker to place a request [14] [15] [16]. These findings can be applied to the

modeling of technical systems regarding display of availability, reciprocity and acknowledgement [17].

In sum, linguistics, CA and HRI (Human Robot Interaction) research widely defines requests as represented by singular verbal utterances even though, there are hints at the influence of contextual, interactional and sequential circumstances for the production a singular utterance. Besides, especially research in care settings has primarily focused on requests made by the care-receiving party in face-to-face interaction. Our aim is to expand this perspective by describing requests in a broader sense that takes not only the sequential structure of interactions into account, but also the social and institutional perspective. To provide valid statements for the implications for an ECA-based assistant [2] [18] we examine the requests made by the support worker. This perspective encompasses a highly ethical issue by asking how requesting practices can be embedded into a technical system without compromising the autonomy of the client.

3 STUDY & METHOD

3.1 Ethnographic Research & Data

The research is based on focused ethnography [19] in an institution of supported living based in Germany where people with cognitive impairments get individual in- or outpatient care as required. The research was directed at gaining insights into individual, institutional and social structures, that emerge from everyday activities and routines. We especially explored the actual routines, competences and strategies of people with special needs (clients) in independent living and focusing on the needs of assistance. The institution is located in the sector of integration aid (Fig. 1.) which is organized on two levels: a local 24-hour attendance service and individual outreach work provided by support workers.

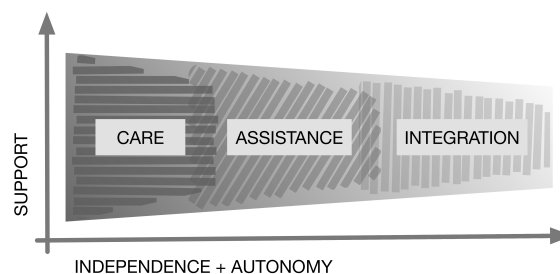


Figure 1. Support levels within in- and outpatient care

The inspection of individual (outreach work) and institutional settings (attendance service) revealed that there is a differentiation between required support levels depending on independence and autonomy of people with special needs. There are three merging levels of support: care, assistance and integration (Fig. 1). Clients with special needs in the care area are supported exclusively within inpatient care and intensive social and physical support. Clients with special needs in the area of assistance live either in in- or outpatient care with individually adjusted support depending on the area of support. On the support level of integration the clients with special needs are living in outpatient care mostly at their own homes and work in so-called sheltered workshops.

To get a comprehensive overview of what assistive practices actually look like, how they are communicated and coordinated

within the assistive social and institutional network of the client, the ethnographic study took place in different areas and settings within the institution. As the integration aid is based on two forms of assistance, we first focused on the central office of the attendance service as the “center of coordination” [20] in the supported living institution. Here we examined how information is shared and transferred, appointments are made and tasks are coordinated. The second focus was on a more intimate setting of regular, mostly one-on-one, weekly assistance meetings with the support worker and the client. We accompanied three client-support worker-tandems repeatedly within a 4-month period. These meetings normally take place at the client’s home and are part of the individual outreach work that among others, involve planning activities, post-processing of past events and assisted time management to provide temporal orientation and structure. Further areas of the ethnographic research focused on a weekly communal breakfast organized by the institution, everyday routines such as assisted grocery shopping or leisure activities (e.g. multimedia classes).

Following the principles of focused ethnography [19] the data was collected during repeated stays in the field and contains a variety of data types, that are ethnographic field notes, observation protocols, documents and photos gathered exclusively during participatory observation in the central office. Further audio- and video-data was recorded during assistance meetings, the communal breakfast, grocery shopping and leisure activities.

The fine-grained analysis of video data is based on CA and provides access to the understanding of micro-sequential processes in interactions [16]. This approach relies on repeated analysis of recorded data and detailed multimodal annotations of relevant modalities of the interaction (e.g. verbal, gaze etc.) to sequentially reconstruct the process of reminding and the interaction order with regard to the temporal interrelationship of modalities. The verbal transcripts are based on the conventions of second edition of the German Conversation Analytical Transcript System (GAT2) [21].

4 REMINDING AS A PROCESS

The ethnographic study reveals the activity of reminding within assisted time management in the context of an assistive living institution as a *process of reminding*. It is framed and coordinated by a client’s assistive network [10], encompassing both formal institutional assistance and informal assistance. The concept of the *process of reminding* contains essential social, institutional and conversational practices and planning activities (Fig. 2).

These planning activities are closely connected to the individual needs and competences of the client and are embedded into the organizational structure of the assistive network. The data show that planning activities usually start with an appointment registration that can be initiated by the client herself/himself, by her/his assistive network or external sources. Either way, this registration is communicated and coordinated with all involved parties. The joint planning of an appointment allows a maximum of transparency and agency for both, client and support worker. Joint planning, that is part of the regular assistance meetings, is one aspect of legitimization of the support worker to apply the successive steps of the reminding process.

We identified different steps that evolve as a *process of reminding* after the initial appointment registration. The core process consists of two essential practices applied by the assistive

social and institutional network: successive reminders that have an instructive character and acute reminders that function as requests.

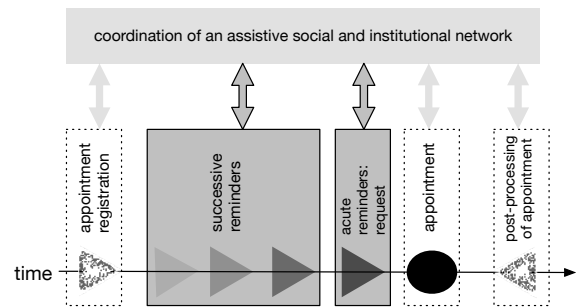


Figure 2. Process of Reminding framed by an assistive network

Successive reminders appear to have a twofold function for the clients with special need in temporal orientation: in the long term they provide reliability regarding planning activities and support temporal orientation on the one hand and on the other hand help to anticipate acute reminders. Acute reminders have a request character due to their temporal proximity to appointments. When comparing this with the findings regarding requests in care settings we see a contrast in the performance of a request and the form not an isolated utterance, but embedded in a request context. The concept model of *reminding as a process* finishes with the actual appointment or optional post-processing.

The *process of reminding* relies on highly complex and adaptive assistance networks, involving official institutional staff as well as an informal social environment involving family, friends and colleagues. This highly personalized flexible support network is being formed to respect and support the participants’ competences and capabilities.

5 PERSONAL SUCCESSIVE REMINDERS

The following case study focusses on the process of successive reminding during an assistance meeting and is temporally located after the appointment registration and before the acute reminder (see chapter 6). The analyzed segment is a record of an assistance meeting where a support worker (S) and a client (C) discuss upcoming and past issues at C’s home. C has no temporal orientation and therefore depends on explicit and recurrent reminders and requests. S’s successive reminding strategies are produced in different formats and temporal stages during the assistance meeting with C (Fig. 3 I-IV).

(a) *Announcement: first appointment reminder*: After discussing recent events S starts the first announcement on reminding C of an upcoming appointment for an assistance plan meeting in three days on a Thursday at one o’clock. The last assistance plan meeting was cancelled and the appointment has now been rescheduled. This appointment involves not only C and S but also C’s legal representative. As there is an institutional network engaged there is the need for coordination. Another rescheduling or cancelling of the appointment due to a possible non-appearance of C would imply additional organizational expenditure for the assistive network. So, C’s punctual appearance has an increased significance in this context. A successive reminding process is central during assistance meetings and an essential key to assure a punctual appearance to appointments.

With his question (Fig. 3 I 01-03) S is reassuring and checking that C is already aware of the upcoming appointment for the

assistance plan meeting. C confirms with **yes**. After the positive confirmation of C, S names the time. By using a conjunction and a temporal adverb he marks the time **and this time at one o'clock** (05) as deviating from the norm. After a short sequence in which C explains why she couldn't make it to the appointment last time S formulates a second appointment reminder.

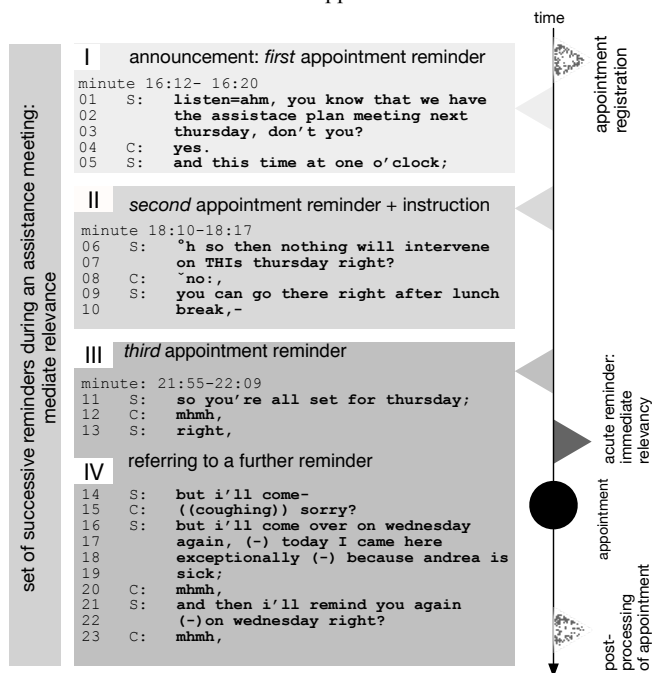


Figure 3. Personal Successive Reminders translated from German

(b) *Second appointment reminder + instruction*: In the second stage (Fig. 3 II 06-10) S formulates another question to reassure that C will keep the appointment (II 06-07) and adds an additional instruction by providing practical guidance so C can manage to get to the appointment on time. By advising her to go to the appointment **right after lunch break,-** (II 09-10) he uses a time category that is manageable for C and provides an understandable reference point in time. Due to C's difficulties with temporal orientation the provided temporal link or 'landmark' is an assistive verbal strategy that bridges C's difficulties with estimating durations. After a short discourse S initiates, the two final steps in the reminding process.

(c) *Third appointment reminder*: In the final steps of the successive reminding process (Fig. 3 III, IV) S is not asking an explicit question like in step I and II but is making a statement which is marked by a dropping pitch at the end of the sentence (III 11). However, after C confirms the statement with **mhmm**, S transforms his statement into a question by adding the sentence final question particle **right**, with a rising pitch.

(IV) *Referring to a further reminder*: In the ensuing sequence S gives a prospect of further steps in the reminding process. He names the exact day on which he will come over for the next assistance meeting (IV 16-17). After that, he inserts a parenthesis to explain why he came in today exceptionally and that he is covering for another support worker who called in sick. C responds by producing the back channeling signal **mhmm**, and therefore signals sustained attention to the interaction [15]. S links to his first utterance (IV 16-17) by starting with a conjunction **and then i'll remind you again (-)** (IV 21) followed by a short

pause. After the short pause (IV 22) he repeats the day that he already named before the parenthesis **on wednesday right?** (IV 22). He closes his utterance again with the sentence final question particle **right**, to claim a positive response which C provides by producing a **mhmm**, in IV 23.

The analysis has shown how a successive process of reminding unfolds at different points in the interaction and how precisely and recurrently the upcoming appointment is referred to. The described strategies of successive reminding establish a basis for an upcoming acute reminder on the one hand and they provide planning certainty and reliability for C on the other hand.

6 ACUTE REMINDERS

The following analysis shows how an actual reminder is produced as a process in its complexity of modalities and presuppositions in human-human-interaction. The extract was recorded after a regular communal breakfast organized by the operator of the external-care-based assisted living. C² is accompanied by her friend (F) who is part of her informal support network. As mentioned in chapter 5, C has no temporal orientation, whereas F is temporally oriented and keeps plans and appointments in mind. The acute reminder emerges from the need to take the next bus. F's reminder strategies illustrate an interplay of attention getting and subtle reminder upgrade strategy.

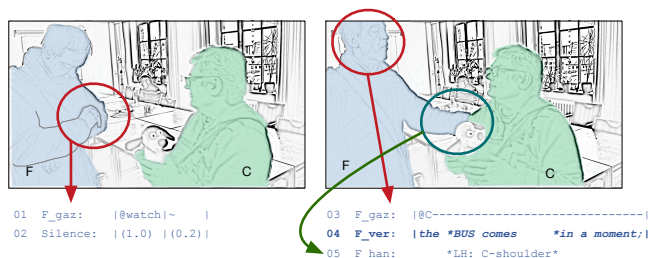


Figure 4. Multimodal display of the reminder activity

(a) *Attention getting and embodied anticipation of a new activity*: C is involved in a group interaction while F has put his jacket on and then, joins the group. This preparatory action of putting the jacket on serves as a change of context and as a visual cue for C. Besides the completion of breakfast, it initiates reminder activities in a subtle way without a manifest display of urgency. F initiates a first stage of reminder activities, i.e. attention getting while C is involved in interaction: F stands behind C and taps on C's back with both hands. This tapping could be interpreted as a subtle form of attention getting which is found in subsequent steps of reminder activities, too. However, its first occurrence is characterized by absence of verbal activity. The first steps of the acute reminder process serve as attention getting devices and do not contain explicit requests or a display of urgency.

(b) *First explicit naming of appointment*: Explicit multimodal forms of a reminder are displayed not until F has got C's attention that becomes manifest through C's gaze [22] at F (Fig. 5). When having C's attention, F gestures an external necessity by an explicit look at his wristwatch followed by a verbal indirect request (**the BUS arrives in a moment;**) that emphasizes the external necessity to leave. The verbal request is underlined by F's direct gaze at C while speaking and by touching C's shoulder (Fig. 5). The reminder becomes a request through the implicit content of the utterance [23] that is only accessible for the two participants: it is a

highly contextualized request that ensures the participants' privacy within the social situation.

(c) *Subtle reminder upgrade*: F retries the multimodal request procedure in the subsequent interaction another three times after monitoring C's reactions. The retries occur with rising frequency and appear as a subtle increase in urgency. The reminder procedure shows a fine-grained coordination of modalities: The retries start with F's observation of C's attention (head orientation, gaze) while she is involved in a conversational task. When C's head movement becomes observable, F anticipates C's orientation towards him. C's change of orientation is followed by F's utterance of the request and a tactile underlining (see section (b)) while F directs his gaze at C directly. It is noteworthy that F embeds the requests precisely in the ongoing interaction and respects C's conversational tasks: he does not interrupt C's utterances, but uses multimodal options for turn taking such as pauses, changes of C's bodily orientation and gaze to secure her attention. So, though he works on the task of reminding, he is also involved in the overall interaction. The subtle upgrade as well as the precisely coordinated placement of reminders ensures C's autonomy and role as a competent participant within the overall interaction.

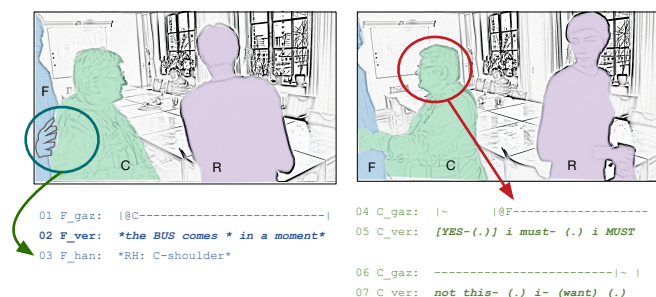


Figure 5. Negotiating and relativizing the reminder-request

(d) *Negotiating and relativizing the reminder-request*: After a total of four reminder retries, F interrupts the interaction for a fifth reminder by varying the attention getting device: he skips the attention-securing via gaze and uses the tactile modality to get C's attention and repeating the verbal request (Fig. 5). C makes this upgraded reminder-request conversationally relevant by turning to F and relativizing the reminder-request with the utterance that there is no urgency in taking exactly this bus (Fig. 5: *i must- (.) i MUST not_this-*). It becomes clear that the reminder-request is perceived and understood by C, but that she still is involved in a conversational task (of ensuring to meet R (researcher) in the following week). After R's reassurance, C and F leave. The negotiation of the reminder underlines C's involvement in the interaction, the solving of a conversational task first, and so, the autonomous prioritization of tasks in interaction and her autonomy in changing an action plan due to contingencies in social interaction. Even though the task of taking the bus seems clear, other tasks are more important and the initial action plan has to be adjusted to contingencies in social and interactional activities.

F and C's reminder system appears to be an evolving process which is adaptive and flexible enough to be embedded in complex social interactions as well as to react to changing circumstances. The analysis shows that it is well-practiced within contingent social interactions to jointly handle complex tasks.

7 DISCUSSION AND IMPLICATIONS

The study has revealed how reminder practices are produced and integrated in the everyday lives of people with special needs and coordinated within their assistive networks in a German institution for supported living:

(a) **Personal Successive Reminders**: The case study in section 5 shows how a joint planning process of the supportive network and the client emerges. The conversational practices applied by the support worker (e.g. explicit instructions and references to future reminder steps) provide security, planning certainty and reliability for the client who needs support in planning and temporal orientation. Joint planning is the basis for a meaningful and transparent establishment of upcoming reminders and provide individual information about the context of appointments.

(b) **Acute Reminders**: Section 6 shows how appointments are contextualized and how the participants' implicit knowledge about consequences and meaningful activities work when a reminder occurs. The analysis shows the evolving micro-process and complex interplay of getting attention / securing contact and applying a subtle reminder upgrade strategy. The reminder process is highly adaptive and flexible and allows to react to changing circumstances within social situations based on close observation (or monitoring) practices.

When applying the supportive network's tasks and practices to the development of a technical system, the empirical data and concept model of the *process of reminding* give hints for implications for system design but also raise issues for a discussion of assistive technologies in the light of ethics.

(c) **Verbal practices and timing**: Adaptive procedures characterize human planning and reminding processes and activities of acute reminders. Following this model, an ECA needs technical and verbal structures to produce recurring successive reminders that lead to acute reminders and effective requesting strategies. The exact timing of these strategies bears not only a technical challenge, but also regarding the design of actual formulation and wording, i.e. interaction conceptualization to ensure that requests or interruptions by the ECA are not being perceived as unexpected or impolite.

(d) **Multimodal monitoring**: Continuous and extensive multimodal monitoring-processes need to be implemented as a precondition for the implementation of accurately applied verbal strategies. These monitoring processes should encompass the monitoring of gaze and head orientation as well as body orientation (e.g. via Eye tracker). Besides these requirements, the system needs a structure to classify the different states of the participant in the *process of reminding* after an appointment has been registered (Fig. 2) to produce meaningful reminders that are timed and synchronized with the classified state. These strategies need to be adapted to needs and competences of each participant [20]. On this account, the system needs to detect different states of the participant's attention to secure contact if necessary. The monitoring of the surroundings (e.g. via Kinect), like the apartment with its artefacts and other present people (e.g. via face or voice recognition) would be needed, to classify and differentiate social interactions. This data can serve as a basis for the system's classification, to i.e. 'understand' different participant states (e.g. attention) in the *process of reminding* to produce meaningful reminders and to apply suitable strategies. How a system's 'understanding' of complex and contingent human activity could be implemented relies on close description and operationalization

of human activities that has to be defined. In the light of ethical discussions monitoring activities carry a serious ethical and legal issue with regard to privacy protection.

(e) Ethical considerations regarding assistive technologies:

Assistive technologies that are developed neglecting complex social and institutional structures probably end up at being an isolated solution for solitary tasks and so, are questionable in their use and effects. It should be discussed what technology is able to provide and how technical assistance could be integrated in the assistive networks meeting the individual needs of each user [10].

By applying the MEESTAR evaluation dimensions we have to ask what autonomy means within the human assistive setting in the light of distributed action and agency. In the context of supported living, clients already are involved in different forms of distributed action and agency in a human network. Which role and task can then the ECA undertake when discussing autonomy and requests (as reminders)? The question of legitimization of an agent making requests is a fundamental ethical issue that has to be discussed in the context of autonomy: We have to conceptualize, define and uncover the role and boundaries of the technical system as either a representative of the support worker or as the enhancement of the client. These conceptualizations and definitions have consequences on the declaration of consent and the use of collected data.

Another ethical issue arises from the matter of system access. In the current system, the ECA is solely able to register appointments and perform acute reminders. It has to be reflected what happens in-between, i.e. should the tasks of support workers be implemented into the system and if yes, how? Or should the perspective be twisted to better integrate the technical system into the assistive network. It is also necessary to discuss the issue of the system's transparency. Facing users that have no expertise in designing assistive systems, it has to be asked, if the human assistive network is allowed to enter tasks or appointments into the technical system, to what extent the origin of these entries has to be made transparent for the participants. One additional implication that emerges from this perspective comprises an explicit marking of the appointment origin on the interface.

(f) Research on interaction in settings with people with special needs: Research on interaction with assistive technologies for time management and organizational tasks widely focuses on the ageing population, while the group of people with special needs in independent living is not well documented so far. Our paper follows this direction and hints at the special competences of clients, the challenges and tasks of support workers, as well as the complex social structures including formal and informal assistive networks. As integration means to enable participation [24], different means for supporting independent living are crucial for the realization of this demand.

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