Mediating Informal Care Online: Findings from an Extensive Requirements Analysis

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Abstract. Organizing and satisfying the increasing demand for social and informal care for older adults is an important topic. We aim at building a peer-to-peer exchange platform that empowers older adults to benefit from receiving support for daily activities and reciprocally offering support to others. In situated interviews and within a survey we investigated the requirements and needs of 246 older adults with mild impairments. Additionally, we conducted an interpretative role analysis of older adults' collaborative care processes (i.e., support exchange practices) in order to identify social roles and understand the inherent expectations towards the execution of support. We will describe our target group in the form of personas and different social roles, as well as user requirements for establishing a successful peer-to-peer collaboration. We also consider our finding from the perspective of social capital theory that allows us to describe in our requirements how relationships provide valuable social resources (i.e., social capital) for informal and social care.

Keywords: Peer-to-peer exchange platforms, informal care, social care, social capital, social roles, personas, user requirements

1 Introduction

Ageing in place [19] is increasingly emphasized as a preferable alternative to formal institutional care. One possibility to prolong ageing at home is to organize on-site support for older adults by strengthening informal care. This care can be defined as support provided by someone from the recipient's social environment [42], such as family members, friends, acquaintances, or neighbors. We address ageing in place within a research project, called GeTVivid (http://getvivid.eu/) that aims to establish a peer-to-peer (P2P) exchange platform that supports informal care practices by mediating them online (i.e., successfully negotiating and establishing a collaboration). We want to empower older adults having mild impairments (e.g., restricted mobility, hearing or vision impairments) to benefit from receiving support for certain daily activities (e.g., carrying shopping bags) and reciprocally offering support in other domains (e.g., do some ironing). We consider older adults as active and equal partners in support exchange, and differ herein from the most predominant view of older

adults in HCI and CSCW, wherein they are mostly seen as passive individuals in need of help [37].

Important for the development of our P2P exchange platform for informal and social care is that previous research has shown how online communities can strengthen local offline communities by providing improved communication in the online world [32], enhancing older adults' quality of life and well-being [44], empowering them to receive and provide support [34], and thereby increasing social capital [39]. We aim to enhance the understanding of P2P support practices that should be mediated online. Therefore, as a first step in our user-centered design approach, we performed an extensive requirements analysis over half a year involving 246 older adults. We investigated older adults' collaborative support exchange practices in 15 situated interviews and carried out a survey with 231 older adults in order to deepen our initial understanding of how older adults use their social relationships to organize their activities of daily living. For the development of our P2P exchange platform (see [30] for further technical information), we created personas that represent our target group, derived social roles that define the social setting and expectations for care practices, and defined user requirements. In this article, we will describe the main outcomes of the requirements analysis.

2 Background

The following section outlines related research on the concept of informal care and related assistive technologies for independent living. Moreover, we describe the theoretical grounding of our research in the concept of social capital and role theory.

2.1 Care & Activities of Daily Living

There is an increasing demand for formal, informal, and social care of older adults, which is explainable by the increase of the ageing population. Organizing this increasing demand is an important topic that requires more civic engagement in order to release pressure from formal institutional care [25]. Several concepts and strategies, such as ageing in place [19], situated elderliness [2], and active ageing ([1] or [15]) have been developed and discussed to address these issues.

The notion of (informal) 'care' is used in various contexts, such that its meaning is not clear-cut [40] and involves different perspectives and dimensions. In relation to this, Henderson [20] points out that care is not only about helping with daily activities such as eating, moving, etc., but "… *making life more than a vegetative process, by communicating with others, maintaining human relationships, learning, working and playing, or recreating*" [20, p.26]. The term 'activities of daily living' (ADLs) is used to describe daily self-care activities, with a distinction between basic ADLs and instrumental ADLs ([20] or [38]). Basic ADLs can be described as daily self-care activities oriented towards one's own body (e.g., eating or bathing), whereas instrumental ADLs are important for older adults to live independently in familiar surroundings (e.g., communication management or mobility) [38].

Among adults aged 50 and above, 25% suffer from a single limitation in performing daily activities and receive support from family and friends [33]. This demonstrates the importance of family members and friends taking over informal care, but also social support contributing to older adults' well-being [36].

2.2 Technologies for Independent Living and Peer-to-Peer Support

An increasing number of assistive technologies focus on supporting older adults in living independently in residential homes for older adults. Nevertheless, Riche and Mackay [36] make the criticism that existing support systems are pushed to their limits and that innovative solutions are required. Current approaches range from relational agents that serve as a kind of companion-like robot (e.g., [13]) to software agents (e.g., [3]), telecare systems (e.g., [43]), networking infrastructures for smart home technologies (e.g., [41]), or ambient information systems (e.g., the 'Digital Family Portraits' [31], the shared calendar 'CareCoor' [4], or the 'Homebutler' http://www.beko.at).

P2P support solutions within the older adult's local (care) networks, such as, 'PeerCare' [36] or 'CareNet' [9], have been developed to facilitate older adults' integration as well as active participation in social life. In addition, community currency systems (e.g., time banks http://timebanks.org/) also focus on supporting reciprocity to encourage older adults to take an active role in society [1]. Recently, several neighborhood P2P exchange and support platforms have evolved (e.g., 'mila' https://www.mila.com/, 'Nextdoor' https://nextdoor.com/, or 'Zaarly' https://www.zaarly.com/).

2.3 Social Capital and Roles

Social capital theory relates to resources that are inherent in the structure of social relationships [8] and allows better understanding of the values or benefits individuals gain out of social relationships. It is "*the aggregate of the actual or potential resources which are linked to the possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition*" [5, p.243]. Such relationships are characterized by norms of trustworthiness and reciprocity [35]. Trustworthiness is the willingness to rely on a communication partner's actions, which is important to build up personal relationships [35]. Reciprocity is the social interaction of giving and receiving [26]. According to Putnam [35], it can be distinguished between bridging and bonding forms of social capital. Whereas bridging forms facilitate the access to external resources and allow heterogeneous groups to exchange, for example, support, bonding forms increase cohesion and identity of small groups. Social capital is a resource, which is not static or unchanging, but highly dependent on what individuals are willing to invest in relationships [14]. This is of particular interest for building up a P2P support exchange network.

Within the social sciences, the concept of social roles has long been a topic for discussion. Five perspectives may be distinguished in recent work: functional, structural, cognitive, organizational, and symbolic interactionist role theory [6],

whereof the last one is most important for our research. Symbolic interactionists stress the roles of individual actors and the evolution of roles through social interaction whereby social actors understand and interpret their own and others' conduct [27]. It defines roles as cultural objects that are "*real insofar as they are recognized, accepted, and used to accomplish pragmatic interactive goals in a community*" [7, p.232]. Symbolic interactionist role theory is valuable for our research, as its micro-perspective allows us to reflect on role emergence through negotiation and social interaction as carried out in support exchange. Thereby, expectations of behavior and action are considered as major generators of roles, learned by individuals through experiences [6]. Expectations are useful, as they imply knowledge of how to act towards others [18]. According to Dahrendorf [12], three main types can be distinguished, i.e., 'can', 'shall', and 'must' expectations that impose different kinds of sanctions if (not) satisfactory accomplished, i.e., positive, negative, or both.

3 Requirements Analysis

Understanding user requirements is an integral part of a development process and is critical for the success of our P2P exchange platform. As specified in the ISO 13407 standard [21], user-centered design begins with a thorough understanding of user needs and requirements. For our requirements analysis we decided to apply different approaches (i.e., situated interviews and a survey), as we have had good experiences when applying a combination of methods to investigate users' needs from different perspectives (e.g., [28] or [29]).

3.1 Procedure

In a first step, we investigated the organization of existing informal care practices of older adults with mild impairments (e.g., restricted mobility). We conducted 15 situated interviews with older adults in three European countries by visiting them in their (residential) homes. The interviews started with a primary trigger question asking about the older adults' daily routines (i.e., how would you describe your daily routines with respect to activities of daily living?), which reflected our interest in everyday life practices (i.e., individually experienced activity patterns of which older adults show a strong sense of awareness [36]). Besides the primary trigger question, we also prepared sub-questions in case the researcher needed them. The trigger question did not involve complex interpretations of an event that could potentially lead to greater misinterpretation effects, as stated by Craik and Salthouse [11]. On the basis of the qualitative data gathered throughout the situated interviews, we performed an interpretative role analysis [18]. We extracted 10 social roles (i.e., support provider and receiver roles) embedded in existing support exchange practices based on the role expectations that older adults have towards each other in the real world [12] (i.e., 'must', 'shall', and 'can' expectations) and the social setting they are happening in.

In a second step, we carried out a survey in order to deepen our initial understanding of how older adults organize their ADLs (e.g., communication patterns,

or who are key persons to organize ADLs) and to investigate how they use their social relationships to organize these activities. Finally, the insights from both studies were combined to derive personas and user requirements. With respect to the requirements, we applied social capital theory in order to better understand the ways in which our platform might support the creation of value in terms of social capital, i.e., the resources users can gain out of relationships that are facilitated online. The personas, social roles, and user requirements are provided as input to the design and development of our P2P exchange platform (see [30] for the current development status).

3.2 Participants

For our requirements analysis, with the help of three end user organizations in three different European countries, we recruited 246 participants representing the generation 60+ with mild impairments who receive support regarding ADLs. The first organization provides 67 residential homes that generate a feeling of 'being at home', wherein supporting and sustaining a high quality of life is very important. The second organization aims at providing a place where older adults have the possibility to network with other older adults and be actively involved in the voluntary work of the organization. The third organization is focusing on sustaining older adults' quality of life and self-determination, maintaining a bridge between the generations, empowering the older generation, and protecting older adults from discrimination.

The situated interviews were conducted with 15 participants (13 female, 2 male). We had an unbalanced sex distribution, as female older adults were more willing to participate in the study. The participants were aged between 63 and 90 years (with an average of 74 years). Eight of the interviewed participants lived together with another person and seven participants lived alone. The interviewees explicitly reported one or more of the following mild impairments: pain, mental and/or sensory impairments, neuromusculoskeletal dysfunction, or mobility impairments. These impairments led to various restrictions and limitations in their everyday life, mainly resulting in constrained mobility and movement.

In the survey, 231 older adults (44.2% female, 55.8% male) participated (102 offline, 130 online). The participants were aged between 55 and 98 years (with an average of 75 years). More than two thirds of these older adults (71.4%) are living in their own home, 21.2% in a residential home, and 7.4% in a retirement home. More than one third (38.1%) is living alone, almost two thirds (61.9%) live with someone else (e.g., with a partner or with their family). The participants reported several impairments, for example, pain (51.5%), visual impairments (48.1%), or auditory impairments (27.3%). In order to have a good representation of our future target user group for our designer and developer, we created three personas that are briefly described in following.

3.3 Personas

The personas help us to increase the focus on users and their needs. The personas were created based on a combined quantitative and qualitative approach [29]. The gathered quantitative data from the survey was used to overcome the problem of subjectivity (when creating personas by manually assigning older adults to behavior variables [10]) by conducting a cluster analysis to segment the older adults. The quantitative data was enriched with the qualitative data to describe the personas. In the following, the personas are briefly described to better illustrate the target group of the P2P exchange platform.

Frank is 67 years old and lives with his wife in a house in the outskirts of a larger city. He uses a computer, a smartphone, the internet, and a TV (including functionalities like Teletext, EPG, or a media library). His computer, mobile phone, and internet skills are rather good and his TV skills even better. Frank and his wife still life rather independently and only need sporadic help regarding ADLs (e.g., family support for doing grocery shopping, tidying up, cooking, taking care of the house and garden). In general, he is very satisfied with the support he receives, but he would be frustrated, if he could not rely on others or if no one would help him when needed. He can imagine additional support from friends and acquaintances, for example, regarding shopping, watering the plants or other activities (like support in the garden). For household activities, he can imagine support from a household helper. He is very cautious about letting strangers into his house, as someone previously attempted a burglary there. In general, he is interested in being there for others and spending time with them. Therefore, he would offer support to friends, acquaintances, and the family.

Anna is 75 years old and lives with her husband in a residential home, where they receive professional support when needed. She uses a computer, a normal mobile phone, the internet, and a TV (including functionalities like Teletext or EPG). Her computer, mobile phone, internet, and TV skills are rather good. Anna and her husband still live rather independently. They do not need help regarding ADLs on a daily basis, but Anna gets support for household chores such as ironing, vacuuming, or cleaning the floor and windows. Her family also supports her once in a while, for example, regarding shopping and sometimes in doing the laundry, but she does not want to become a burden for them. In general, she is very satisfied with the support she receives, but she would be disappointed, if she could not rely on others or if no one would help her when needed. She can imagine extra support from friends and acquaintances, for example, regarding shopping, watering the plants, or other activities. If she needed help regarding ADLs, then she would accept more regular help from a household helper. She would be very cautious regarding strangers, as she read a lot of the stories about the ‘Neffentrick’ in the newspaper, where strangers pretend to be a niece or nephew in order to get access to the home and steal something. In general, she is interested in being there for others and spending time with them. Therefore, she would also offer support to the family, friends, and acquaintances. She would request support from her family, but maybe also from friends, acquaintances, or sometimes even strangers (e.g., for window cleaning).

The third persona is our anti-persona, i.e., intended to identify older adults we are specifically not designing for. *Luise* is 85 years old and lives in a residential home, where she already regularly receives professional support (i.e., formal care).

We use the three personas for different activities. For example, the developers and designer use them to address the user's needs, but they are also used for marketing to investigate how to address users and specify the value proposition. Additionally, we decided to extract from our situated interviews social roles, expectations, and social settings for different informal care support practices that our personas could adopt.

3.4 Social Roles

Social roles are useful, as they imply knowledge about how to act towards one another (i.e., role expectations) [18]. Being aware and making use of this implicit knowledge in a supportive exchange facilitates the predictability and organization of informal care. The social roles were identified with the following procedure. In a first step, we conducted a content analysis with the data from 15 situated interviews to identify already enacted support practices that illustrate the level of action from which we extracted our social roles (i.e., narratives expressing actions in which older adults provide and receive support to/from others). In a second step, we assigned role expectations (i.e., 'can', 'shall', or 'must') in order to identify how participants expect these practices to be enacted. As a third step, we grounded the identified practices and related expectations according to the social settings in which these actions are executed. A compact summary of our investigation is provided in Fig. 1 by illustrating the identified social roles in relation to their social grounding. In the following, we briefly describe each role.

The *Relieving Person* provides support that is motivated by reducing stress on the family (e.g., babysitting). The Relieving Person believes that the family considers this support as *not* binding (i.e., support practices are entirely embedded in 'can' expectations).

The *Responsible Person* provides support as an obligation towards the family (e.g., carrying impaired relatives). The Responsible Person believes that the family considers this support as binding (i.e., support practices are entirely embedded in 'shall' expectations).

The *Opportunity Provider* provides support to the family to foster social engagement. The Opportunity Provider believes that the family sees this support as *not* binding (i.e., support practices are entirely embedded in 'can' expectations).

The *Opportunity Receiver* receives 'on the fly' support from the family. The Opportunity Receivers, who receive support from their family, consider these support practices as *not* binding (i.e., support practices are entirely embedded in 'can' expectations).

The *Companion* provides support to anyone at any time mainly to neighbors and acquaintances. The Companion believes that the neighbors and acquaintances consider this support as *not* binding (i.e., support practices are entirely embedded in 'can' expectations).

The *Immediator* provides support in spontaneous and rather immediate situations (i.e., devoting only limited time resources) mainly to neighbors and acquaintances.

The Immediator believes the strength of expectations that are attached to the support s/he provides highly depends on the actual support that is needed by the neighbors and acquaintances (e.g., is it a 'critical' matter where support is timely needed). Therefore, support practices provided by the Immediators are either embedded in 'can' or 'shall' expectations, depending on the immediacy of these respective practices to be enacted.

The *Preserver* helps to sustain the materialistic resources of neighbors and acquaintances (e.g., newspaper, books, or records). The Preserver experiences that the neighbors and acquaintances see this support as *not* binding (i.e., support practices are entirely embedded in 'can' expectations).

The *Re-User* receives needed materialistic resources from neighbors and friends. The Re-User considers support practices as *not* binding (i.e., support practices are entirely embedded in 'can' expectations).

The *Socializer* supports social inclusion of friends and fellows on a reciprocal basis (e.g., organizing dinners). The strength of expectations concerning the reciprocal support given by the Socializer is either embedded in 'can' or 'shall' expectations depending on the actual activity (e.g., when organizing an event for friends, reciprocal invitations are expected, i.e., 'shall' expectation).

The *Comforter* reciprocally provides and receives emotional support from friends and fellows (e.g., consoling each other in difficult times). The friends and fellows, who provide support to and receive support from the Comforter, consider the social support activities as *not* binding (i.e., support practices are entirely embedded in 'can' expectations).

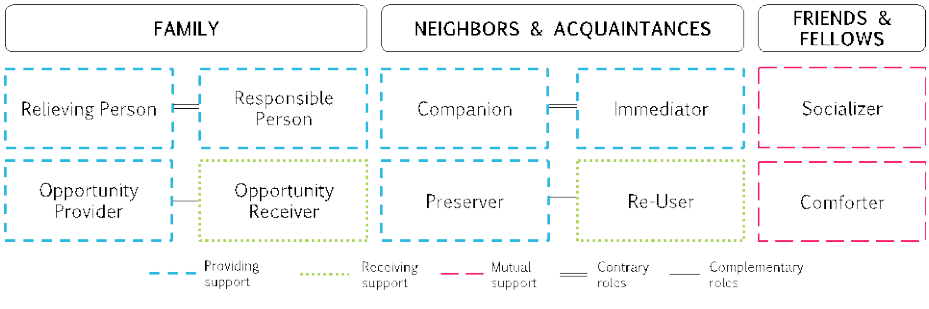

Fig. 1. Visualization of identified social roles in offline support-exchange dependent on relevant social setting (i.e., family, neighbors & acquaintances, or friends & fellows).

The social roles describe, which roles older adults currently take over in which social setting and what the inherent expectation towards the execution of support are. As can be seen in Fig. 1 we predominantly found social roles for providing support. Related research states that older adults desire independence and autonomy and are more enthusiastic about giving help than receiving it [23]. This can be strongly supported within our findings, as even if the older adults having mild impairments are partly in need of support, they are also very keen to provide support to others. We believe that the unbalance between receiver and provider roles of older adults is strongly related to their actual mental and physical condition (i.e., how much they are actually 'forced' to take advantage of and ask for support from others).

On the basis of our personas, social roles, and the underlying social capital, we identified the following user requirements for our P2P support exchange platform.

3.5 User Requirements

In our online support community, we consider that new users should arrange their expectations of how to act towards one another online, whereas the actual support exchange is happening in real life. Therefore, the sustainability and reliability of such online-formed relationships is highly dependent on the 'successful' enactment of support practices in the real world (i.e., did the online elaborated expectations of how to give and receive support, appropriately match reality when enacted offline?). This is specifically important in order to develop mutual beneficial relationships. Thus, we need to think about how we can best facilitate such negotiations in online environments. In the following paragraphs, we present our user requirements to be addressed in the design and development of our P2P exchange platform for informal and social care.

Consider that family members are the most active support providers for informal care, i.e., the family supports older adults by cleaning windows, shopping, watering plants, doing laundry, ironing, cooking, or dusting. In general, with the survey results, we found out that half of the surveyed older adults (51.7%) are in need of support. With regard to the importance of being in contact with others, 81% of the older adults consider contact with the family to be highly important. Therefore, if older adults do not receive support so far, they would accept support for most of the previously mentioned activities from their family, but they can also imagine support for shopping, cooking, watering plants, tidying up, doing laundry, or ironing from others (than family members, friends or acquaintances). Additionally, older adults find it hard to imagine accepting support from friends and acquaintances for household activities. The P2P exchange platform should, on the one hand, make use of the resources that the family provides (e.g., grant access also for family members), referring to bonding forms of social capital. On the other hand, older adults should be able to discover support offered by others (beyond the family) for ADLs (e.g., best practices or success stories) and build up new beneficial relationships, i.e., increasing their radius of trust [16] (bridging forms of social capital).

Consider that friends are most active in social care, i.e., organizing events to stay in touch and spend time together in order to avoid loneliness and social exclusion. The survey results indicate that more than half of the surveyed older adults (56.3%) see regular contact with their friends as important. Thereby, friends indicate real friendships and do not include lose acquaintances. For example, friends visit each other, organize coffee parties, go with each other to hobby groups, do club or outdoor activities, as illustrated in our Socializer role. The P2P exchange platform should enable group activities in order to support making new friends (i.e., relationships) that can take over social care activities in the future (in particular if friends do not any longer live close by older adults living in a flat in a residential home). This fosters the cohesion and identity of small groups, which in turn provides valuable new resources (i.e., bonding forms of social capital).

Enable cross-generational contact, i.e., fostering social contact between generations enhances older adults' subjective wellbeing. With the situated interviews, we found out that older adults consider cross-generational support as 'joy', 'being needed by others', or 'giving something back to the society'. Specifically, general contact with children and providing support in taking care of grandchildren (e.g., babysitting) is seen as highly satisfying. This kind of support activity is represented in our roles of Relieving Person or Responsible Person. The P2P exchange platform should, therefore, make use of resources embedded in cross-generational relationships, in terms of engaging older adults in activities wherein they actively support the younger generation based on their experience and skills (e.g., to read stories to kids in a kindergarten). In turn, the middle-generation (e.g., parents) can support them, resulting in a win-win situation and bridging forms of social capital.

Consider reciprocal relationships, i.e., providing and receiving support should have the characteristic of a balanced 'giving and taking' in relationships as in the role of the Socializer or Comforter. Thereby, reciprocity characterizes mutual beneficial relationships. Our survey revealed that one fifth (20.8%) of the respondents expect support back from their family. However, almost half of them (43.9%) expect to receive support in return from acquaintances. Bellotti et al. [1] revealed that in unbalanced relationships (i.e., where giving and receiving support is not balanced), the inability to reciprocate potentially decreases older adults' quality of life in general. Therefore, it is important to ensure that a Socializer or Comforter not only provides support activities, but also receives support back from the beneficiary.

Support activities should be balanced in general, i.e., providing and receiving support from others should be in balance, especially, when enacted frequently over time. Our results indicate that even though older adults are in need of support, they are also highly willing to provide support to others (60.2%) in order to address the desire of independence and autonomy [23]. As we found out with the situated interviews and the survey, if older adults only tend to take over support-giving roles (e.g., Companion, Preserver, and Immediator), they should be proactively recommended activities related to posting requests or taking advantage of support from others. However, it needs to be ensured that offers of support do not imply obligations in return to avoid imposing any burdens of reciprocity on receivers.

Provide complementary role matching, i.e., the possibility to find and/or match people that complement each other in providing and receiving support. The right matching of 'complementary users' can encourage more active participation in online communities [34] and result in satisfying supportive exchanges for both the receiver and provider. For example, the roles of Opportunity Receiver and Opportunity Provider complement each other with regard to the needs (i.e., fostering social engagement and providing 'on the fly' support) they satisfy within their respective social settings (i.e., family). The identification of appropriate counterparts (e.g., through complementary role matching) to fulfill particular needs is the basis for creating beneficial relationships on the platform.

Consider that offline social roles should not be seen as equivalent to online social roles, i.e., instead, foster role characteristics (e.g., expectations, time investment, or social setting) online that are critical for the identification with and enactment of social roles in the real world. Therefore, we should make visible online the specific role characteristics that are needed to successfully negotiate and guide real world

support. Due to the additional online interaction on the support exchange platform, initially offline negotiated social roles may alter, or new (online) roles emerge, based on online interactions (such as e.g., 'Moderating Supporter' or 'Central Supporter' as investigated by [34]).

Support equal strength of expectations for provider and receiver, i.e., a 'shall' expectation may not be satisfied with a 'can' support. For example, if a neighbor offers to bring something along from the pharmacy as s/he is going there in the next couple of days and another older adult asks her/him to bring medicine the same day ('shall' expectation), then it will be insufficient if the neighbor 'can' only bring it by the end of the week. Therefore, it is important for the P2P platform to clarify expectations online in order to match the appropriate counterparts for offline support enactment. For example, if an older adult offers to go for a walk, this should not automatically mean to go for a walk every week (i.e., here the expectations would not fit).

Support different time investments, i.e., frequency and duration of support. For example, the Immediator provides spontaneous support with little time commitment, but the Companion provides time whenever needed. Riche and Mackay [36] found out through testing the 'PeerCare' system that older adults show a strong sense of awareness of the daily routines of the people with whom they interact on a regular basis. Therefore, it should be ensured that spontaneous and long-term support suit daily routines and that the effort for organizing the support is balanced with the actual time invested to support others.

Support selective information sharing for support exchange, i.e., when providing offers or requesting support, it is important to have the possibility to share information selectively with regards to social bonds. Gibson et al. [17] suggest adapting the degree of information sharing to particular groups (e.g., family, close friends, or work friends). These different groups are important, as older adults make a clear distinction between friends and acquaintances (i.e., one group named 'friends' to cover all relationships regardless of closeness is inappropriate). Therefore, peer group management should be provided on the P2P exchange platform in order to support selective information sharing among peers.

Support different roles of users, i.e., social roles are fluid in their nature, meaning they change over time in the course of actions. Users can take over different roles for different support activities and also the kind of role can change when performing the activity over a longer period of time. For example, an older adult is initially willing to provide support to others in immediate situations on a rather 'loose' basis (i.e., Immediator role). After some time, s/he gets to know the people s/he has supported multiple times better and establishes a meaningful and more binding relationship with them leading to an enhanced willingness to invest more resources (e.g., time) to provide support (i.e., Companion role). In terms of designing for social roles on the P2P platform, we have to think about how we can balance human needs for role clarity and fluidity (e.g., simplifying social roles across digital interfaces to define role clarity that is responsive to changes over time) and how to deal with role characteristics that are potentially more stable over time than others.

Build up trust in other users, i.e., encourage older adults to offer support or fulfill requests of strangers in order to establish relationships with them. Older adults believe in another peer's capabilities, honesty, and reliability based on their own experiences.

The survey revealed that, for more than half of our participants, it is important to know that they can rely on each other (63.6%). The community manager (who is a trusted third party and inter-mediator, e.g., an end user organization) should be responsible in a first step to grant access to the P2P exchange platform only to trustworthy people. In order to build up trust, older adults use reinforcement learning to update the strength of each relationship and compute the balance of relationships over all contexts. The community manager should, therefore, also arrange regular offline events, where older adults have the possibility to get to know each other. This is important to build up trust, a precondition to develop mutual beneficial relationships. Additionally, older adults want to provide the minimum amount of personal information possible on an online platform, but also want to have as much information as possible about others before getting in contact. As anonymity opens doors to possible misuses and abuses by malicious peers, we identified real name, age, rough location, and profile picture as crucial information that older adults are willing to share in their profile in order to discover other peers in the community.

Avoid unfulfilled support requests, i.e., if older adults request support, there should be an escalation mechanism in case no one responds. Older adults do not easily bring themselves to request support, as requesting support is negatively seen as being a burden to others. However, if older adults pay for support (e.g., professional household help), they consider it as 'positive' as it fits in the concept of 'give and take' (i.e., mutual benefits for both parties). This is also represented within our survey results, where the surveyed older adults indicated that, besides the family, they mainly receive support (57.7%) from household professionals that they pay for. An example for an escalation can be that initially the community manager is informed about open requests. Then, s/he can check whether there is an open informal or professional offer suiting the older adult's request and needs, whether s/he knows someone that can fulfill them, or whether s/he contacts family members. For more than half of our survey participants, it is important that someone will help (57.1%) and to know there is always somebody there (54.5%).

Make use of older adult's particular strengths and competences, i.e., offering and organizing support with regards to particular competences or mutual exchange. For example, during offline community events, older adults should be motivated to think about their competences and how they can use them to support others by providing offers or fulfilling requests. If the competencies of 'care-dependent' older adults are strengthened, they are likely to maintain or regain an independent, self-sufficient, and meaningful life [22]. The P2P exchange platform should allow older adults to take advantage of and make use of transaction opportunities and their own competencies by supporting others.

These user requirements summarize the insights gained into older adult's support practices, their preferences and needs, and address the underlying social roles that define the social setting and expectations for informal and social care. Additionally, we described the role of relationships as valuable social resource (i.e., social capital) and how to foster them.

4 Conclusion

Motivated to gain a better understanding of informal support exchange practices, we conducted an extensive requirements analysis with 246 older adults as a first step in our user-centered design approach. Typically, focus groups, interviews, or user surveys are performed to collect data and identify user needs [24, 28]. From a classical requirements analysis point of view, we conducted situated interviews and a survey, created personas, and identified user requirements. We found out that older adults are highly aware of their own and others' daily routines, but did not uncover a lot of unfulfilled needs. For example, it is important to consider family members as the most active support providers for informal care and friends as most active in social care. It is also important to enable cross-generational contact, to build up trust among users and enable selective information sharing, to avoid unfulfilled support requests, and to make use of older adults' particular strengths and competences.

Additionally, from a theoretical point of view, we applied an interpretative role analysis to extract different social roles in informal care practices and investigated how social capital is used to organize respective practices. This theoretical analysis helped us to identify implicit knowledge and experiences that most of the older adults hardly articulate. Therefore, we refined existing and defined additional user requirements that we need to address in the design and development of a successful P2P exchange platform. For example, social capital and social role theory revealed the importance of enabling reciprocal and trusting relationships, to support different social roles. They also revealed that offline/online roles should not be considered as equivalent and particular role characteristics are critical for mediating support online (the platform must match complementary roles, support equal strength of expectations for providers and receivers, and allow for variability in time investments). Further, these theories indicate a need to enable a balance of providing and receiving support.

For establishing a successful P2P collaboration, creating benefits for all involved parties (i.e., social capital), it is also necessary, beyond the classical tradition, to investigate user requirements from a theoretical perspective and combine empirical findings with theoretical understanding. The social role investigation revealed valuable insights about care practices in terms of expectations and social setting, which in term helped us to better understand how older adults can gain resources out of (new) relationships. We better understood the complexity of P2P support exchange practices, which we address in our user requirements. Therefore, in a next step, it is important to think about the design implications and technical specifications in order to satisfy the user requirements we gathered.

In the following, a short outlook regarding the design of our P2P support exchange platform in the GeTVivid project is provided (more technical details can be found in [30]). It will be accessible on a TV set in combination with a tablet as a second screen, as equipping an older adult's home with additional unfamiliar technologies is not an appropriate solution to create a perfect home environment. On the platform, for example, users will be able to post offers or requests, accept offers from others, fulfill the requests of others, organize group events, send messages, or manage a calendar for appointments and reminders (see Fig. 2).

Complementary role matching is supported in the first step of creating an offer or request. The user will be shown corresponding open requests or existing offers before

entering a new one on the platform. Additionally when specifying the offer/request, users can decide 1) if they want to have a fixed date or make it indefinitely available, 2) where it should take place, or 3) who should see it in terms of selective information sharing. These are important aspects in order to support the expectations of the provider and receiver. When accepting an offer or request a negotiation process will be started, in order to come to an agreement and support equal expectations. Additionally, profiling algorithms will alert the community manager in case of unfulfilled requests or one-directional support activities, in order to foster balanced relationships and, in the best case, reciprocal relationships.

Fig. 2. Start screen on the TV providing access to the most important functionalities.

In the beginning, small local area networks of neighbors will be established by a community manager. During offline events the users will get to know each other, in order to build up trust in users. Later on, it is envisioned that family members willing to support also other adults will also be able to join the platform. As the platform does not solely focus on older adults but also entire neighborhoods, cross-generational contact will be supported. In particular, our P2P support exchange platform should mediate support activities and help building up relationships (i.e., social capital) amongst all the local community members.

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