P/REFERENCES OF DESIGN

EXPLORING INTERACTION AND CREATIVE PRACTICES FOR RECONFIGURING ACTIVE LIVING IN AGEING COMMUNITIES.

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ABSTRACT | The aim of this paper is to describe the collective engagement and design approach adopted inside a European technology-enhanced ambient assisted living project, aimed at supporting the autonomy and self-management of health of the older people, through the use of innovative technological devices. The collective design methodology adopted in the research, including interviews, sharing sessions, co-design workshop and affinity diagrams, aimed at investigating the concept of Active Living with a mixed top-down and bottom-up approach, by combining theoretical definitions with user perspective for deriving scenarios and functionalities to stimulate older people. The following factors of Active Living were identified as the main dimensions of older people's experience: (a) empowerment, (b) perceived self-efficacy, (c) autonomy. This research allowed us to discuss and reconsider these dimensions and to propose novel factors for defining Active Living as an emerging experiential and interactional reality consisting of a balance between the personal sphere and the relational one. Technology acceptance and adoption play a fundamental role in supporting patients with mild cognitive impairment disease (MCI) when technology is designed, and perceived, as a tool that facilitates self-determination.

1. Introduction

The population is gradually ageing, with global life expectancy increasing by more than 6 years between 2000 and 2019, from 66.8 years in 2000 to 73.4 years in 2019. In addition, it is estimated that in 2050 more than 20% of the population will be over 60 years old (World Health Organization, 2015). For these reasons, interest in ageing is growing: despite improved living conditions, increasing life expectancy in fact brings with it challenges, related to physical and cognitive deterioration (Inouye, Studenski & Tinetti, 2007). A particularly problematic cognitive-related expression of ageing is dementia. While not totally disabling in most cases, the various forms of dementia still negatively affect a person's health and quality of life. Dementia sufferers are particularly exposed to social isolation (Hackett, Steptoe, Cadar & Fancourt, 2019), depression (Ong, Uchino & Wethington, 2016) agitation, apathy and anxiety (Cerejeira, Lagarto & Mukaetova-Ladinska, 2012). In addition, dementia is also associated with an increased likelihood of falls, difficulty with self-care and social relationships, and memory problems (Miranda-Castillo, Woods & Orrell, 2010; Wilcox, 2009).

Dementia in older people can be considered as the last step in a slow process, ranging from normal cognitive decline due to aging, to mild cognitive impairment (MCI), to full-blown dementia (Jongsiriyanyong & Limpawattana, 2018). Faced with this scenario, some solutions are needed in order to be able to intervene early, as soon as the first signs of cognitive decline emerge, so that the older person can remain autonomous and independent as long as possible and delay the progression of deterioration, supporting them in all those activities that are impaired (Sosa et al., 2012).

It is in this context that the present research is set. The research aims to ensure the well-being of people with mild cognitive impairment by supporting their autonomy and self-management through the use of an innovative modular mobile App, that delivers coaching services related to nutrition, physical activity, cognitive exercises, and social relationships. The system is thought to help older people with MCI to become more resistant to the changes the old age brings and take better care of themselves.

The technology is designed as an open, modular, and adaptable platform to provide self-management and coaching services to people with MCI, integrating informal and professional assistants as needed, to be used independently or in combination with lifestyle monitoring systems or wearable devices on the market. The approach used in this research is a user-centered one, that is, based on end-user participation at all stages of design in order to adequately address the needs of target users, ethical and cross-cultural dimensions, and to monitor and validate the psychosocial impact of the technology (De Vito Dabbs et al., 2009). Indeed, it has often been noted that people with mild cognitive impairment or other similar diagnoses are often not included in research (Chopra, 2021) and data collection comes from the field of caregiving, while instead “to give voice to people with dementia and increase their level of empowerment even in research processes, it is important to include them as valued participants. Therefore, public and patient involvement (PPI) and co-production, especially in an interdisciplinary health care and design context, is important to bring together, adapt, adopt, amalgamate, and develop appropriate methods to facilitate people with dementia as active partners in every stage of research” (Niedderer et al., 2017).

2. Active Living Framework

In line with the healthy aging definition that focuses on the optimisation of opportunities (Swedish National Institute of Public Health, 2007) a multidimensional concept has been used for the design of the system, based on the meaningful integration of five main elements:

- healthy nutrition;
- daily physical exercise;
- regular cognitive and mental activities;
- maintaining social contacts inside and outside the family;
- keeping an active interest in society.

Such elements are tightly interwoven since maintaining good physical health and functioning plays an important role in facilitating mobility and enables older adults to perform more integrated functional tasks which include activities of daily living, fulfillment of social roles, and recreational activities. Furthermore, good cognitive health is linked to social connectedness, independence, and life activities, and it might be preserved and enhanced by maintaining an intellectually engaged and physically active lifestyle (Halaweh, Dahlin-Ivanoff, Svantesson, & Willén, 2018; Bourassa, Memel, Woolverton, & Sbarra, 2017).
We identified the following factors as main dimensions of older people's experience:

- empowerment;
- perceived self-efficacy;
- autonomy.

2.1 Empowerment

The notion of empowerment (Perkins & Zimmerman, 1995) is foundational in our approach since it does represent the overall scope of an intervention. The empowerment is a multidimensional concept constituted by several components including supporting older people to keep their current levels of mental functioning; by preventing possible decay in cognitive and social skills; by coping with adverse events and negative experiences; and by exploiting latent resources (Mitzner et a, 2010). That is why, in order to empower older people to live independently, designers should make sure that older people can adapt and configure devices according to their personal circumstances in a way that their independence can be supported and be constantly renegotiated (Giaccardi, Kuijerb & Nevenc, 2016; Giaccardi, Nicenboim, 2018). Renegotiation of self-image may support the idea of iterative empowerment pathways as structured, organized and goal-oriented paths for a healthy population integrating multiple levels of skill-support.

2.2 Perceived Self-Efficacy

Self-efficacy can be defined as a personal judgment of ‘how well one can execute courses of action required to deal with prospective situations’ (Bandura, 1982). In general, individuals with high perceived self-efficacy are determined and show more effort across a broader range of tasks than people with a lower level of self-efficacy.

Staying active is reportedly connected to self-efficacy since it implies good physical functioning and the ability to autonomously reach a goal. It has to be noted that decreased levels of self-efficacy, resulting from low levels of exposure to related stimuli, are also associated with higher levels of anxiety and this is particularly relevant in the interaction design for the elderly.

2.3 Autonomy

Staying independent was viewed as a major characteristic of ageing well. Beyond the participants' living status (alone or with family), the importance of being independent was connected with the autonomous status of the older adults. A major concern that was frequently mentioned in the user research was not being or becoming a burden to others. In particular, along with the interactive discussions in all groups, target users involved in the user research reflected on the necessity of staying independent in performing their daily life activities including both personal and instrumental activities.

We have used the Active Living components to analyze, understand and interpret the findings from the empirical research on users by investigating:

- How the users might confirm, integrate and expand the definition?
- How the users’ perspectives might allow the researchers to disentangle this concept?
- How the users’ concerns, motivations and internal experiences might enrich the design of the interactions?

3. Research Methodology

The research and design methodology developed in the project integrates methods and techniques from a broad range of disciplines, from ethnography and psychology to Design research and Participatory design. The research methodology adopted in the research involved 41 participants (both people with and without a diagnosis of MCI) from Italy, Switzerland, the Netherlands and Canada in user research and design materials explorations and 6 expert participants including researchers and scientists from clinical psychology, interaction design, and technology development.

The following table shows participants numbers, divided by the activities carried out in each country, and the paragraph below reports the description of the activities:

Table 1. Participants involved in the study.

Activity	Scope	Italy	The Netherlands	Switzerland	Canada
Interviews	Collect qualitative data about “Active living” meaning	10 participants	10 participants	4 participants	/
Evaluation of Envisioning Scenario in participatory sessions	Define system future User Experience and functionalities	4 participants	5 participants	/	3 participants
Exploration of digital materials in Co-design sessions	Validate task flows and design solutions defined, by using interactive mockups	4 participants	/	/	/
Affinity Diagram	Requirements elicitations	2 experts	1 experts	1 experts	2 experts

3.1 Interviews and Sharing Sessions with the End-Users

Interviews have been carried out by expert partners able to establish a relationship of trust and reciprocity with people of concern, to use an appropriate language, a participatory approach and to keep in mind cultural markers and to manage any vulnerabilities. Through interviews, experts have had the opportunity to collect qualitative data about what “Active living” means for elderly people.

Field data collected in the first part of the research have been used as input for Scenario-based design, addressing the system service and user experience.

3.2 Evaluation of Envisioning Scenario in Participatory Design Sessions

The team has defined 3 main scenarios with a few User eXperience (UX) /User Interface (UI) Statements to be validated together with participants to explore the future system functionalities. These materials were presented to end users in order to identify and understand their perspectives about those affirmations, in terms of acceptance, perceived utility and satisfaction. Here below an example:

Personas: Elizabeth is 74 years old and lives alone since her husband passed away a few years ago. Nevertheless Beth is a determined and dynamic woman. She is constantly on the move. Beth handles all her daily activities, such as grocery shopping and housework. She is also very active in the social field. She likes to do things for others, like getting groceries for her neighbors.

When she gets out, she prefers to walk, but in case of necessity, she uses a bus, which is another opportunity to socialize! She has no relevant age-related physical problem but she recently noticed that her memory is getting worse. She loves meeting up with her friends, especially to play Bridge. Once a month, she goes to the theater. Elizabeth is quite capable with technology. She uses a tablet to search for online recipes and to consult the theater's program. She also uses a smartphone to communicate with her family.

[Extract of] Envisioning Scenario:
Beth heard that tomorrow evening there will be a performance and set the appointment on the calendar. The system checks the events organized in the town and compares the collected data with those recorded by Elizabeth. The system detects a gap in data: a similar event will take place in two days. So the system offers further information on the theater program and asks her: "Are you sure your event is correct? Do you want to check?"

Statement [to validate with participants]: I believe that a tool for checking my calendar and confirming the scheduled event, could be useful.

Participant answer: "This service is like a guardian angel. It could be a great brain aid. If developed well, it could be very useful."

In doing so, Storytelling has been emphasized for the Active Living concept exploration, to elicit intrinsic motivation issues and to explore alternative futures with relation to the 'as-is' experience of MCI and formal/ informal caregivers.

In general, the use of scenarios (Carroll, 1995; Carroll, 1997) allowed to structure data gathered through activity analysis while envisioning the role and functionalities of the system, and the assessing and validating the envisioned solutions from a technical perspective. The validation of these scenarios, allowed to revise the preliminary formulation by enriching and extending them.

The scenarios that came from, represented the starting point used to design and define a set of interactive mockups, useful in the following phase.

3.3 Exploration of Digital Materials in Co-Design Sessions

Starting from the data collected during the previous activity, experts used the revised scenarios to build specific task flows, defining the most effective User Experience. Based on these task flows the team designed the User interface and relative screens to test the UX. These screens were then used to create a first prototype to be submitted to end users, obtaining an interactive mockup. The flow sequences were designed using Sketch. The prototype was animated with Adobe XD creating a mixed interaction in which direct touch interaction was combined with the "Wizard of Oz" technique to allow users to interact with the interface while the application functionalities are simulated. This technique requires the user to interact with the system to be evaluated, while a hidden operator processes the user input and consequently simulates the system response. This method allowed experts to test with end users a few specific flows and stimulate the discussion for generating new ideas. This exploration session has been carried out with 4 participants and allowed the team to elicit and validate the "Active Living" Requirements that emerged during all the previous phases.

3.4 Affinity Diagram

The affinity diagram is a problem-solving technique useful to organize data according to its natural relationships. This tool, also known as affinity chart, thematic analysis and K-J method, was created by the Japanese anthropologist (more specifically the ethnographer) Kawakita Jiro. Over time, multiple variants of this method were elaborated and improved (Plain, 2007).

This technique is considered very useful to manage a large collection of mixed data that is too complex to proceed directly to the requirements stage of the project. Compared to the usage of one of the formal techniques - such as task or workflow analysis - through the affinity diagram activities, the risk of losing the users' context decreases. In fact, it is particularly adopted during the design process, to secure the quality of qualitative data and allow bridging the UX research to the design phase, avoiding the loss of information, significance and conceptual connections among data.

This step-by-step approach (Alänge, 2009) provided the designers with the possibility of using sticky notes with a group of participants. The aim was to group the information in macro thematic categories and identify conceptual links among them to define a set of design recommendations.

The session started from the definition of the main research question.

People involved had to identify what is the problem they want to investigate and figure out. This question formulation facilitated the focus on facts during the data collection. The second step consisted in writing down the insights - collected during the contextual research - on sticky notes. At this point, the sticky notes were grouped by the principle of affinity. The first level grouping allowed gathering information with the same meaning. A headline was added to each group referring to the general theme.

The clustering has been repeated a second time, depending on the complexity of the issue and allows for a higher level of abstraction. As Alänge (2009) confirms this process continues until a shared understanding has been reached. In particular, this process stopped as soon as the panel obtained a few supergroups: they are thematic categories able to contain all the sticky notes with a common significance. These supergroups were then linked to show interrelationships among them. Using the arrows, the team proceeded with the connections between the main topics. The direction of the arrows indicated the consequentiality and allowed us to identify the order of reading of the contents. Defining relationships meant understanding and prioritizing the most important issues influencing the question analyzed. For what concerns the Affinity Diagram related to this project, the session has been carried out remotely, using the Mural visual collaboration online software. The team was made by six participants from consortium countries, Italy, The Netherlands, Switzerland and Canada, following the below questions:

- What does Active Living mean for aging people?
- Which are the main Active Living components?
- How can we design interactive technologies to support Active Living?

Starting from this data, the research group validated all the information currently available. At this point, participants have followed a partially different process compared to the traditional affinity diagram method. The following step consisted of prioritizing the topics and figuring out what the team considered most significant, by voting both main clusters and single items. Each participant had to express his preference for a maximum of 15 votes, (by using a star icon) and once the activity was completed, the team shared opinions and thoughts. Participants were asked to be aware of which values, motives, and priorities they were using as foundation ideas before starting ranking:

- Is this your user’s priorities, your organization’s, the stakeholder’s, or your own? Which ones should you put the most emphasis on?

4. Findings from Design and User Research

This paragraph reports the main findings from the user research activities. All the participants in the engagement sessions have been stimulated to take part with questions and proposals and for exploring the interactions strategies with a coaching service. The participatory sessions allowed us to understand the real needs of users, their motivations, habits, but above all their concerns and frustrations. Users have positively participated at the validation of the scenarios, emphasizing the aspects of the project that are most relevant and useful to them.

4.1 Results from Interviews

Direct interviews with people with mild cognitive impairment (MCI) allowed the researchers to directly explore memory degradation, how do people react to forgetfulness and loss of cognitive abilities. As also reported here below, motivation is crucial to carry out cognitive tasks:

> "I know that it would be important to train memory with reading, crossword puzzles … but these activities bore me. Some years ago, I loved reading a lot of books and sports newspapers." (participant 1 - IT);
>
> "I take care of my mind more than my body. In fact, playing in a theatre company, I often have to learn my lines from the script by memory. This is a good exercise to train my memory. I also read a lot and I like crossword puzzles and rebuses." (participant 3 - IT)

In particular, the majority of respondents reported that they use a variety of strategies including timetables, and crossword puzzles, like:

> "I use different strategies to not forget my appointment. I have a timetable where I put the bills and I mark the expiration dates. I also set the alerts on my smartphone to remind me of my appointments." (participant 3 - IT);
>
> "I also play cards on the computer to maintain my memory training." (participant 5 - IT);
>
> "I think it's very important to keep my mind trained. I do crossword puzzles and I read to exercise my mind." (participant 8 - IT).

Other participants in the research questioned the importance of planning, as reported here:

> "I always plan what to cook the next day and the housework to do. I never write down my plans, but I try to keep them in mind." (participant 8 - IT);
>
> "Planning is not important for me. I will see what tomorrow will bring, everything will be alright. When you plan something, it can turn out very different in the end" (participant 3 - NL).

Cognitive activity has also been related to the ability to use and the acceptability of technology, as reported here:

> "I am not able to use it. I have only a mobile phone. I am not interested in learning the use of the main technological devices (smartphone, laptop …)." (participant 1 - IT) and here "I don't like very much technology but I able to use smartphone, Internet and I have also Facebook profile" (participant 2 - IT).

An increasing number of situations in the daily life of the elderly have been pervasively modified by the use of technology, including storing pictures, monitoring physical activity, and communicating with people, as reported here:

> “I always use my laptop, smartphone, and Internet. I like technology very much and I often store and modify my photos on my computer.” (participant 3 - NL);
>
> “I really like technology and I always use the Internet, laptop, social networks, and smartphone. I also use a pedometer that monitors my progress and performances. I can see them through an app on my smartphone.” (participant 5 - IT);
>
> “It is important for me to communicate with people by means of my phone” (participant 3 - NL);
>
> “I send emails for the choir, I make photos and copy files for Spanish class. Then I can make the spaces larger and use different colors for the translations. I get emails from the pharmacy”. (participant 4 - NL).

As emerged from the interviews, social relationships are a key aspect for older people. In particular, the end users consider social life as an essential aspect of maintaining an active and satisfactory life:

> “Looking at these images I think that the most important is to maintain social relationships because I like to compare my opinions with other people on different topics. It makes me feel alive.” (Participant 1 - IT);
>
> “I believe that the lifestyle should be appropriate to the age of the person. For me, social relationships are essential to a healthy life. I take good care of relationships with my family.” (Participant 3 - IT);
>
> “I need to have a lot of social relationships to be happy. I need to discuss and spend time with colleagues, friends, family, and grandchildren. I wouldn't know how to live without social relations.” (Participant 6 - IT).

This element therefore shows that isolation can lead to worsening the daily life of people suffering from cognitive impairment. Maintaining constant social relationships allows people to have a better attitude and feel more motivated to follow a healthier lifestyle, as reported in the following quotes about personal interests’ sharing:

> “I think that to have a healthy life is to stay fit and cultivate hobbies and interests.” (Participant 1-IT);
>
> “He likes to cook for the residents of the two flats here. He made soup for Easter and we had brunch. He really enjoys doing that” (wife) (Participant 5 NL);
>
> “Sometimes I call my friend to grab something to eat in the city nearby” (participant 8 NL).

This aspect has been broadly considered by the team during the definition of scenarios.

4.2 Results from Evaluation of Envisioning Scenarios

Among the aspects that emerged during this activity, the use of technology had a relevant importance. Very different points of view have emerged on this issue. As shown below, some users (the ones more capable with the technology) were interested and excited to use the proposed system. On the other hand, users less familiar with the technology were quite frightened. This leads the team to deduce that it is important to design solutions that are particularly suitable for this less convinced target, trying to foster greater trust in technology.

Future scenarios allowed eliciting opposite attitudes towards technology, ranging from personal skepticism towards technology, until very enthusiastic perspectives. These attitudes might be seen in statements like:

> “I am not very much interested in technology.” (Participant 11- IT)

> “This service is like a guardian angel. It could be a great brain aid. If developed well, it could be very useful.” (Participant 12- IT);

> “I would love to use it! I'm very curious about technology. I think technology could represent a proper aid if it's used in the correct way.” (Participant 13- IT).

Some of the participants also highlighted the cognitive aid role that technology might play, such as:

> “With these modern systems we use the brain less than years ago. In the past when you had to call someone you had to remember your phone numbers. Today we are used to pressing a key and calling quickly. On the other hand it is also true that technology simplifies your life.” (Participant 12- IT).

Among the most important results of the participatory sessions it has been reported that seniors, their relatives and caregivers need to be aware of the benefits of physical activity. Not only to increase motivation towards physical activity but also towards the use of technology as a motivator. Results also show that lack of competence is the most important barrier to engage in physical activity. Possibilities for social interaction are shown to be the main motivator. However, it should not affect seniors’ sense of competence and autonomy. Goals’ setting is already widely used in the whole caretaking process. The goals and pop-up notifications should be succinctly, specific and should focus on resolving the critical causes of the lack of hunger. The notifications should stimulate a new and healthier eat/drink rhythm. It is important to create awareness in a positive way. Elderly may get a negative experience with the system because of unreachable goals. The difficulty level of the goals should therefore automatically adjust to the skills of the person. It should not be too confrontational and should stimulate a positive mindset. wasting water for brushing teeth).

4.3 Results from Mockup Exploration

By using the interactive mock-up in co-design sessions, people were allowed to enter into two main components, like Physical Activity and Memory. Regarding the first one, all the participants were aware about the importance of regular physical exercise, and reported to exercise at least once a week. At the same time, when the team proposed the usage of a device, like a smartwatch to monitor physical parameters, not all the people were committed, as reported here:

> “I'm always on the move. It seems interesting, but I don't feel the need to have a smartwatch” (Participant 16- IT);

> “I already have one (she wears it). Instead I am very interested in having additional information about my physical activity, know how many kilometers I have traveled, heart rate, etc. I am a curious person. I do a lot of physical activity, in addition to walking, I go to the gym 3 times a week.” (Participant 17- IT);
>
> “I'm not interested in having a smartwatch. I don't do much physical activity. I usually walk a little and in these moments, I prefer to do it alone." (Participant 18- IT).

This exploration allowed the authors to highlight that people want to maintain their autonomy and independence and not everyone feels the need to monitor their physical activity in such detail. For what concerns memory, people have reported that they need to write down all important appointments and information they have to remember. In general, the system was positively accepted, as reported here:

> “For me it would be very useful to have help to remind me of things. The tablet would be perfect because I sign everything, shopping, visits, appointments and I do it on a calendar or smartphone” (Participant 17- IT).

At the same time, it is essential for people to be able to maintain their autonomy. Designing for this target means providing tools that, according to personal needs, allow them to feel autonomous and able to take care of themselves, as it happens with social relations, materials used as cognitive artifacts, like the post-it, and the use of the personal agenda: as reported here:

> “I prefer to remember things by myself. I don't want to get help from this point of view. If I need, I am asking for some help. My husband always tends to remind me of things." (Participant 18- IT);
>
> “Sometimes I wonder, "Did I do this? Once done, I throw the related post-it” (Participant 18- IT);
>
> “I usually use the agenda to remember things, but I think that the system help could be useful. I would use it.” (Participant 17- IT).

4.4 Results from Affinity Diagram

Keeping in mind the starting questions, the researchers taking part in these sessions were engaged in trying to make sense of the clusters of concepts and creating supergroups in order to answer the question: “What factors are most strongly affecting the starting issue/problem and how these factors are interrelated?”. As reported in Figure 1, the awareness of independent living represents one of the most important themes that the group of participants was discussing.

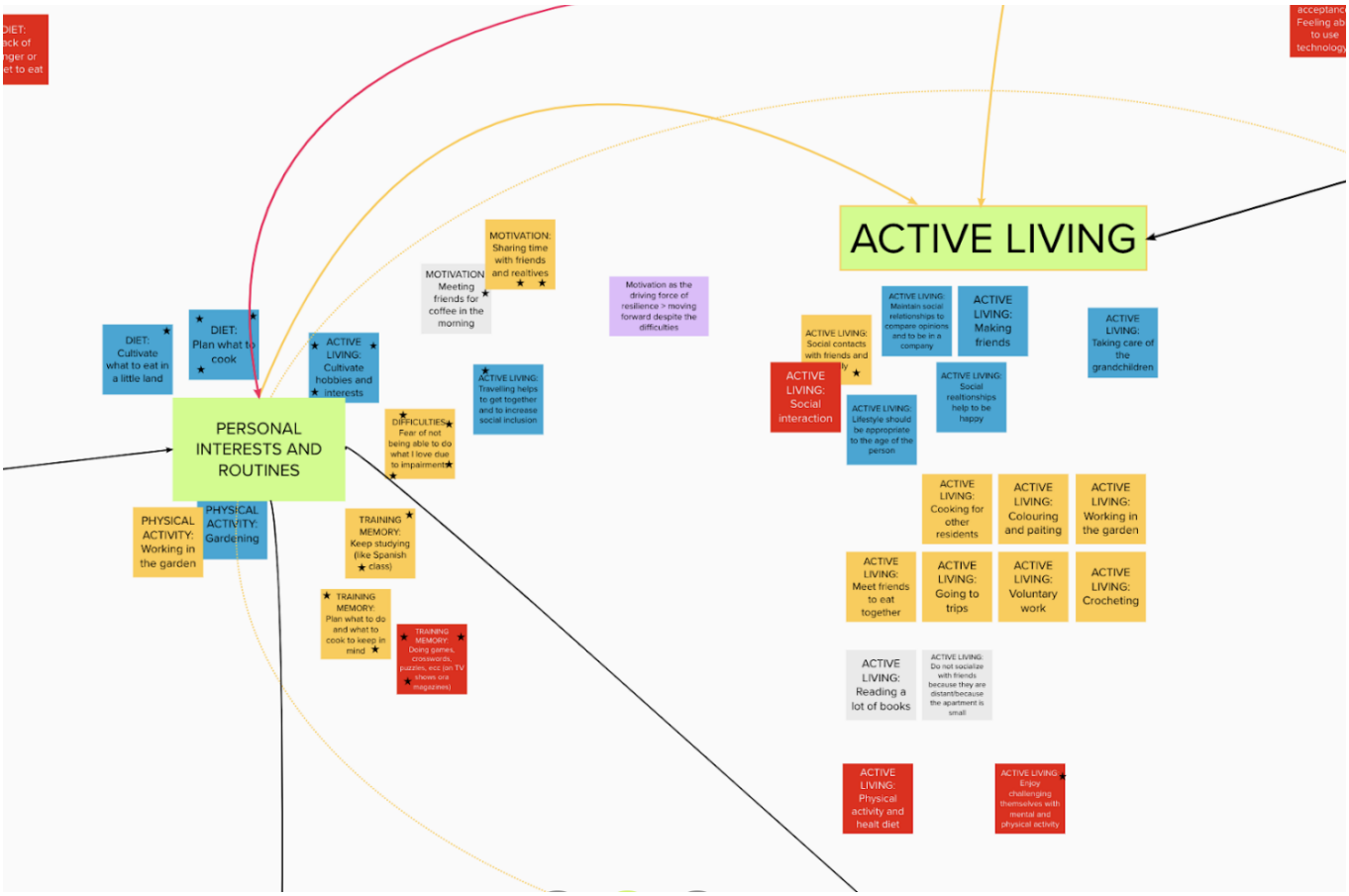

Figure 1. Awareness cluster with the detail of evidence of results from the research.
Some post-its include the preference star as well.

Most interestingly, the Affinity Diagram allowed the experts to create connections among the Active Living components, as reported by the other activities that have been carried out in this research. Figure 2 shows an example of the supergroups of clusters that have been created in the session.

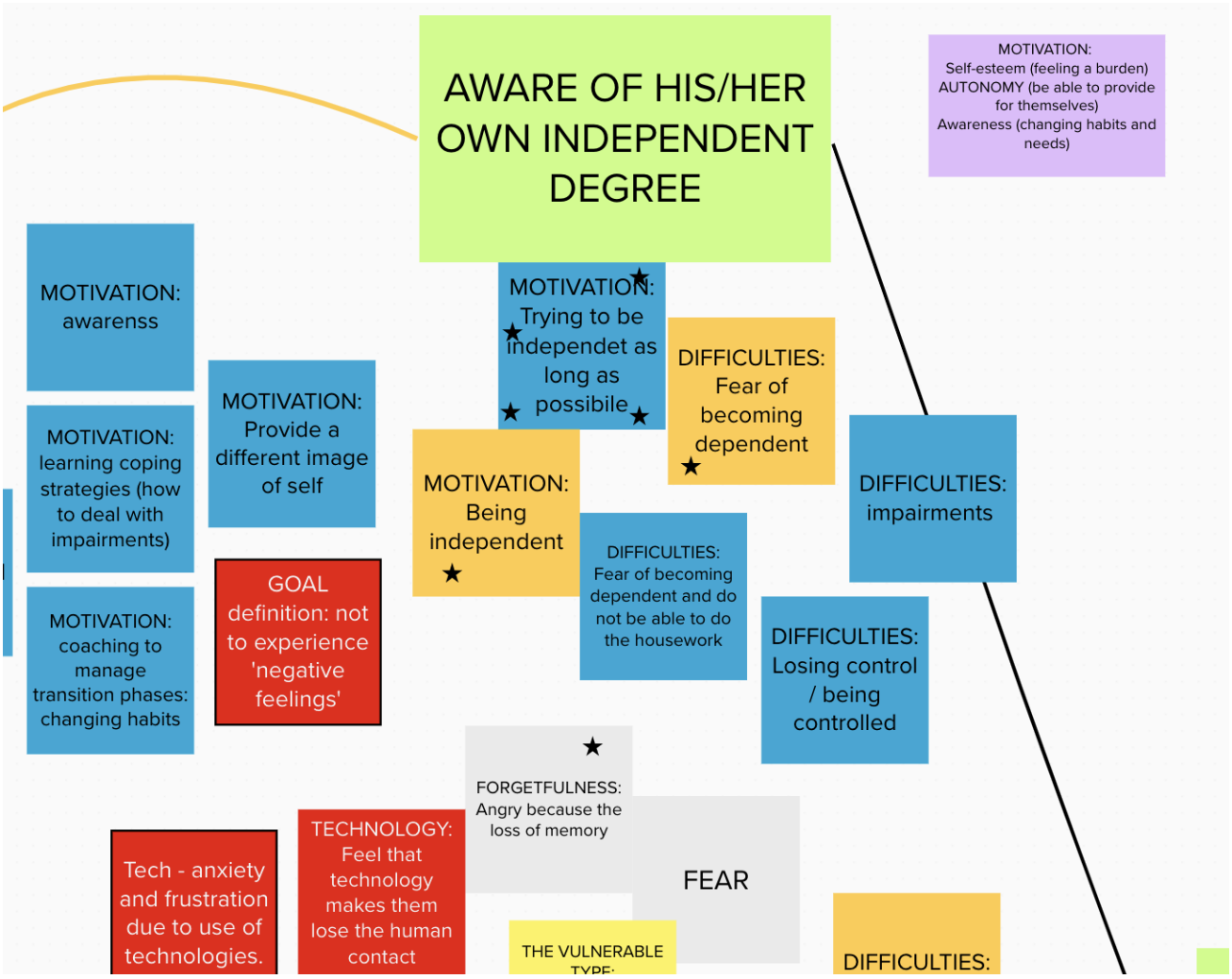

Figure 2. Connections among the clusters to create supergroups.

The Affinity Diagram allowed us to process and elaborate the qualitative data obtained by the user research into a structured knowledge base around the Active Living definition for the intervention. In our framework, Active Living is strongly grounded on the opportunity to stay fit while cultivating personal hobbies, like for example cooking, driving, painting and reading and with sharing personal interests and experiences. Action and interests are thus aimed at maintaining social relationships and contacts: negotiating ideas and values, discussing personal opinions with other people on different topics is considered essential for a healthy life. Social connections in fact may amplify, suggest, trigger a series of novel interests and stimulate people with MCI to live in a more positive way.

Regarding technology, the patients with MCI involved in our design phases have shown a higher level of acceptance if technology is perceived as a tool to facilitate self-determination. Technology is expected to be user-friendly and designed considering the possible visual impairments that can occur in old age and the limited users' skills. Technology should not provide "orders": the user must feel that he can choose and have full control of the activities he is carrying out. Also considering motivational aspects, the recommendations could be linked to the interests and activities that the user prefers: the user appears more favourable to implicitly receiving coaching advice.

5. Conclusion

In order to complement the top-down theoretical definition of Active Living provided in Par. 2, this research allowed the team to consider Active Living as an emerging reality consisting of a balance between the personal sphere and the relational one. In other words, a person is more motivated to live in a healthy way,

when he/she tries to maintain independence, including self-esteem, autonomy in daily activities, acceptance and awareness about the changing habits and needs, and carry on positive and inspiring relationships. In particular, motivation plays a key role in leading a healthy and satisfying life and represents the driving force of resilience that allows us to move forward despite difficulties. Motivation is also achieved through cultivating personal hobbies and interests, like for example cooking, driving, painting and reading.

Older people's participation in the exploration of Active Living allowed the team to verify the hidden assumptions behind research hypotheses and to disclose their actual perspectives about cognitive decline, self-perception and active ageing expectations. Personal life conditions, inner motivation challenges and management of dynamically changing health conditions are all factors that might be considered at the heart of assistive technology research and design through the active participation of people with vulnerabilities. stimulate and support awareness and individual decision-making actively, and promote collective participation to generate common critical thinking that can address the challenges of the climate crisis by contributing to more responsible and sustainable social and cultural progress.

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