

***Matchmaking Algorithm as a Tool to Tackle the Aging-Related Social Network Shrink:
Results and Recommendations From the Transdisciplinary
HannaH Technology Development***

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Abstract

This paper argues for the transdisciplinary conduct in the development of innovations in smart aging solutions based on the research results from the development of a matchmaking algorithm that tackles the aging-related social network shrink. The HannaH research team focused on developing the matchmaking algorithm that would support the exploration of new social contacts in the nearby of the place of residence of a user. The algorithm was designed so it can be used either in the smart speaker or as the smart phone app. The paper presents the research results from the concept development based on the research within end users as well as relevant experts. The series of focus groups, follow-up interviews and the MEESTAR study that focused on the iterative co-creation and the reflections of potential risks of the technology, resulted into three areas of research outcomes that are presented in the paper: (1) general concepts and looks, (2) data safety and research architecture and (3) ethical principles and legal processes. Further, we demonstrate how the smart aging solutions development and implementation can be effectively empowered by the transdisciplinary conduct. We show how personal assistance supports intragenerational ties and local community development, we suggest that providing feedback effectively contributes to participative development and digital competences raise, and we discuss the interrelation of digital safety and economic measures of the innovation development. We conclude with the argumentation for transdisciplinary perspective on compensation of the sensitive ethical aspects of the technology and bring suggestions for respective possible measures.

Keywords: Aging, Iterative Co-creation, Matchmaking Algorithm, MEESTAR, Social Network Shrink, Transdisciplinarity

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Introduction

The Institute for Applied Research on Aging at Carinthia University of Applied Sciences (IARA, CUAS) develops transdisciplinary solutions for active assisted living, with a special focus on aging and regional structural context (IARA, 2023; Oberzaucher et al., 2021). We specialize on life situation of older people, technical support and possibilities of aging, as well as the economic and demographic conditions of aging. Our mission is to achieve and utilize scientific findings about aging society, and to improve the social, health and economic situation of older people. We do this in a transdisciplinary manner; that means that we combine the focus on demographic change and regional development, socio-technological innovations and the social inclusion and participation until old age. In this paper we demonstrate how we proceed in a transdisciplinary manner on the case of the HannaH project in the stage of an innovation development and bring results on three levels (general concepts and looks, data safety and research architecture and ethical principles and legal processes).

The Development of the Matchmaking Algorithm HannaH

The project Hannah, a small collaborative innovation development project that place in 2022 with the support of the Active Assisted Living funding (AAL) and the consortium consisted of Norwegian, Dutch and Austrian partners. The business partner and the consortium coordinator was the research and the development company SPRIGS from the Netherlands (SPRIGS, 2023), on the user side there was the Dutch Senior Association (NOF, 2023) and the municipality of Raelingen in Norway (Raelingen commune, 2023), and the research part was taken by IARA, CUAS (IARA, 2023).

The problem that HannaH project focused on can be demonstrated by a short quotation of a senior person: “It became so silent around me.” According to the research, the social networks tend to shrink during aging in terms of size, diversity and frequency of social contacts, whereby the circle of friends tend to be reduced more significantly than family ties. (Wrzus et al. 2013). The existent research shows that the peak of the social network development in the human life is situated between mid-twenties and early thirties. Afterwards, it tends to slowly but surely drop and it significantly drops in the senior age, whereas this trend tends to appear more on the friendship dimension of the social networking than on the family side. The average size of the friends network of people over 55 years is then between four and five friends.

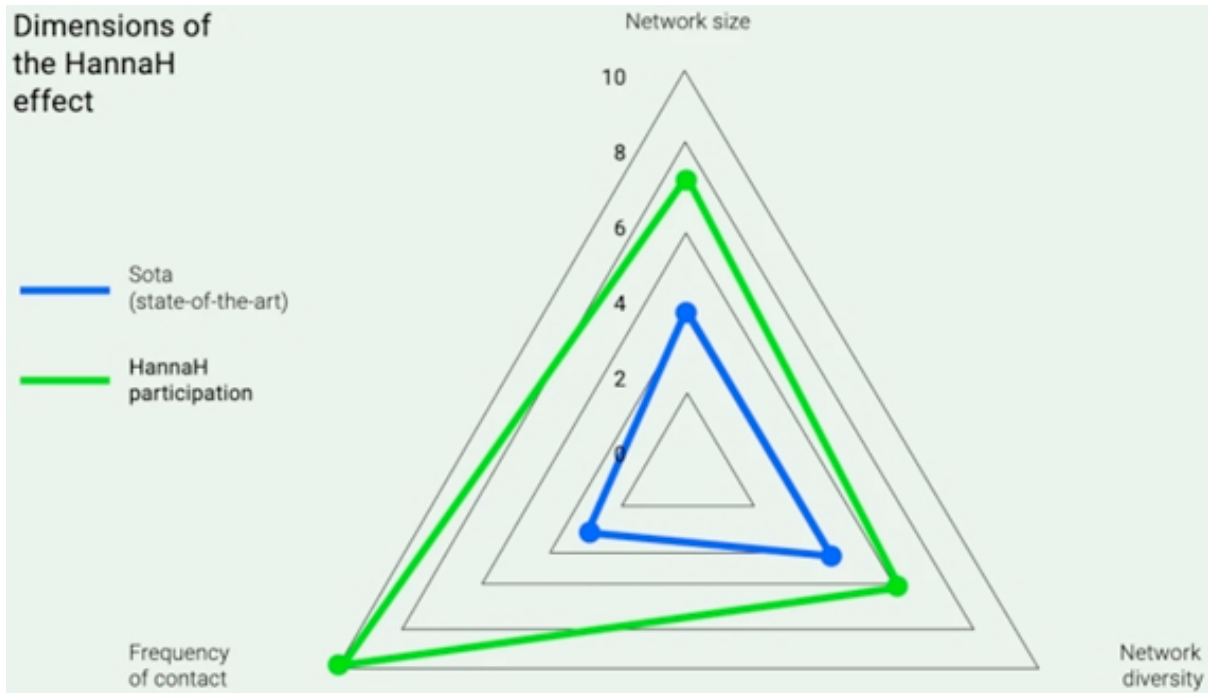


Figure 1: Social network shrink. Resource: HannaH project

We focused on the social network shrink on all three dimensions: size, the frequency of the social contacts, and the diversity. The idea is that user would be prompted to trying new social contacts on more basic level and gives themselves new opportunities to develop new social relationships with people they do not know from previous life, despite relatively limited mobility and diversity of social contacts in comparison to previous life stages.

The HannaH technology tackles shrinking of a social network in a following way: After the introduction, basic schooling and installation, the matchmaking algorithm, either in the smart speaker or as the smart phone app, invites user to make short contact with somebody they do not know, but may share the interests with via short audio incentive. Based on the approval in the form of short conversation the algorithm picks someone from shared database and suggests the other person short conversation with someone new. All users input basic data into the HannaH database by themselves, so the algorithm has a reservoir of interests and other relevant data to search through. The suggestion for new social contact would be formulated in the short sentence like “Would you like to chat with somebody?” Shall both, first and the second user reply positively, HannaH organizes online chat session through audio speaker between the two of them. Of course, if those two users enjoy the chat, they may chat again on their own initiative, or even at some point also meet each other and develop their social contact into the more complex relationship that is no longer dependent on HannaH facilitation. On the contrary, in case any of the users wishes to withdraw from the contact during the audio-facilitated matchmaking, HannaH should navigate them into the smooth and easy withdrawal. During our research, the HannaH technology was explained to the end users and experts with the help of short comic showing how the matchmaking algorithm (incorporated into the smart speaker) may facilitate the social network expansion.

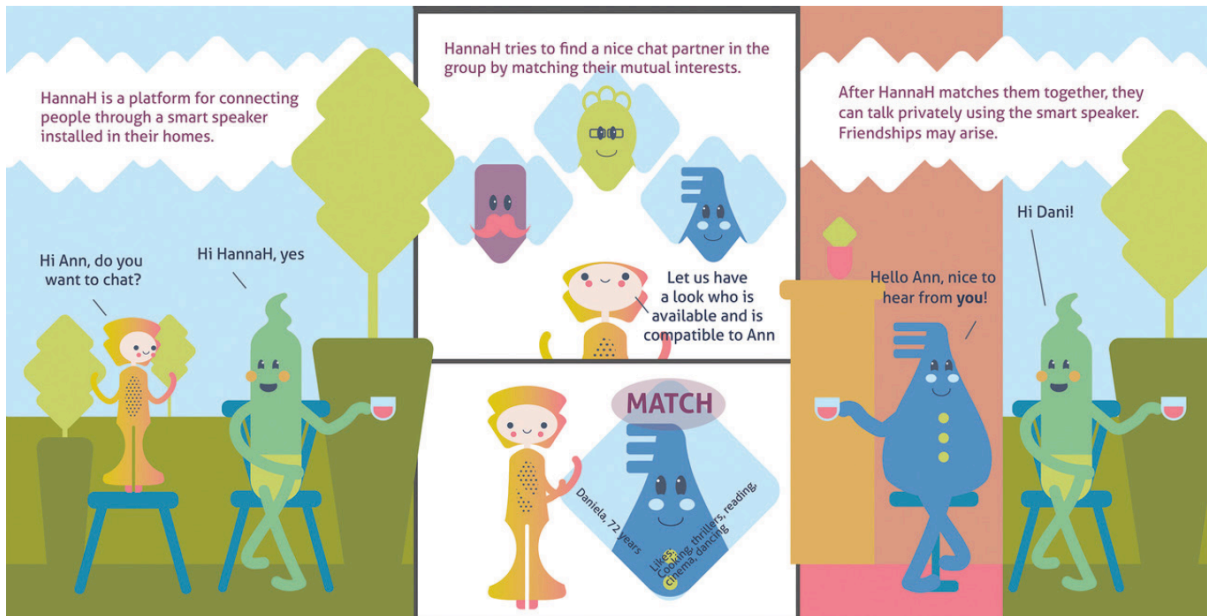


Figure 2: Comic approaching HannaH technology to end users. Resource: HannaH project

Methodology

Our research task at IARA was to contribute to the development of concept of HannaH by the iterative co-creation of the matchmaking algorithm. We focused on the formulations of the end users needs and the reflections of the potential risks of the technology. This entire research design was focused on developing on the first stage of the aging innovations development. That means we focused on the idea and the concept development, not the implementation and the evaluation, or productization and anchoring.

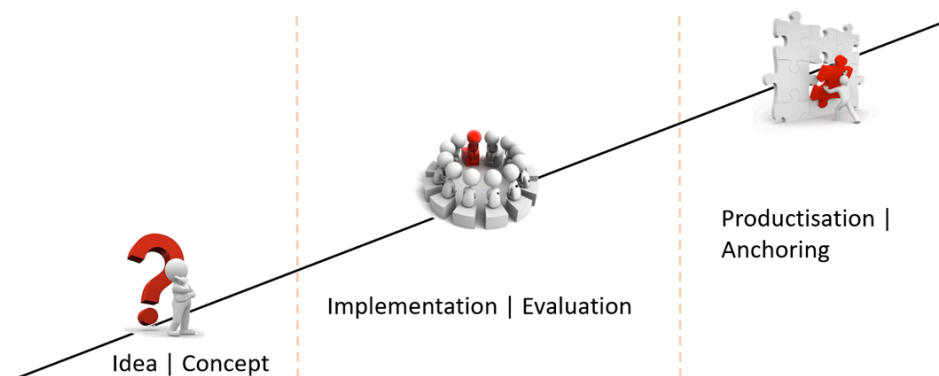


Figure 3: Smart aging – filling the innovation gaps. Resource: Oberzaucher, 2023

The research design was the following: On the side of primary and end users (that means seniors), we conducted several focus groups in all the participating countries, together with 33 participants, and individual follow-up interviews with 12 people from Netherlands and Austria. On the side of experts, we spoke with experts from active assisted living, care, and other interdisciplinary experts in the later stage of the research. First we conducted a set of focus groups together with five experts from care and active assisted living and finally we conducted the MEESTAR study (Menzeschke et al. 2013), the Model for the Ethical Evaluation of Socio-Technical ARrangements. All together, we spoke with 7 people with the

following fields of expertise: user design and software development, information technology, industrial engineering, disability and diversity studies, psychology, applied social sciences and sociology. With our study we answered the following research question: **What are the user needs and the potential risks of the matchmaking algorithm that is supposed to tackle the social network shrink in an older age?** The research results can be clustered in three topics. One is the general concept and looks of HannaH, second is the architecture and data safety of HannaH, and the third is the ethical principles and the legal processes, while developing and introducing HannaH into the market and society.

Research Results I. General Concepts and Looks of HannaH

Looking at general concepts and looks of HannaH; both, end users and experts agreed on the importance of personal assistance of the matchmaking algorithm implementation. Both groups said that it is really important, that the entire philosophy, how to use it, and also the selection of well-fitting potential participants should be communicated in a face to face dialogue. We assumed that this suggestion has great potential for the local community participation and that this can also strengthen the intergenerational social ties, for example, by creating a voluntary group in the local community of youngsters that may help the technical support of the technology, and so forth.

An important outcome that came from end users was that HannaH should not be mismatched with a human assistant, and that it should be clear that HannaH is a technology, not human. The need of such emphasis may have been triggered by an outlook of the introductory comic (see Figure 2), as HannaH is in a way humanized there. Research participants emphasized that it should be clear that HannaH is not a human assistant from the very beginning. Further, both groups, end users and experts came with an idea that it would be good either during the usage, or at the point of exiting or entering to give the opportunity to give the feedback to the developers and then the algorithm can be developed further. Experts also suggested that it would be good if there is a support hotline in case technical issues appear while using HannaH.

Especially experts pinpointed at the importance of the critical mass of users that should be in the reservoir of contact at the point of introducing HannaH, because in their perspective this raises the possibility of quick and suitable matches; and the experts agreed that if the algorithm would not quickly give well-fitting match then the user will not be motivated to use it further. So the critical mass of users from the very beginning resonated as an important point when it comes to general concept of the developed algorithm. In association to this point, the experts also emphasized that the trust and meaningfulness of using HannaH has to be built very fast and that there are social media platforms, concurring applications, and software, so somehow the end users have to be motivated to use HannaH; and this goes back to the first point of general concept and looks results, since the motivation to continuously use HannaH may be supported by the cooperation with local authorities, be it care workers, the network of volunteers or civic associations.

Research Results II. Architecture and Data Safety of HannaH

Both, end users and experts delivered valuable inputs regarding the architecture of the matchmaking algorithm safety and its data security. In terms of HannaH form, the suggestion was given that it would probably be the best, if HannaH is both stationary and portable, because then the matchmaking algorithm would be able to meet the diversity in the mobility

conditions and habits of end users, and that it could also be flexible and follow one primary user's mobility habits diversity, so it can be used both at home and on the way by one primary user. Another valuable input was that no matter if HannaH is in the smart speaker or as the smart phone app, it should have incorporated very transparent on-off button, in order to secure privacy and to ensure users that they are not constantly being listened to.

Something, that was definitely not welcomed by the research participants, was the possibility of automated detection of emotions by HannaH. The idea behind this suggestion was, that the automated detection of emotions may ease the user to withdraw from discomforting interaction, or strengthen tackling the loneliness, if HannaH indicates that a person feels lonely and suggests new interaction. But, all sorts of possible automated detection of emotions were simply not evaluated positively and considered desirable.

Regarding the data storage and sharing, the suggestion was that this service should be independent, it should not be served by any third part, so there is no data sharing issue with any third party, like external company. Similarly, regarding the data storage, the suggestion was that data should be stored as locally as possible for similar reasons.

There was suggestion that the data sharing setting could be flexible, so some users can share only the minimal amount of data and then later if they trust the system more or from the beginning if they feel like it, they can choose to share more data in a more complex way, because this could give them better fitting matchmaking services. Such flexibility of data sharing setting could support developing trust to the system and the user comfort.

Regarding the discussion of cost for services, the debate was quite diverse, but more participants were at the end of the day in favour of public funding and free of charge of service of HannaH. Finally, the research brought idea that HannaH could have an added function as emergency alarm and this could also be considered an added value of the technology.

Research Results III. Ethical Principles and Legal Processes

Last but not least, we discussed the ethical principles and the legal processes with the research participants. During the interdisciplinary expert discussion according to the MEESTAR study (Menzeschke et al. 2013), the high ethic risks were pinpointed in the dimensions of care, safety, justice and privacy. And average risks were defined in the dimensions of autonomy, participation and self-conception. Overall, the HannaH technology was evaluated as ethically sensitive, but in a way that can be compensated for.

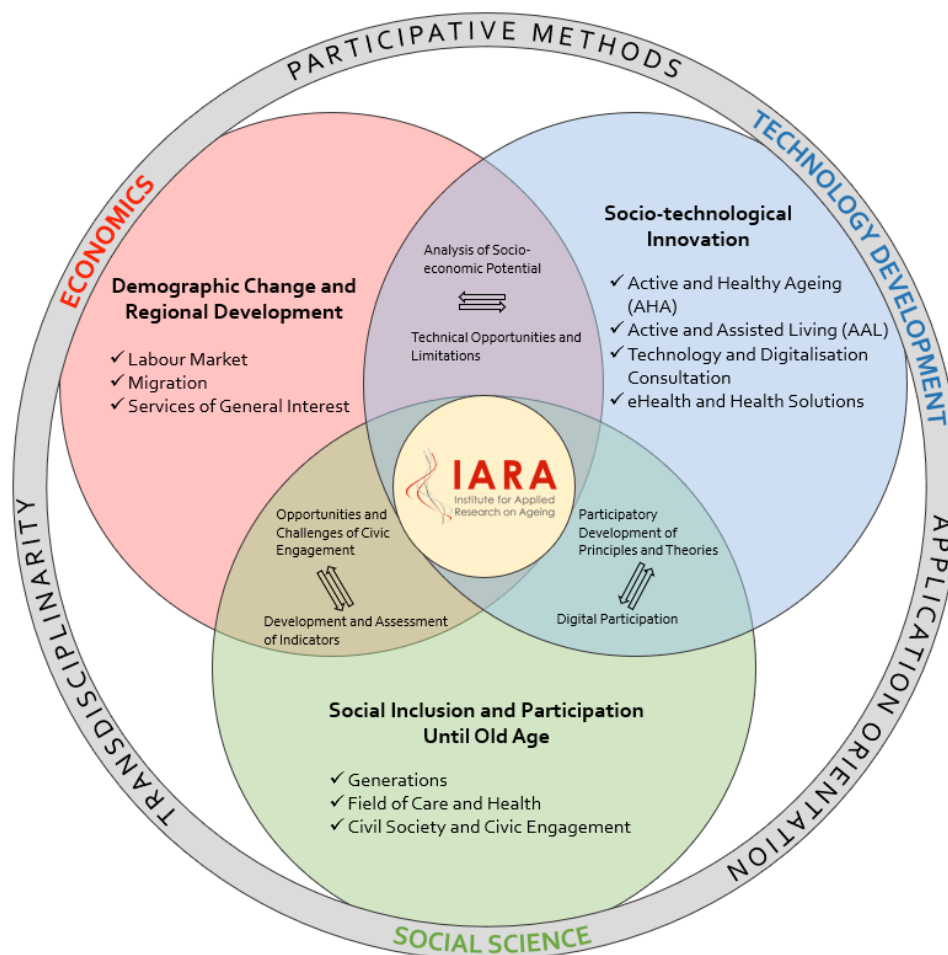
During the MEESTAR study debate, the experts concluded that support in stress resilience and self-control skills would be highly recommended and this would be a great preventive measure while introducing HannaH. That means, that some of the risks or ethically sensitive issues that may come with the technology, would be resolved with supporting human skills of dealing with loneliness, stressing communication, pressure on decision if I am, as a user, going to proceed with slowly developed new friendship or not. The experts also strongly recommended to introduce some technical support of the system abuse prevention. For example, for commercial purposes of third parties and so forth.

We also discussed the issue of intercultural friendships, multicultural societies that are aging, and the experts concluded that perhaps it would be a good preventive measure if the

matchmaking algorithm does not address cultural differences during the matchmaking at all. There was also one critical topic of tackling loneliness, featuring technological support of such process; the experts agreed that there is a slight jeopardy of substituting the outgoing routine with audio home-to-home contacts through the speaker or application, so that here also the support of local community services may be a good prevention of such an unfortunate development, so the technology does not at the end of the day support loneliness, not tackle it.

The Potential of the Transdisciplinary Conduct

We would like to conclude with showing how we treat transdisciplinarity and transdisciplinary approach in our Institute for Applied Research on Aging, based on the data from the HannaH research. Smart aging solutions can be effectively empowered by the transdisciplinary conduct. Transdisciplinarity is not just combining different forms of knowledge, it is as a matter of fact creating new forms of not only knowledge, but also solutions.



Resource: IARA

Figure 4: The transdisciplinary approach of IARA

In order to demonstrate it, let us get back to some of the concluding remarks from HannaH research outcomes, and discuss the transdisciplinary approach to them, in terms of further development of the technology, or any other research and development in the field of smart aging.

In the general concept and looks of the HannaH technology, there was stated the importance of personal assistance of matchmaking algorithm in implementation. This would have potential for local community participation and for the strengthening the intergenerational social ties with local community, care providers or teenage participants who would voluntarily give technical support to end users. That means, that personal assistance in implementing the matchmaking algorithm would present not only the opportunity to develop local civic engagement, but it could also present an economic input for local economies to blossom.

The second exemplary outcome that demonstrates well the transdisciplinary approach is the suggestion to incorporate the possibility of providing the feedback by end users in order to continue in development of an algorithm. This not only helps the technology development, but it also supports development of the digital competences and participative approaches in the research and development. This means that such measure can also support closing the digital gap in a society where HannaH would be introduced.

Sometimes the transdisciplinary approach uncovers the dilemmas that need to be resolved. This can be demonstrated on an example from the research outcomes on architecture, safety and data security. The suggestion that the data should be stored as locally as possible, de facto raises the costs of the technology if we consider contemporary European economic framework. So to an extent, this conflicts with the suggestion, that the service should be free of charge. The technological solutions that are being developed in the aging research, should be parallelly piloted economically, we need to think if and how can public financing support the solution, how low threshold it can be in terms of accessibility of end users, etc. Such discussions and simulations should be piloted well before the productization phase and this can in terms of impact help developing smart aging solutions with more significant social impact.

Conclusion

Based on the research results examples given above, we can conclude that the transdisciplinary conduct in the aging research brings more opportunities than challenges. The statement from the HannaH MEESTAR study was that this technology is ethically sensitive, but in a way that it can be compensated for. Once a research team introduces transdisciplinary perspective on research topics, it also widens the reservoir of the solutions and shortage compensations in more than one disciplinary field.

For example, when we were talking about the technological support of HannaH with experts, and the fact that it may bring people into dilemmas, how to deal with being overwhelmed with too many new social contacts, or technical difficulties of handling the device, this could be approached as positive challenge and the introduction of the technology can be combined with the education of being more resilient, more digitally competent, so at the end of the day, the seniors could benefit from introducing new technology, if it is followed by the right social solutions; and if it is economically harmonized with the local and global economical and demographical framework.

In the smart aging, the technology does not only play an assistance role. In the case of HannaH matchmaking algorithm, it brings added value in terms of neutrality of service given and supporting user's autonomy by providing matchmaking exclusively according to the inputs that user inserts to it. The user should be as much as possible in charge of creating

their own social networks and the matchmaking algorithm is supposed to operate with sensitive approach, not engaging them into unwanted contacts. Thus, HannaH operates in a decently personalized manner, while supporting and empowering user's autonomy. Such outcome could be formulated thanks to the transdisciplinary approach, that IARA team introduced while developing the HannaH matchmaking algorithm.

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