Designed to serve

Valorization Addendum

According to the Appendix 4 of the Regulation Governing the Attainment of Doctoral Degrees at Maastricht University, knowledge valorization refers to the "process of creating value from knowledge, by making knowledge suitable and/or available for social (and/or economic) use and by making knowledge suitable for translation into competitive products, services, processes and new commercial activities" (definition adapted from the National Valorization Committee 2011). I believe that new knowledge, just as any type of innovation, should not be only academically, but also societally relevant. In this addendum, I discuss the relevance and value of this dissertation for a diverse set of stakeholders, including managers, users, policy makers, and society at large. I show how my research findings and the research approach I have developed can be utilized in practice.

Chapter 2 - Value of Social Robots in Services: Social Cognition Perspective

This chapter introduces the conceptual foundations and the framework of value co-creation/destruction of social robots in services. I conceptualize social robots as systems of varying affective (e.g., perceiving and acting upon emotional reading) and cognitive (e.g., logical and rational thinking) capabilities which affect users' personal values which in turn can positively or negatively impact robot's acceptance. With the emergence of non-human actors in complex service systems, this conceptual chapter provides important value-centric implications primarily for technology developers and service providers. First, technology developers should map robotic functionalities (e.g., recognizing user's moods, processing user's medical history, alerting caregivers in case of an emergency) according to the proposed matrix of affective and cognitive resources to increase the likelihood of user acceptance. Understanding which functionalities contribute to perceptions of human-like warmth and which to perceptions of competence, can help in crafting value propositions which will better convey the value of different robot types (e.g., thinking robot, feeling robot, or robo-sapiens). Furthermore, understanding how different functionalities feed into warmth and competence dimensions can help technology developers focus on enhancing the users' perceptions of the robot's human-like mind and behavior.

Second, since values tend to be abstract and ambiguous, interdisciplinary innovations teams are advised to get their 'hands dirty' and employ interpretative approaches to get equipped with unconscious, tacit elements of user knowledge such as users' dreams, hopes, anxieties, and fears. Technology

developers need to understand which personal values get activated as users' network contexts get disrupted by novel technologies such as social robots. That implies extending their methods toolbox with qualitative, generative research approaches (e.g., user narratives, context disruption interviews, generative techniques) that gather in-depth network insights and tap into activated personal values. Third, service providers need to start introducing novel automated services by first releasing early service prototypes and testing them with users through participatory sessions. This process should be continued in an iterative manner to detect potential hindrances to value co-creation such as privacy and data management concerns, robot maintenance and repair, and authenticity of artificial emotions. In this way, service providers can translate users' positive and negative evaluations of the robot's instrumentality to their value attainment to technology developers, in order to design robotic technologies around value trade-offs.

Chapter 3 - Beneficiaries' View of Actor Networks: Service Resonance for Pluralistic Actor Networks

Chapter 3 zooms into the activation of users' personal values such as functional values (e.g., safety and organization), social values (e.g., entertainment and connectedness), and emotional values (e.g., love and companionship). It further argues that the tools that are currently used by marketers and designers might not be the most appropriate to understand the differences in how people perceive value and value-creating networks. To fill this gap, I introduce Contextual Value Network Mapping as a tool which allows users to represent their own understanding of network structures and value co-creation/destruction rather than assuming that there is a single service network type. In that way, this chapter and its accompanying mapping tool offer important implications for both user researchers and users themselves. Benefits for users include:

- An opportunity to freely map their understanding of what is implied by a care-network, without being pushed to fit their mental maps into pre-established network templates;
- A way to make abstract future scenarios concrete, intangible elements tangible, invisible more visible;
- A gamified approach that relaxes anxiety surrounding technology discussions;
- A way to externalize mental processes to capture social connections and elicit pain-points and gain-points of robotic technology introduction.

Here, I present a couple of quotes from my respondents' feedback regarding the interviewing method/mapping technique:

> *Yes, it certainly helps [having cards]. It gives more structure…And I have the tendency anyway to draw when I talk…it would be difficult to express everything just in sentences…And it also helps me to understand it better to clarify some things for myself before I talk about them. It really helps, yeah! (Respondent A)*
>
> *Yeah, it helped [having cards]! Because then you [the interviewer] remember more things that I've said or done using the cards and then you can probe deeper on these things. For example, "At this point you've said this…". So it was fun! It really helped. And the visualization helped a lot. (Respondent B)*
>
> *I like it how you ask questions with cards. It makes it easier to answer your questions. (Respondent C)*

Benefits for researchers of using the mapping card activity include:

- Helps in the recruitment of participants since they feel excited about the card 'game';
- Helps elicit users' tacit knowledge revealing more than traditional interviews;
- Allows researchers to probe into users' thinking by observing their actor cards placements and changes in actor positions prior and after the technology disruption;
- Induces 'sensitivity to others' among users (i.e., makes users think of other actors affected by the technology) to provide a network-conscious approach to designing technology-enabled service systems.

Furthermore, the concept of service resonance informs service designers and developers that they need to take the diversity of users' networks and personal values into account. This chapter highlights the differences between elderly peoples' mental models of elderly-care expressed through network visualizations, but service developers need to take into consideration that for any service, there are many actors whose mental models are significant (e.g., patients, doctors, nurses, family members, facility managers, etc.). Hence, to design new technology-enhanced services, one needs to understand the different mental models with which the service needs to resonate.

Chapter 4 - Service robots: Value co-creation and co-destruction in elderly care networks

Chapter 4 focuses on identifying users' expectations of the robot's value co-creating/destroying roles in care-based value networks. This study offers valuable insights for technology developers, service designers, service managers, and healthcare personnel. My findings demonstrate that elderly people find robots that are equipped with social skills comparable to human caring actors. Specifically, the robots invoke perceptions of anthropomorphized functions and value co-creating (i.e., enabler, ally, extended self) and value co-destroying (i.e., intruder, replacement, deactivator) roles. Service providers should understand that different categories of users might have different hopes and fears when it comes to robots, in order to tailor robotic services to enhance rather than inhibit users' health-related goals. Furthermore, adopting a network-conscious approach can garner important value co-creation/destruction trade-offs between the self and others-orientation. This can be leveraged when developing social robot introduction activities and communication strategies (e.g., acknowledging users' concerns and proposing ways to circumvent possible value co-destruction potential; harnessing network influences by emphasizing the value co-creation potential for formal or informal caregivers).

Moving service design from user-centric to network-conscious focus acknowledges that the user is not an isolated island, but rather embedded within networks of actors - that have their own views of benefits and risks of a novel (technology-enhanced) service and can even be show-stoppers when it comes to service acceptance. Therefore, my recommendation to various stakeholders intrigued by networked innovations is to engage in Context Disruption Interviews and Contextual Value Network Mappings to gather in-depth insights on value co-creation and co-destruction potential of technology-enhanced services on an individual user and network levels, from perspectives of different network actors. I advocated for and introduced the CAIC method (1. **C**ontextual Value Network Mapping – status quo, 2. **A**ctive immersion, 3. **I**ntroducing disruption, 4. **C**ontextual Value Network Mapping – new condition) to diverse sets of audiences, by offering both academic and practitioners' workshops and conferences. Below, I provide a list of events where this method was presented (excluding the academic conferences):

- "The Disruption of Service Networks", workshop at the Service Design for Innovation Conference (Cologne 2017);
- "Socially Assistive Robots in Care-Value Networks", presentation at the Institute for Systems and Robotics (Lisbon, 2017);

- "Programmed to Care: Designing Value Networks Around Social Robots", workshop at the AI | IA Conference – 'AI & (strategic) InterAction' at the Brightlands Smart Services Campus (Heerlen, 2017);
- "Assisted Living in Healthcare"; Service Science Factory's workshop for the Alhtour project (Maastricht, 2017);
- "Social Robots in Services", presented at the Department of Computer and Information Science (IDA) of Linköping University (Linköping, 2018);
- "Design of Complex Service Systems and Value Networks", workshop at the Service Design for Innovation Conference (Porto, 2019);
- "Programmed to Care: What is the value of Social Robots in Healthcare?", masterclass at the Limburg Leads 2019 (Maastricht, 2019).

Chapter 5 - Robotic Versus Human Coaches for Active Aging: An Automated Social Presence Perspective

Chapter 5 draws on automated social presence theory to show that users activate mechanisms of social perception when interacting with a socially-capable robot and that users humanize the machine in their imagination. Based on real-life field experiments, I report that social robots make elderly users feel like they are in a company of a social entity. Furthermore, I show that human actors score higher on social cognition dimensions (i.e., warmth and competence) compared to social robots. However, I show that social robots do not lag far behind humans in their ability to motivate elderly people for physical activity.

Robotic technologies can be seen as a potential solution for ensuring the well-being of elderly people and their care-providing networks through improved service, constant presence, and reliability. Still, the introduction of robots within the elderly care setting provokes brisk academic and public policy discussions moving from dystopian (e.g., fear of losing human touch, human obsolesce, privacy concerns) to utopian (e.g., panacea for social problems, unburdening of the overworked care staff, prolonged independent living) projections. This study provides an early indication that socially-capable robots can act as exercise coaches for elderly people and thus have a potential to improve users' physical and psychosocial wellbeing. However, I emphasize how together with improved autonomy of robots, their affective capabilities (e.g., kindness, care, emotional sensitivity) and task competence (e.g., ability to demonstrate exercises, understanding of the elderly's physical impairments) need to be enhanced.

In line with the findings of this dissertation, I advise service managers to evaluate the robotic technology they intend to implement through robot's i) similarity to

humans in terms of looks, mind, and behavior, ii) affective and cognitive capabilities, iii) value co-creation/destruction roles, and iv) level of autonomy. For the state of art social robots, I recommend augmentational roles (e.g., motivational coach, gaming partner, conversation partner) rather than more advanced care-providing roles (e.g., nursing, consoling). However, as robot's autonomy, artificial empathy, reliability, spontaneity, and flexibility improve, I believe robots will be well-equipped to extend elderly people's social networks and support human caregivers in more challenging social tasks.