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Value-infused Design for a Service-Matching Platform for the Elderly

Research-in-Progress

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Abstract

Population aging is a worldwide trend. Designing systems aimed at this population segment is difficult because requirements identification remains a challenge. We describe value-infused design as a possible solution to this problem. The paper shows how value-infused design may be operationalized by translating value priorities into design imperatives, and then, into design principles that guide the design of systems. We demonstrate this with the design of a service-matching platform aimed at assisting the elderly for locating services such as housekeeping, meal preparation and others. We find that values such as tradition, security and self-direction remain important for the elderly. These, however, require a translation into design principles. The paper describes a prototype system that was built reflecting these principles, and concludes with implications for operationalizing value-infused design and describing next steps aimed at empirical evaluation.

Keywords: Value-infused design, Elderly, Service-matching

Introduction

Population aging is a worldwide trend and the proportion of elderly people continues to increase. According to the United Nations Population Report (UN, 2015), 900 million people reached an age of 60 or older, accounting for 12.5% of the total population in 2015. It is estimated that by 2050, the number of elderly people will increase to more than 2.1 billion, and the proportion will more than double from that in the year 2015. The report also indicates that the number of elderly who are living independently (alone or with their partner only) is increasing (UN 2015), and that most elderly people prefer to live in their own places rather than in hospitals or nursing homes. To assist the elderly living independently at home, peripheral services such as housekeeping, meal preparation, regular health measurement, home physiotherapy are of high demand.

The aging of Japan is thought to outpace all other nations. The country is purported to have the highest proportion of elderly citizens, not just in rural, but also in urban areas, resulting in a “super-aging” society (Muramatsu and Akiyama, 2011). The elderly (65 and over) in Japan are projected to be over 40% in 2050 (UN, 2015). Elderly who need care in order to live by themselves have also been growing. Most hope to stay at home rather than in a care facility or hospital even though they find it difficult to live on their own. Although there is a sophisticated welfare system in Japan and hospitals / elderly care

institution can provide medical and other services for the elderly (often with only 10% of the actual cost via a national insurance plan called long-term health insurance plan), this does not cover meticulous care to improve quality of life for elderly. They still need to seek help for some additional services from professionals beyond medical institutions.

There are many service matching businesses (platforms) available in the market, such as TaskRabbit (US) and Airtasker (Australia). They take the form of an online and mobile marketplace that matches freelance labor with local demand, allowing consumers to find immediate help with everyday tasks such as cleaning, moving, delivery and handyman work. Users can describe the task they want and indicate a budget, the platform broadcasts the task to the community members who bid to complete the task. However, such, generic service-matching platform cannot be directly used to serve the elderly for several reasons. First, some services required by elderly require nursing knowledge and professional certification. Second, the elderly are still more accustomed to looking for services from yellow pages or newspaper advertisements. Using an online and mobile platform remains somewhat challenging for them. The third is an issue that is specific challenge for Japanese users. They need help to understand which service is covered by the national insurance and to what extent before they can make a decision. Other than these three issues, probably the most important issue remains the question of how to better reflect the distinct and specific perspectives of the elderly users. The research question we consider, therefore, is: *what should guide the design of platforms (such as service-matching) for the elderly?*

We argue that the several existing alternatives for requirements elicitation and software and information systems design (e.g., Babar and Lescher, 2014) are likely to be inadequate in the context of designing systems for the elderly in general, and more specifically, for service-matching platforms because they cannot adequately consider the characteristics and unique needs of the elderly. To address the research question, we follow a design science orientation, which conceptualizes research as learning via building of artifacts (Hevner 2004, von Alan et al, 2004). An important input to our effort is the use of kernel theories, which ensure that our design science efforts are theory-infused (Sein et al, 2011). The kernel theories we draw upon for this work include the theory of basic human values (Schwarz, 1992, 2005, 2012) and value-sensitive design (Friedman, 1996), including more recent investigations in this space such as *Anonymized* (2016) and Dadgar and Joshi (2018). We derive values that are important in this context and develop an online service matching application “Lotus Helper” to provide home-based care service to elderly people from professionals outside healthcare institutions.

The paper describes the combination – deriving values from the elderly and design of the prototype – as value-infused design. The paper is organized as follows. First, we discuss the value-infused design, examining and extending prior work on value-sensitive design, as the overarching framework for the study. Next, we discuss how to extract values relevant to the context of study. This is followed by a description of the prototype and artifact along with a brief description of how the artifact reflects the values. We conclude with contributions of our work and pointers for future empirical studies.

Value-infused Design

Scholars have argued that values that are valued by the users can and should shape the design of information systems and services in important ways. Values are defined as “what person or a group of people consider important in life” (Friedman et al., 2006, p. 349). The values perspective draws on domains such as moral philosophy and business ethics to bring forth a sense of right and wrong, and what ought to be (Rokeach, 1973). They reflect an appreciation of intrinsic human priorities rather than economic benefit (Purao and Wu, 2013). They capture what matters to us as individuals. Infusing values in design ensures that we see design as a choice to inscribe in the information system the values we value to eventually shape life, work and society. Design, in this sense, takes away choices that we do not value. Incorporating values into design (value-infused design), therefore, requires the acknowledgement of higher-order human principles instead of treating design as simply meeting the functional requirements for efficiency and utility (Liu et al., 2015).

Prior work describes a few approaches to incorporate values into the design. One example is value-sensitive design, which the authors describe as a theoretically grounded approach “that accounts for human values in a principled and comprehensive manner throughout the design process” (Friedman, 1996). It is a position that proposes a proactive approach for the incorporation of values in design

(Manders-Huits, 2011), similar to Van den Hoven's (2008) position to "frontload ethics" in engineering endeavours. It has been applied in the design of the privacy support for web users (Xu et al., 2011), the security features for web browsers (Millett et al., 2001) and other fields. Friedman et al (2002) proposed a three-stage method to guide the design of technology to take account for human values, including conceptual, empirical, and technical investigations stages. The conceptual investigations phase requires a theoretically informed analysis on the values that are critical to the main stakeholders. Technical investigation phase designs how to utilize information technologies to support human values identified in the conceptual investigation phase. The empirical investigation phase is to assess the testable prototype developed in technical investigation phase and provide feedback to the theoretical perspective of the design.

In spite of such conceptualizations, significant challenges remain. There is no systematic way to expressly recognize the values that are relevant to the design. It is not clear how abstract human values should be translated into concrete design guideposts that designers can use. Values-infused design is an approach that tries to address some of these concerns to outline simple technique that clarify how values can inspire design efforts so that the designers can identify design features and create interactions appropriate for the users (Purao & Wu, 2013). A first step towards this goal is to incorporate the values into the design process by building on the ideas such as scenario-based design (Carroll, 1995), which uses scenario narratives to ground design efforts into the lives of intended users. To identify features and visualize how service encounters can be facilitated with these features, another idea is to build on work related to user experience with techniques such as service blueprinting (Bitner et al, 2008) and interaction diagrams as to bridge from abstract values and concrete design decisions. Following these precursors, we next move to demonstrate how we used scenario as an anchor for value extraction, and for developing design principles that reflect the values identified.

Identifying Values for Design

To identify values relevant to the design context, several scenarios were constructed to illustrate the demands of the elderly in Japan. For example, consider the following scenario:

Toki Suto, 65 years old, living alone at an aging apartment in Tokyo. She has recently recovered from a stroke, and needs physiologist visit for her to guide her on the daily exercise. She needs transportation to visit the hospital biweekly in the next month. She has been using computers mainly for browsing news. She has never done any transactions online. She has tried to look for help from advertisements in local newspapers.

The set of scenarios were examined with the theoretical lens for value extraction, grounded in the theory of basic human values (Schwartz, 1992). The theory of basic human values (Schwartz, 1992) identifies ten motivationally distinct types of values: *power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity, and security*. The theory defines values as desirable, trans-situational goals, varying in importance, that serve as guiding principles in people's lives (Schwartz, 2005). Some values inherently contradict one another (e.g., benevolence and power) whereas others are compatible (e.g., tradition and security). Actions expressive of any value have practical, psychological, and social consequences that are either in conflict with or will be compatible with the pursuit of other values. Prior work suggests that among the ten fundamental values, the elderly appear to prioritize the value of tradition, conformity and security, which corresponds to an emphasis on conservation (Lyons et al., 2007). Conversely, they place little value on stimulation, hedonism, and self-direction. Our prior work, based on a survey of senior citizens in Singapore, also reveals that the elderly bring up the values such as tradition and conformity but were more driven by security, sometimes at the expense of other values such as privacy (Anonymized reference).

According to the theory of basic human values, tradition and conformity are especially close motivationally because they share the goal of subordinating the self in favour of socially imposed expectations. They differ primarily in the objects to which one subordinates the self. Conformity entails subordination to persons with whom one is in frequent interaction – parents, teachers or bosses. Tradition entails subordination to more abstract objects – religious and cultural customs and ideas (Schwartz 2006). In the context of online service matching site, it is possible to argue that there is less of an influence from other, which may suggest a greater focus on tradition.

Here, **Tradition** refers to the general feeling of respect, commitment, and acceptance of the customs and ideas that traditional culture or religion provide the self (Schwartz 2006). Tradition demands responsiveness to immutable expectations set down in the past (Schwartz 2006), and explains, at least partially, why senior citizens have high resistance to new technology. When age-related diseases accelerate the rate of neuronal dysfunction, neuronal loss, and cognitive decline, elderly individuals develop cognitive impairments further slowing the cognitive processing ability (Murman 2015). To respect the tradition values rooted in elderly people, any e-service design should minimize the change in their way of thinking and doing thinking, and try to reduce their cognitive load when processing information.

Security is the perspective related to safety, harmony, and stability of society, of relationships, and of self. It is one of the conservation value in human beings. The elderly are believed to value security and stability of the living environment more. They are less tolerant of uncertainty and more motivated to reach a definitive decision (Leventhal, et al., 1993) in pursuing a safe living environment. They are especially motivated to reduce uncertainty and risk and to avoid situations that threaten to deplete their psychic and emotional reserves. According to Hofstede national cultural dimension (1983), the Japanese culture rates high on uncertainty avoidance. Thus, we argue that the influence of security value is even stronger in our research context. When engaging with online services, the uncertainty in the qualification of the service providers, service delivery process, and cashless online transaction will all threaten elderly people's feeling of security.

Finally, **Self-direction** refers to independent thoughts and actions including choosing, creating and exploring (Schwarz 2003). A self-direction value was derived from organismic needs for mastery and from the requirements of autonomy and independence. Self-direction reflects a person's creativity and openness to change, emphasizes independent action, thought and feeling and readiness for new experience. Prior research pointed out the elderly people are low in self-direction (Lyons et al, 2007). Issues of personal autonomy is believed to be a central issue to the long-term care of elderly people whose self-determination may be restricted by medical problems, functional limitations and physical incapability (Scott et al, 2003). Many older people need to be empowered to have the knowledge and the ability to make a decision of their own free choice (Ekelund et al., 2014). Respect for *autonomy* is a key principle in health care ethics (Scott et al, 2003), and it will also be essential for developing e-services for elderly people. When the elderly are looking for services online, they would prefer to complete the task independently with little help from other people. A decision support tool will increase elderly people's confidence in information processing and decision making.

Based on the analyses of the scenarios, following the theoretical lens of basic human values (Schwartz 1992), as described above, the following values (what matters to the elderly) were identified. The analysis translated these values to what we called design imperatives (key goals for the design efforts), and from these, design principles were derived (how to achieve the design goals). Table 1 summarizes this translation and derivation.

Table 1: From Value Priorities to Design Imperatives to Design Principles

Value Priority (what matters)	Design Imperative (goals for design efforts)	Design Principle (how to achieve the design goals)
Tradition	Maintain conformity	Minimize cognitive load
Security	Enhance confidence	Reduce perceptions of uncertainty and risk
Self-direction	Promote empowerment	Provide a sense of control on decisions

The Lotus Helper Prototype

Guided by the design imperatives and design principles derived from the basic human values significant among the elderly, a web-based on-demand service-matching application called *Lotus Helper* was developed in collaboration with a Japanese startup company to pair care-receiver's needs (elderly individuals who need assistance) and caregiver's service (helpers who have the requisite certificates or professionals who can care for the elderly) in Japan. The eventual aim of *Lotus Helper* was to improve the quality of life for the elderly people by allowing them to locate helpers who can assist them in simple

activities such as eating, bathing and cleaning. The current service range within *Lotus Helper* is concentrated on in-home care service, not services that may be delivered in other institutions such as hospitals or nursing care facilities. The design builds on three roles of primary users: administrator, care-receiver (CR, the elderly) and the care-giver (CG, the helper).

Principle 1 suggests that the design of the online service-matching site should aim to reduce elderly users' cognitive load. Prior research suggests that website complexity will influence users' visual attention and subsequent behavior (Wang et al., 2014). In addition, the design of the prototype for senior citizen should consider the constraints from their physical capability such as vision and cognitive processing speed. The *Lotus Helper* system, therefore, follows a simplified design mechanism, including clear organization of content, appropriate use of fonts, color and size. It also keeps a simple and intuitive flow for job posting and service selection (see Figure 1). It is important to note that the basic service flow of *Lotus Helper* is not unique. The design decisions that lead to specific features, on the other hand, are unique, allowing *Lotus Helper* to more clearly reflect the values of the elderly and design imperatives derived from these values.

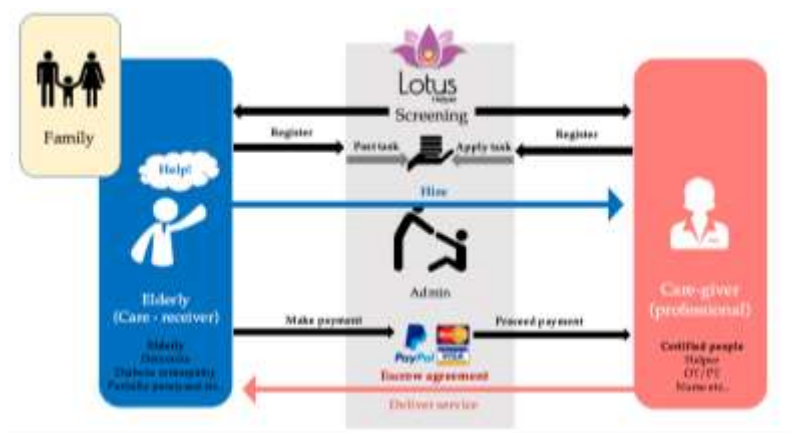


Figure 1. Service Flow of *Lotus Helper*

Principle 2 suggests that design should reduce the uncertainty and potential risk in service selection and transaction. This is accomplished in *Lotus Helper* by a few mechanism that protect privacy, communicate about service quality and ensure payment security. The terms and conditions on the site data privacy are presented to the users when they first register. The site also requires all the CGs to upload certification when they register an account with the site. The administrator screens the certification of each CG to ensure eligibility. Uncertainty reduction is also achieved by facilitating seamless communication between CR and CG via online chat and email, so that any questions can be promptly addressed. The CRs can also review the rating and feedback to the CG provided by other users to. CGs can be rated on a 1-5 scale by the other CRs (see Figure 2). The elderly people would be able to make their decision based on the rating.

Task description	
Title :	Short term stay care (2 days)
ID :	#4568
Post by :	Suzuki Kouhei
Post date :	3Aug. 2016
Budget :	¥365
Task description :	Looking for short term stay (2 days) care for my mother who is dementia during my absence, and take care of our pets.

Apply for task

Care receiver details



Naitou Yukari

★★★★★

348 reviews

Figure 2. Rating and Reviews

If both parties' budget and workload match, CR is able to hire the CG and proceed with the payment in escrow. The administrator holds CR's payment until the service is successfully delivered. The payment gateway used can be PayPal and Credit Card. The administrator can release payment after CR's review is entered (Figure 3).

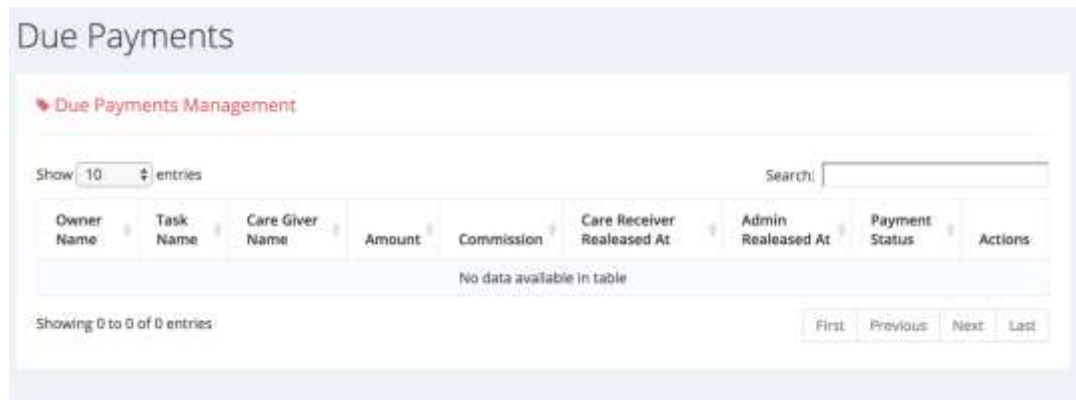


Figure 3. Delayed Payment with Escrow

Principle 3 details the need to provide tools to ease the information processing and decision making process, so that elderly users can complete the tasks independently on the site. The system provides users two ways to choose the service: browsing and through recommendation. Once CR and CG became registered users, CR is able to post the task, and CG can to browse for tasks. Users can view the tasks in different ways: as a list-view or a map-based view. The CR are also able to view the CG givers living near them.

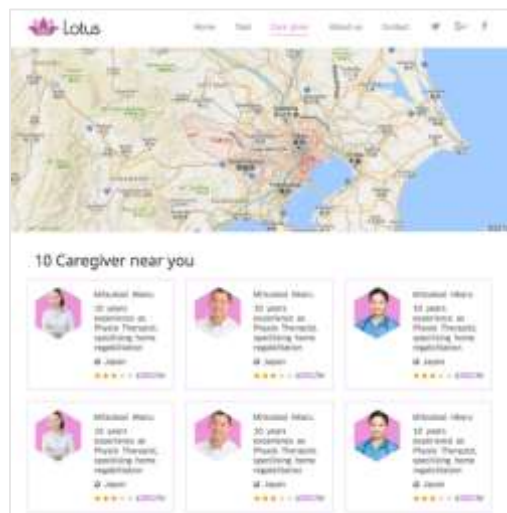


Figure 4. Location-based View of Caregivers

With more users registering on the site, more information and choices are available. The users may feel that searching optimal choices through the online application is difficult. The belief that more and more choices are better may have become a common belief among online vendors (Schwartz, 2000). However, too much choices and information demotivates and makes users indecisive (Iyengar and Lepper, 2000). In general, online users are often presented with situations in which they come across too many options and choices. Thus, the system provides a recommendation engine for the users to look for the best match based on system recommendations, which is developed based on both parties' preferences, such as task description, time and review.

Design features

Table 2 below summarizes the design features built into Lotus Helper based on the work described above. The Table shows the design principles, and the corresponding design features.

Table 2. Design Features

Design principles	Design features
Minimize cognitive load	• Uncluttered web interface with simple fonts and few options • Simple service flow matching that in traditional platforms
Reduce perceptions of uncertainty and risk.	• Terms to enforce confidentiality about information of the elderly • Certification for CG, screened by administrator. • Liability and insurance protection programme protect CRs. • Rating and review system to improve service quality and trust. • Escrow system to reduce disputes in monetary transaction.
Provide a sense of control on decisions	• Recommendation engine to match the CR and CG • Location-based display to help the elderly visualize distance to CG

Next Steps: Empirical Investigation

The prototype is currently undergoing user and market testing. It will be rolled out in Tokyo first and open for registration to all the senior citizens living in the city. A mix-method analysis will be conducted to assess the senior citizens' perception on the service matching site developed. The users will be invited to fill in the Schwartz's value survey (1992) to understand their inherent value orientation. In-depth interview on the website usage will be conducted. System log data will also be kept to provide objective indicators on system functionalities and service usage, i.e., browsing time before a service is selected, number of clicks before posting a task request. The data will be compared and contrasted to understand the whether the design principles are followed and have achieved the intended outcome.

Discussion and Conclusion

In many contemporary projects, the design of systems such as service matching platforms focus on the algorithms while neglecting the actual requirements from the users. This can be particularly problematic when the intended users are a population such as the elderly. Taking a value-infused design perspective, the study followed a design-oriented research approach to derive design imperatives and propose a few value-driven design principles to improve the design of such platforms. Based on the theory of basic human values, the scenario-based approach, and extending prior work in values-infused design, we have identified tradition, security and self-direction as important values to the design of online service-matching site for the elderly. A set of design imperatives is derived from these values, which are then translated into design principles that are used to drive the design of a prototype developed for the elderly in Japan. In the paper, we have discussed the artefacts derived from the proposed design principles. We hope that the method we have implicitly outlined in terms of derivation of design imperatives and design principles can be further codified and subjected to scrutiny in other, similar settings. We hope that with an empirical validation with actual users, the study will contribute to the field of value-infused design by proposing novel artefacts to improve the experience of population segments such as the elderly.

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