Master Thesis

Community-based Service for the Psychological Well-being of the Elderly: Antecedents and Consequences of Prosocial Behavior to Positive Emotion

1450205 Pengcheng Zhou

Supervisor: Kunio Shirahada
Main Examiner: Kunio Shirahada
Examiners: Michitaka Kosaka
Naoshi Uchihira
Yasunobu Ito

School of Knowledge Science
Japan Advanced Institute of Science and Technology

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Pengcheng Zhou

School of Knowledge Science,
Japan Advanced Institute of Science and Technology
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In aging background, age-related psychological and social issues have grown into a global concern, abundant researches have pointed out that emotion as the motivation and outcomes for conducting social behavior is significantly penetrated into people's daily life. Since the elderly in Japan has confronted the loneliness issue which caused by lack of social contact with others in the community they lived in. Addressing to this issue, this research aims to build a model for optimal psychological well-being in community-based service by identifying the impact of prosocial behavior to positive emotion of the elderly.

In order to achieve this goal in a service viewpoint, this research has divided into two studies. In the first study, it aims to identify how the emotion of the elderly get affected by other people's prosocial behavior and their social preference in different conditions. In this part, the demand of the elderly could be derived from the experiment. The prosocial behavior contexts contained three domains, helping, sharing and informing. All of the context are testified under two conditions (nonmonetary vs monetary; occasional vs routinely) which affect brain-directed decisions differently towards same behavioral content. The experiment was proceeded by using Optical Topography device which using Near Infrared Spectroscopy technology to measure the brain activities of the elderly in the prefrontal cortex through

hemodynamic responses

associated with prosocial behavior stimulus and a semi-structured interview conducted afterwards.

According to the interpretation of study I results, the prosocial behavior characteristics, helping behavior that release the elderly physical burden, sharing behavior of working with a same goal, informing behavior of expressing the thank and caring feelings left good impression to the elderly. Therefore, the second study designed a community event working with the local organization and community for experimenting and investigating how to apply prosocial behavior characteristics to the community-based service. Helping behavior implied as help to find the charming of the community, sharing as share knowledge during interaction, informing as sending thank message with each other. All characters designed in a strolling activity which fit for the insufficiency of current community activity design. For collecting data, it is combined with the observation and the questionnaire survey, which including the motivation of their participation and the satisfaction about each of the segment design in the event.

The results indicate that prosocial behavior is sufficiently affect the elderly people's affection. Although different prosocial behavior context could evoke the elderly's positive emotion in different degrees, well-applying the prosocial behavior contributes to the community-based service design and service co-creation process significantly. For a prosocial behavior context applied community-based service, not only the elderly but also some other younger age groups sensed the accomplishment and enjoyment from the event.

Combining the two studies, a community-based service model proposed according to the steps of the provider's strategy, the mental statement changes of the recipients and the co-creation process. Moreover, based on the interpretation about the whole research, the community-based service and the psychological well-being definition has been given. Although, this research specifically identified in the prosocial behavior context, the proposed model could be applied in other context also. Well-applying this community-based service model will boost the social connection among the service provider, local residents and community they lived in.

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Chapter 1：Introduction

1.1 Research Background

In 21st century, aging has become a global issue in sociology and economics, the various services and products has aiming their target to the seniors in the society. Currently Japanese age ratio has reached the first place among the world and the aging rate has kept growing. In 50 years, it's estimated by the government that 40% of Japan's population will be over 65 (World Population Review, 2015). Issues that concern about the life quality of the elderly has risen government attention. While quality of life has diverted into objective and subjective indicators in multi-disciplinary studies, health-related issues developed into a great concern (Bottomley, 2002).

For health-related issue of the elderly, Japanese Ministry of Health Labor and Welfare has carried long-term care: providing several care services for the elder people in a long period. Including *in-home services, facility services, preventive long-term care services, comprehensive services for long-term care prevention/daily life support, community-based services and community-based preventive long-term care services* (Annual Health, 2015, pp.233). Among all these services that they provided to the elderly, they mainly focused on the physical health caring, such as *regular visiting, living assistance* and *outpatient care.* However, recently the psychological issues of the elderly like Kodokushi required to be solved. Therefore, tackling the loneliness issues with providing appropriate social services for the elderly becomes valuable.

In the long-term care system, the community-based services are key segments that aiming to support different types of regional activities for the elderly to continue living in their accustomed living area (Annual Health, 2015). As previous research and references stressed that community service is a not-for-pay activity (Giles and Eyler, 1994; Seifer, 1998), residents and local institutions as the key roles in the community supposed to have more value co-creation happened to boost the further development of the community. In early study, community-based services in long-term care system mostly designed for the disabled elderly to offering their physical support (Gaugler et al., 2005). In order to expanding the psychological supports for the elderly, Community-based service, supposed to be generalized into all of the services provided by community members to benefit the public or its institutions. Currently, most of the services in communities used to be provided by the government, they could not take enough care of all the details of the elderly people's life due to limited resources. Therefore, the involvement of the local community residents spurred a necessity to community-based services.

In social perspective, Japanese communities have provided various social activities for the local residents and the elderly. Activities like volunteer activities, matsuri events, study groups and club activities. Among all these social activities, volunteer is a lead one, combing the characteristics of intrinsic, associative and gratuitous (Odaira, 2012). Getting involved with social activities not only helps people to make social connections but also instills in them a sense of fulfillment and joy (Cattan et al., 2005; Bartlett and DeSteno, 2006). In psychological well-being theory, positive emotions have an important role of optimizing social behavior (Fredrickson, 2001). Moreover, it is thought that the elderly as a whole have a better sense of moral and social norms, which would lead to more prosocial behavior (Warburton and Terry, 2000; Penner et al., 2005). Prosocial behavior identified as "*a broad range of actions intended to benefit one or more people other than oneself*" (Batson and Powell 2003, p.463) has brought the potential to applying prosocial behavior concept into community-based services.

In service viewpoint, Vargo and Lusch has pointed that Service has been identified as a process of value co-creation in 2008. Community-based service as one kind of service, it also aiming to the value co-creation during the process that the elderly participated. While community-based service specified into prosocial behavior characteristics, what process they are been through and what kind of value they are creating has not stressed sufficiently in

previous studies. Therefore, it is necessary to know what kind of prosocial behavior characteristics are applicable for community-based service for benefitting with psychological well-being.

In psychological viewpoint, Subjective well-being, defined as *a person's cognitive and affective evaluations of his or her life* (Diener, Lucas, & Oshi, 2002, pp. 63). To creating a high level quality of life, subjective well-being should be effective with economic and social indicators (Diener and Suh, 1998; Diener, Oshi, & Lucas, 2003). Since the well-being contents will be change according to different contexts, the psychological well-being as another interpretation of subjective well-being requires further identification about the cognitive and affective evaluation.

In neuroscience viewpoint, abundant research has identified that the prefrontal cortex of the human brain is responsible for emotion recognition and generation (Aoki et al., 2011; 2013; Ochsner et al., 2012). The prefrontal cortex significantly affects the amygdala and anterior cingulate, parts of the brain that are involved in emotion and empathy generation (Cardinal et al., 2002). Perceived empathy as an emotional state could motivate prosocial behavior as a consequence (Hoffman, 2008). Consequently, the value co-creation process in community-based service could be identified through measuring the brain reaction along with subjective evaluation.

In totally, based on the understanding of developing psychological well-being in community-based service, it is necessary to analysis the elderly people's perception and preference towards the specific prosocial behavioral context and testified through practical events.

1.2 Research Questions

On the basis of the unclear situation of the connection between psychological well-being and community-based service. This study aims to build the model for optimal psychological well-being in community-based service by identifying the impact of prosocial behavior to positive emotion of the elderly. For achieving this goal, a main research question and three subsidiary research questions have raised.

Main research question (MRQ): How does psychological well-being can be perceived for the elderly in community-based service?

Generally, it requires the specific prosocial behavior context in community-based service, how the elderly perceived the context information, what's their psychological attitude towards these context and the practical application of the context.

Sub research question 1 (SRQ1): How does the elderly affectively and cognitively perceived the prosocial behavior?

In this subsidiary part, the elderly perception to the prosocial behavior context will specified and investigated the detail emotional changes.

Sub research question 2 (SRQ2): How to improve the motivation of the elderly to get involved into community-based service?

After the first question finding some factors that the elderly prefer through the preference to the behavior decision making, combining the previous studies to specified their motivations to involve into the communities.

Sub research question 3 (SRQ3): How to apply the prosocial behavior antecedents and consequences into community-based service for serving the elderly?

Based on the perception and preferences of the elderly towards the specific behavior, the general ideas about how to designing a community-based service will be structured, after that another event will be held to see the practical application of those behavior characteristics, finally to compared the differences and efficiency of prosocial behavior implication in community-based services.

1.3 Research Methodology

This research has applied qualitative methodology in general. In order to sufficiently answer the research questions and achieve the goal of this study, it divided into two studies. Figure 1.1 shows the detail information of two studies and methods.

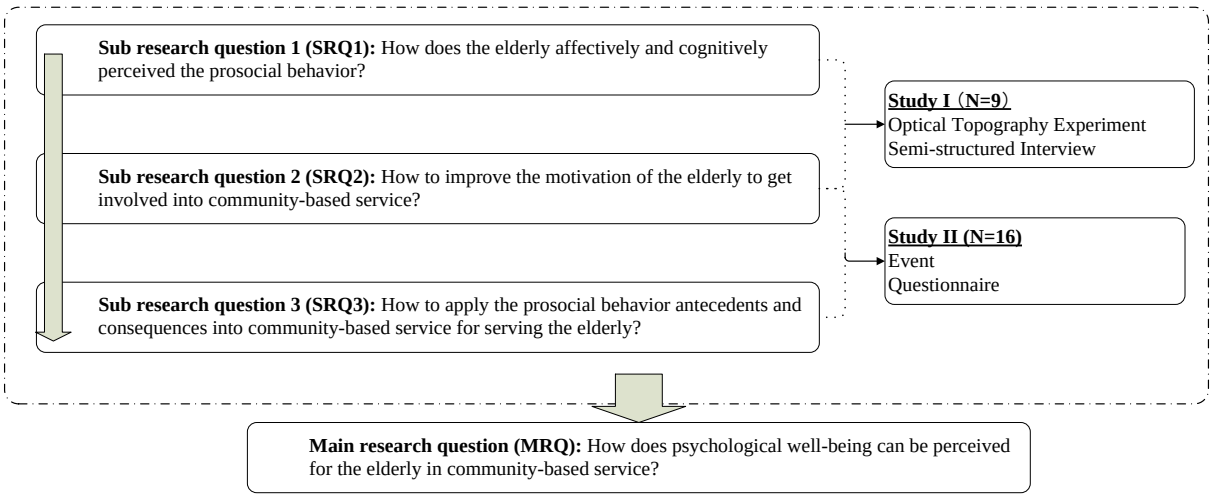


Figure 1.1: Research methodology overview

The first study aiming to identifying the factors of the prosocial behavior that make the elderly people generate positive emotion (feel happy) and also how do they perceived those behavior (prefrontal cortex activation and oxygen-hemoglobin dynamic changes). Therefore, the study I has applied optical topography which is a noninvasive brain imaging method that is able to identify the emotional responses in the prefrontal cortex and effective for measuring the dynamic changes through the time (Aoki et al., 2011; Sato et al., 2011). In the neuro economics and marketing field, optical topography technology has not been highly used yet, however, the advantage of light weight and measurable in the daily-like environment (Pinti et al., 2015) enabled the possible application to this study.

The second study selected the most influential factors from the first study combining the existed community activities, designing some segment details by using the high evaluated prosocial behavior factors to support the shortage of the previous event in the community. After the event, there is a questionnaire survey to the participants to measure their motivation involved into the community and their satisfactions about the contents of every details of the event. During the designing process, this research will also considering the local organizer's viewpoints to the event design.

1.4 Structure of this study

This dissertation contains six main parts which are ‘Introduction’, ‘Literature Review’, ‘Study I’, ‘Study II’, ‘Community-based service’, ‘Conclusion’, all information presented as Figure 1.2. Detail explanation as following:

In chapter 1, the introduction has been given to induce the aging background, aging caused psychological issues that has been paid attention in government community-based service systems. Overviewed the previous studies that related with this issue and the standpoint of this research. From the new viewpoint, research questions and methodology have set up.

In chapter 2, based on the social issue and the research aim, literature reviewed start from psychological viewpoint, prosocial behavior viewpoint, neuroscience viewpoint and service viewpoint, four main aspects. From the psychological viewpoint, various studies focused on the loneliness issue and their proposals in different angles of the elderly people’s life has been reviewed. From the prosocial behavior viewpoint, the deep connection of prosocial behavior and positive emotion generation stated. Moreover, the necessity of quoting prosocial behavior idea into a community-based service design for serving the elderly also narrated. From the neuroscience viewpoint, the study explains the requisition to analyze the emotion changes and perception by brain imaging and how does the brain works for controlling human behavior and emotion. Finally, from a service viewpoint, service, community service and how to design service explained with steps.

In chapter 3, it explains the sequences of the whole research combining the theory supports. Then this chapter explained the specific steps of the study I. Contents including pre-investigation, experiment steps and approaches, data analysis and results. The subsidiary research question one and two discussed in this chapter.

In chapter 4, study II, it explains the application of study I, several investigation and hearing that has held in community meetings. Regarding to the community current issues and combining the characteristics of the prosocial behavior from study I, a mini-case conducted to investigate the implication of the study I to a practical level.

In chapter 5, two studies synthesized into community-based service model, a new interpretation about the community-based service definition. Through the model, it has been explained from a service design process to a practical value co-creation process. From the

specific segments and process of the community-based service model, the psychological well-being outputs will be given.

In chapter 6, a conclusion drawn to the contribution and limitations of the research. The research questions are precisely emphasized. Furthermore, a potential implication of this new community-based service is presented in future work profoundly.

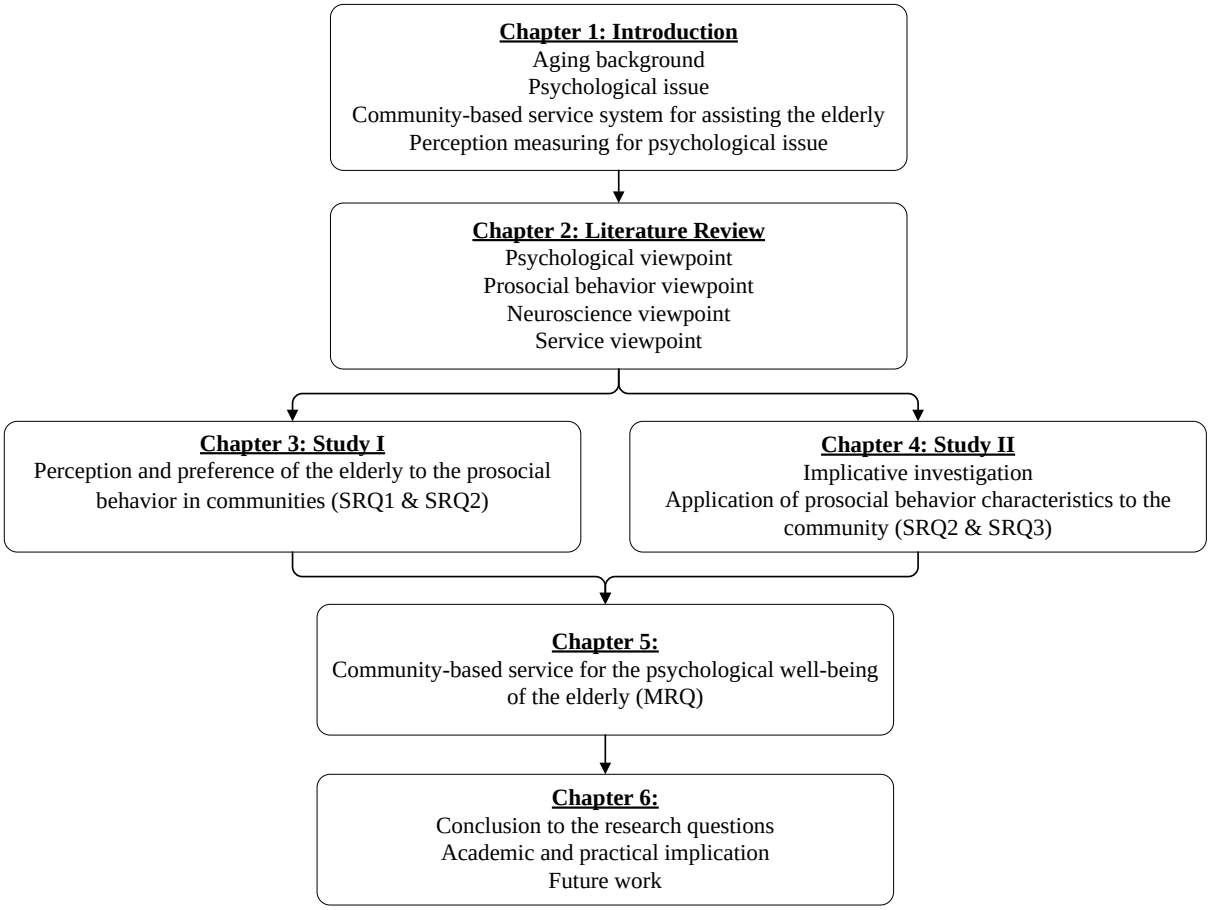


Figure 1.2: Structure of the study

Chapter 2：Literature Review

2.1 Psychological Viewpoint

From the aging social issue, this research aiming for contributing the psychological well-being of the elderly. Psychology as a broad approach contains human behavior and mindset, containing the reaction details that human experienced in daily life. The broadened discipline has specified for working the elderly, on the illustration of the psychological issues of the elderly, the current studies' solutions and the positive psychology three aspects.

2.1.1 Loneliness issue

In Japan, *kodokushi*, (lonely death) phenomenon among elderly people which is firstly described in the 1980s, has risen public attention since then.[1] It's not only a social issue, it's also a crisis for the worldwide aging population, because it indicates the elderly people in aging society are facing more psychological issue which need to be solved.

Loneliness is one kind of mental state experienced when the interpersonal relationships divert from their expectation (Peplau and Perlman, 1982). As a mind state has been proven that strongly affected elderly people's physical health, severe loneliness issue will cause suicide, depression and mental disorder (Fees et al., 1999). From sociology point of

[1] Time, 2010, Japan's "Lonely Deaths": A business opportunity, last access on Dec. 20th 2016, http://content.time.com/time/world/article/0,8599,1976952,00.html

view, predictors of loneliness is not only related with personal psychological statements but also related with family and surroundings, which has more profound influences to elderly people.

Social connection and loneliness issue like the two sides of the coin, neither of the two sides can be separate. Lack of social bonding, such as losing family members or apart from the relatives will bring much more loneliness to the elderly people and loneliness increasing correlated leads to the social isolation (Holmen and Furukawa, 2002). Social network which usually used refer to the social structure made up of several social actors, among the structure, various social interactions will be build. Family kinship is one of the aspect of social network, however with the development of community dwelling, social network among elderly people also get broadened.

Community residents, especially elderly people desired more frequent contacts with friends and people who cannot reached that will get higher levels of loneliness (Bondevik and Skogsstad, 1996). Figure 2.1 presented the study results that Holmen and Furukawa did in 2002, they have specified the social network elements as housing (whether live alone included), satisfied friends to be contacted and good friends to talk everything. The results shows that when the elderly people have satisfied friends to contact with, they will have less loneliness.

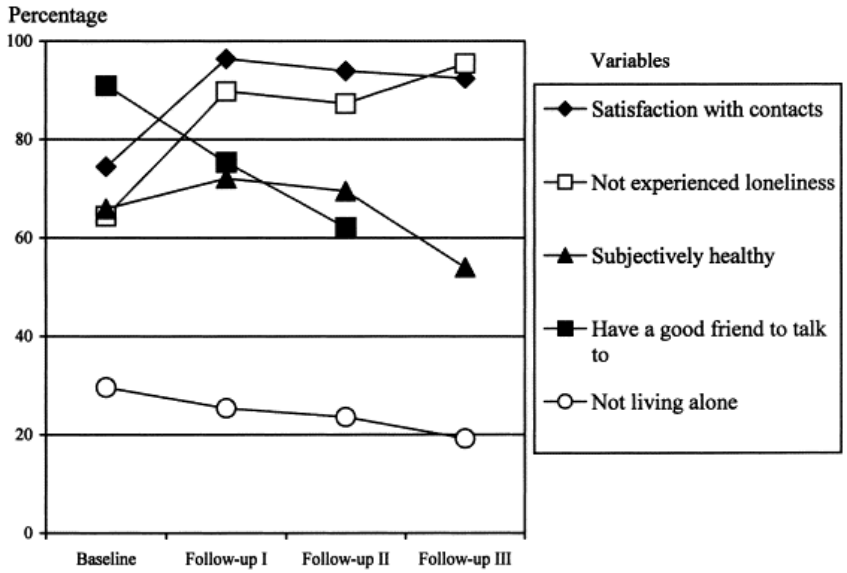


Figure 2.1 : A 10 year follow up of reported satisfaction with friend contacts, experienced loneliness, subjective health, having a good friend to talk to, and housing among elderly people, living in a parish of Stockholm (Holman and Furukawa, 2002, pp.270)

In general, human being as social creatures, just as Maslow has expressed in hierarchy of needs, love and belonging is in the third level beyond the physiological and safety needs. Elderly people facing with age related physical health and losing someone affecting, which leads them more fragile and needy for friends or other people's caring. Lack of social networks and contact will definitely cause loneliness issue is different degree (Golden et al., 2009; Hughes et al., 2004).

Besides the requirement of having social contact, stress during the social contact becomes another related factor that affect elderly people's loneliness. Since, in daily life, it's hard to distinguish the difference of lonely individuals and individuals who don't feel lonely. In that case, with more social contact the elderly people will feel lonely easily. More importantly, middle-old aged people (around 70) and old-old (80+) have more connect with the lonely individuals than non-lonely persons (Hawkley and Cacioppo, 2007). Insufficient development of social network will trigger a loop of a group of elderly people need to facing the loneliness issue.

Digging the bad effects of lacking social network of the elderly, the various life aspects links to the loneliness issue including the specified contexts and the personalities of different individuals. Considering the loneliness issue solution, affecting factors required further analyses with more predictors such as how the elderly people assesses themselves in the surroundings and their awareness about their needs and wants. Bridging the social network, to let the elderly retained from a positive psychology loop.

2.1.2 Positive psychology

Positive psychology widely applied for developing people subjective experiences, also known as human well-being, which including human satisfaction to the past, enjoyment to the present and expectation to the future (Seligman and Csikszentmihalyi, 2014). In current psychology theories, positive psychology hasn't well applied in community psychology, which is a key reason that this study has penetrated into (Peterson, 2006). Positive psychology has been proven benefits human motivation, moral virtue cultivation and capability elevation (Sheldon and King, 2001). Based on those psychological benefits, a multiple connections among positive psychology, intrinsic affection and behavior performance could be perceived

as Figure 2.2 shows.

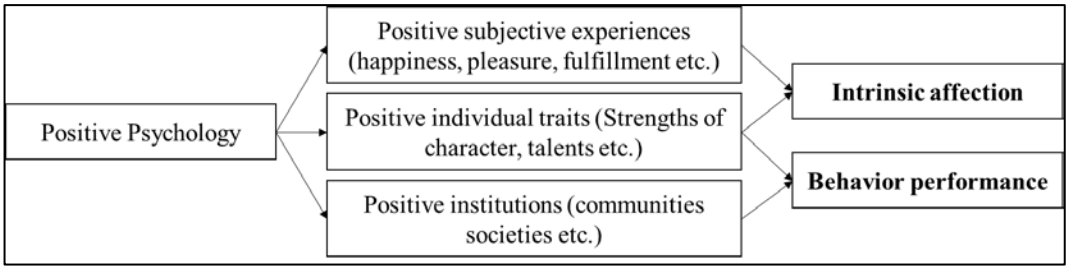


Figure 2.2：Illustration about positive psychology study branches (Graph based on Peterson, 2006, Uno translated, 2010, pp.21)

Connection of positive psychology and intrinsic affection mainly reacted in those two aspects. On the one hand, moral virtue, as one of key point in intrinsic affection, collectiveness and compassion is very important in eastern countries. While harmony concept hasn't been highly emphasized in current studies, the appreciation to other people's behavior already presented the crucial significance in positive psychology development (Snyder, Lopez & Pedrotti, 2010). Mentioned the appreciation in positive psychology, it also applied into a motivation to highly involved into social activity and provide the benefits to others.

On the other hand, positive emotion like happiness, enjoyment, optimism and sense of accomplishment is another key reciprocal relationship with intrinsic affection. Those positive emotion are good for human physical and psychological health development. Evidence referred that positive emotion highly related with improving human immune systems or increasing the health related information (Richman et al., 2005). For the social loneliness issue in previous session, solving loneliness of the elderly people also connected with improving their positive emotion and life satisfaction (Gruber et al., 2013).

Positive psychology and behavior performance also had a significant meaning. Mainly demonstrate in positive emotions aroused a series of affective circumstances, like conducting more behaviors that benefits others (Fredrickson et al., 2000). At the same time, positive affect also require specific behavioral context to stimulate. Which refers that positive emotion and behavior performance affect each other in some degree (Fredrickson, 2001). However, if the behavioral context is not clear, it will not consequently arouse the positive emotion as the behavioral context supposed to.

2.2 Prosocial behavior Viewpoint

Positive emotion and behavior performance has a reciprocal relationship. For solving loneliness issue, Bridging social network and help the elderly generate more positive emotion under specific behavior context support is an essential perspective. Furthermore, bridging social connection and developing interpersonal bonding also explained in many behavioral studies. Especially prosocial behavior committed to the psychological benefits. Therefore, this section will explained the prosocial behavior and standpoint of this study has focused.

2.2.1 Prosocial behavior concept

Prosocial behavior originated with psychology study branches. The development of the prosocial behavior studies has focused on the connection with empathy, which related with the motivation that offering behaviors that benefit others (Eisenberg and Miller, 1987; 1990; Eisenberg, 2003).

Regarding the various interpretation of prosocial behavior. This research has select the definition, *"A broad range of actions intended to benefit one or more people other than oneself - behaviors such as helping, comforting, sharing and cooperating"* (Batson, 2003, pp. 463). In 2009, Warneken and Tomasello, proposed three basic aspects of prosocial behavior, helping, sharing, and informing.

Since people who share the same values generate more empathy by acting prosocially (Eisenberg and Miller, 1987; Chow and Chan, 2008), communities that provide places for embedding connectedness and social norms have greater potential to develop prosocial behavior. For applying those prosocial behavior, the implication into social activities supposed to be explored.

Community residents, especially elderly people desired more frequent contacts with friends and people who cannot reached that will get higher levels of loneliness (Bondevik and Skogsstad, 1996). In Holmen and Furukawa research in 2002, they have specified the social network elements as housing (whether live alone included), satisfied friends to be contacted and good friends to talk everything. The results shows that when the elderly people have satisfied friends to contact with, they will have less loneliness.

Social support in community as Wilcox has classified, the support variables are

neighborhood and community interaction, and the interactions that happens within neighbors and participation in voluntary activities. The group interventions which is the mostly studied by previous literature has the positive effect to dealing with loneliness issue or social isolation (Cattan et al., 2005; Dickens et al., 2011). The main idea that the intervention groups want to convey is sharing the feelings of loneliness among their friends that same age with them, through the talks, they will perceive one kind of spiritual support from others and it will reduce their feelings about being isolated (Routasalo et al., 2009).

As those mentioned characteristics of current social support and activities, voluntarily, sharing, communication are the key aspects addressed in this issue. Prosocial behavior, also highlight those key aspects should considering those social support and combining the local community situation and provide a good solution to applying prosocial behavior.

2.2.2 Reciprocity of prosocial behavior and psychology benefits

After a previous review about the basic concept of prosocial behavior and the possible implication into community social aspect, we looked into the linkage of prosocial behavior and psychological benefits. Since prosocial behavior could be the potential solution to psychological well-being in community-based service, exactly what kind of psychology benefits could be brought reviewed as following.

Prosocial behavior and psychological benefits are studied in lots of different branches. One way is from prosocial behavior side view, the most famous one is about motivational theory. Prosocial behavior has been studied as an extension of intrinsic motivation. Intrinsic motivation, which is *defined as the doing of an activity for its inherent satisfactions rather than for some separable consequence* (Ryan and Deci, 2000 pp.71). Intrinsic motivation has been mentioned contributed to the creativity (Higgins and Kruglanski, 2000; Elsbach and Hargandon, 2006). The creativity has significance to benefits the community or organization that people in. In 2011, Grant and Berry (pp. 77) has proposed *prosocial motivation which defined as an other-focused psychological process that directs employees' attention toward others' perspectives on what is useful, enhancing the impact of intrinsic motivation on creativity.*

The benefits of prosocial motivation are not only focused on the people or cooperators but also other people's behaviors. Moreover, because the relationship context or social context

that people involved into also very important (Maner and Gailliot, 2007; Grant and Berry, 2011). While in same community, the moral sense and the context they are sharing are very close, which is very benefit for people engaged. And the prosocial motivation could be generate from seeking for the belongingness or self-esteem.

From psychological benefit side of view, benefits like generate positive emotion is a key aspect. Empathy defined as *an affective response that is identical to or very similar to what another person is feeling or is expected to feel* (Spinrad and Eisenberg, 2009, pp. 119). Empathy also is a bi-beneficial product that people who involved could affectively empathy aroused from the communication or connection. On the other hand, the psychological benefit of prosocial behavior is the happiness that they get from conducting a helping behavior (Aknin, Dunn & Norton, 2012). Organizational commitment to the psychological attachment has been mentioned in the early stage of study (O'Reilly and Chatman, 1986), which is like a combination of belongingness to some organization and the sense of achievement that people get from the activity. They are convertible factors impact on each other.

Mentioned the convertible factors of prosocial behavior and psychological benefits. There is a term, reciprocity, derives from the social norms stands for behavior that people paid for return other people's kindness or help (Shumaker and Brownell, 1984). In this case, there are two actors which are provider and recipients. Although some research has mentioned such kind of interaction potentially increased the psychological burden to the recipients (Greenberg, 1980), generally the recipients and providers could gain the benefits in different degree. The connection between prosocial behavior and psychological benefits summarized based on previous literature are presented like Figure 2.3:

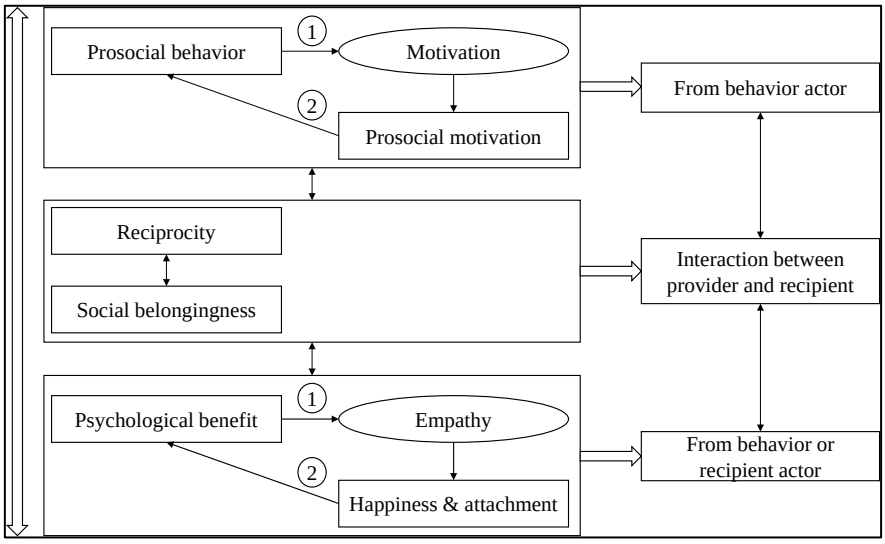


Figure 2.3：Illustration of the connection prosocial behavior and psychological benefits

2.2.3 Behavior and human perception

As we mentioned before, the motivation of human conducting prosocial behavior, empathy in psychological aspect are the key points in providing a prosocial behavior positive loop. No matter how much the emotion and motivation are connected together, they are all based on the neurochemical systems (Buck, 1985). The effect of affection and cognition are related with how does human perceived that and what kind of judgement people made afterwards. The neural system in human brain has a complex system. Human brain required a specific context to arise their affection cognition (Lang, Badley & Cuthbert, 1998)

Besides the affective cognition about the human behavior, previous research also mentioned that human brain could have a great potential to observing other people's actions which are greatly connected to their social judgment and conducting same or similar behavior, so called mimicry (Van et al., 2004). It enlarged the possibility to study prosocial behavior, reciprocity in social contexts and activities.

All in all, in this section, we has discussed the multiple connection between prosocial behavior, psychological benefits, motivation and the connection with human perception. As for the specific brain section and the functions that related with psychology and behavioral science we will further interpretation in next section.

2.3 Neuroscience viewpoint

After the deep appealing relationship of prosocial behavior and psychological benefits, we could find that prosocial behavior could be a good solution to solve the lack of social connection caused social networking issue. Moreover, previous researches also have mentioned if the positive emotions and the behavior reaction should be controlled in specific contexts. According how to measuring the psychological changes. Studies in neuroscience has given previous support and explanation.

2.3.1 Human perception to emotion recognition

Emotion recognition has several type of ways to express, such as facial recognition, expression recognition, visual and auditory. The current studies also pointed out that in human brain there are lots of area correlates to emotion recognition, such as amygdala, orbitofrontal cortex and right parietal cortices (Adolphs, 2002). Human brain as the highest controlling system, regard as the basic study to identify how does human perceive other people's reaction and emotion, at the mean time it is significant related with how people decide to involve into social activities or communication.

In 2012, Ochsner, Silvers and Buhle have proposed a model of cognitive control of emotion. It provides a very clear and important theory of the multilevel of how people perceived the tasks and regulate the emotion. Figure 2.4 represents the multilevel approaches and Figure 2.5 demonstrates the model of cognitive control in human brain.

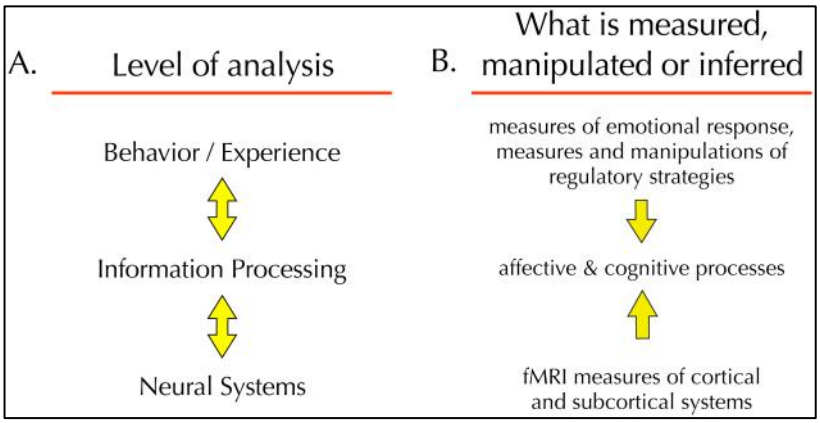


Figure 2.4：A multi-level approach to building model of emotion regulation (Ochsner, Silvers & Buhle, 2012, pp. 30)

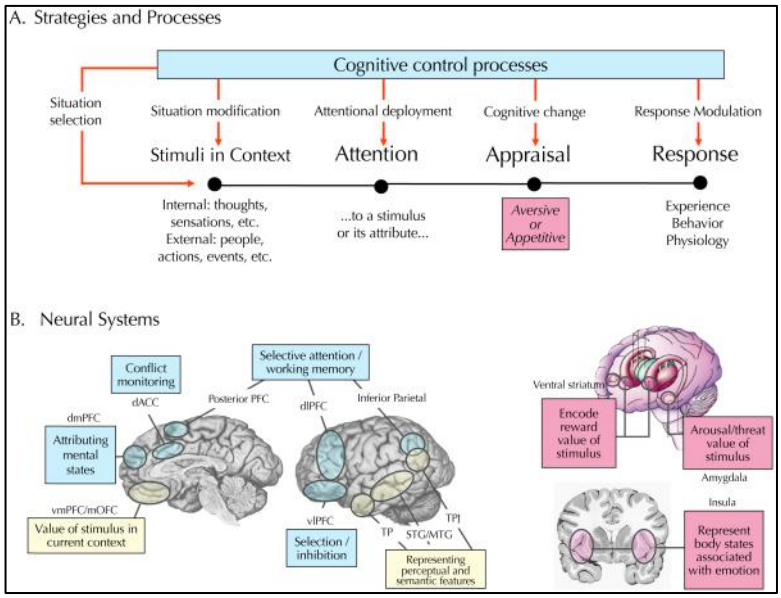


Figure 2.5：A model of the cognitive control of emotion (Ochsner, Silvers & Buhle, 2012, pp. 31)

From the two figures we could find out that cognitive control system require they had some experience first, which is they need to take part into some social activities and they generate some feedback or evaluation towards their experiences in the neural systems. Through that way, they get the responses and decision making to other people or to themselves. While the brain functioning the emotion regulation, they also start from a cognition to the social contexts and rising their attention. In the model, we could notice the most of the functioning job happened in human prefrontal cortices. Thus prefrontal cortex probably more related with the issue that this research want to solve.

2.3.2 Prefrontal cortex leading human behavior and judgement

Abundant studies also mentioned that the prefrontal cortex of the human brain is responsible for emotion recognition and generation (Aoki et al., 2011; 2013; Ochsner, Silvers, & Buhle, 2012). In particular, the medial prefrontal cortex plays an especially importan role in human emotion processing and behavioral control (Price, Carmichael, & Drevets, 1996; Etkin, Egner & Kalisch, 2011). Furthermore, the prefrontal cortex significantly affects the amygdala and anterior cingulate, parts of the brain that are involved in emotion and empathy generation (Cardinal et al., 2002). Perceived empathy as an emotional state could motivate prosocial behavior as a consequence (Hoffman, 2008).

Prefrontal cortex locates at the frontal area of human brain as the figure 2.6 presented. It is highly related with emotional responses, attention and behavior judgement. Medial prefrontal cortex also been tested significant related with self-related information (Gusnard et al., 2001). Specific into this research, while the identification of what perception the elderly has to the social context, self-referred knowledge must be aroused from the prefrontal cortex. The social context contained task used to arise their attention first and then after the information processing, the judgment of how to conduct the behavior and reaction consisted in the prefrontal cortex.

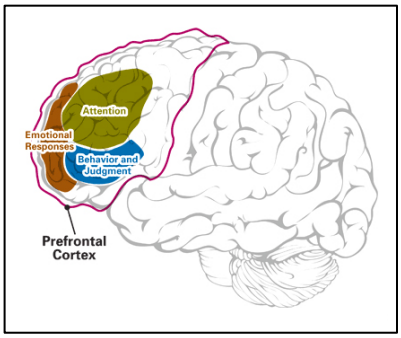


Figure 2.6：Prefrontal cortex area illustration [2]

As for the relationship between prefrontal cortex and social cognition, the studies have further interpretation. Prefrontal cortex could be divided into several different sections. In each of them the specific function has some little differences, the details as Figure 2.7 show. In prefrontal cortex, it processing through a perception and reminds of their own experiences and knowledge to help them so the judgment

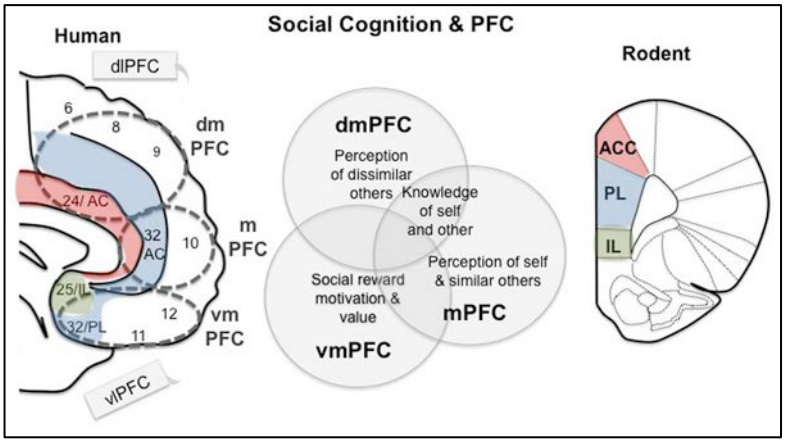


Figure 2.7：Working model for prefrontal regions involved in social cognition in human and mouse (Bicks et al., 2015, pp.3)

[2] "Exercise as an Aid for ADHD", last access at Dec. 25th , https://unbrss.org/2015/03/11/exercise-as-an-aid-for-adhd/

2.3.3 Near-infrared spectroscopy studies to perception identification

About the human perceptive identification, the most widely used is the magnetic resonance imaging (MRI), which could detect the brain area specifically and tissue active situation (Atkins & Mackiewich, 1998). However in recent studies, functional near-infrared spectroscopy (fNIR or fNIRS), has highly applied to measuring the hemodynamic responses associated with neuron behavior and the blood flow (Strangman et al., 2002; Sato et al., 2013).

Optical topography as a development of fNIRS method, is noninvasive brain imaging that is able to identify the emotional responses in the prefrontal cortex and effective for measuring the dynamic changes through the time (Aoki et al., 2011; Sato et al., 2011). In the neuro economics and marketing field, optical topography technology has not been highly used yet, however, the advantage of light weight and measurable in the daily-like environment enabled the possible application to elderly studies (Pinti et al., 2015).

For this research, the application of optical topography is also a new trial to the social and community service context. The optical topography method used for the whole identification process. As for how this research combined the service concept explained in the next section.

2.4 Service Viewpoint

In service science theories, Service-dominant logic is one of the key theory in marketing and neuromarketing about advertising. Recent studies also mentioned that the social service has not been well studied (Anderson et al., 2013). As the psychology and behavior section that been mentioned, community that people are sharing same values are easily to communicate with each other and bridging the social connection. For applying service concept into social services has a significant meaning.

2.4.1 Value co-creation process

Service has been identified as a process of value co-creation (Vargo and Lusch, 2008) and could bring the merits for both the elderly and the communities that they lived in. In 2008, Vargo, Maglio and Akaka (pp.145) has proposed the three viewpoints of service science:

(1) The application of competences (such as knowledge and skills) by one party for the benefit of another, is the underlying basis of exchange

(2) The proper unit of analysis for service-for-service exchange is the service system, which is a configuration of resources (including people, information, and technology) connected to other systems by value propositions.

(3) Service science is the study of service systems and of the co-creation of value within complex configurations of resources.

The three aspects are affecting each other, from exchange to co-creation. Although the current value co-creation are based on three main directions: technology, social organization and business (Spohrer and Maglio, 2008). The value co-creation originally proposed by Vargo and Lusch in 2004, they mentioned the value co-creation happened from both the service provider and customer. Then Grönroos has further discussed that the interaction concept is also taken an important role in value co-creation. The interaction happens in a multiple or reciprocal actions (Grönroos, 2011).

In this research, the value co-creation happened in multiple levels, partially as Figure 2.3 illustrated, in different layers the actor or provider role is changeable. Moreover, while we stand on the social service point of view, the provider and customers' role will have some change. The changes also depend on the social service context they've been through.

2.4.2 Value-in-context and actor roles

Value-in-context is a key concept in value co-creation, each single changes of context will affect who will be involved into the service, what service supposed to be well provide and what values they created (Chandler and Vargo, 2011). Both of Vargo and Grönroos have mentioned that while the value co-creation process in a service, resources required to be integrated into the process. In a community context, the resources required lots of layers. Such as the support from the government, the human resources and even the cooperation with other companies or third parties. And in 2008 specifically, Vargo and Lusch have modified rge foundational premise (FP) 9 (pp.8) from *Organizations exist to integrate and transform microspecialized competences into complex services that are demanded in the marketplace* into *all social and economic actors are resource integrators*. Moreover, the new one FP10 (pp.9) was defined as *Value is always uniquely and phenomenologically determined by the beneficiary*.[3] Form the changes towards value and the expansion to social service, value-in-context gained more potential to the community-based service development.

Mentioned social service, the concept about social construction in service field need to be reviewed. In a social system, the interaction and interpersonal relationship development reshaped the actor roles in exchanging service to create better values (Edvardsson, Tronvoll & Gruber, 2010). As the figure 2.8 shows, it is developed from 2009 Vargo proposed the contextual nature of value co-creation, which relationship in the service system has risen public attention.

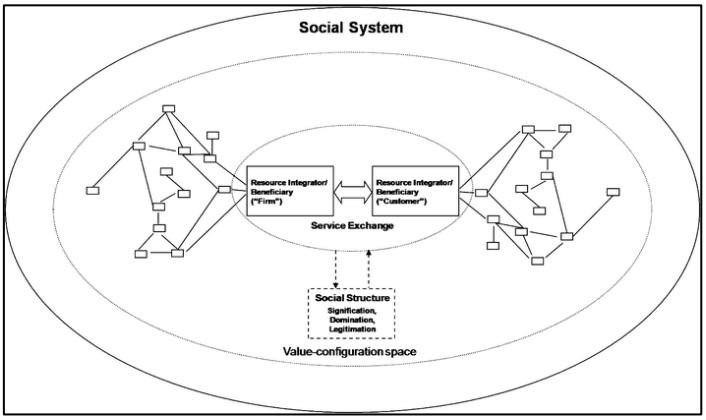


Figure 2.8：Expansion of S-D logic by incorporation of social structure and service/social systems (Edvardsson, Tronvoll & Gruber, 2010, pp.333)

[3] In 2004 and 2006, Vargo and Lusch originated brought up the definitions about foundational premise. The FP9 was revised and FP10 was added in 2008 literature

As previous study brought up, the value-in-social-context has lot of propositions, in each of them, the actor or people who involved into the relationship transformed by phases. For which this research tried a multiple level to appealing the issue and propose an appropriate theory. In the first study, affective and cognitive process require the elderly taking more reviver roles and co-created the value which is the prosocial behavior characteristics with experimenter. In the second study, during a service process the elderly are taking role more closely to an actor, affecting each other in different segments.

2.4.3 Experience-centric service

Experience in service defined as "*An experience occurs when a customer has any sensation or knowledge acquisition resulting from some level of interaction with different elements of a context created by a service provider. Successful experiences are those that the customer finds unique, memorable and sustainable over time, would want to repeat and build upon, and enthusiastically promotes via word of mouth.*"(Voss, Roth & Chase, 2008, pp.249). The experience-centric service require the service provider could focusing providing experiences to the customers and at the same time to generate some emotional connection with the customers.

As an extension of value in context, experience in service also significantly related with how smooth the co-creation made among people involved into services (Helkkula, Kelleher & Pihlström, 2012). In which case, while people are experiencing same circumstances and sharing same knowledge and norms, it could be a guarantee that the communication and co-creation process will proceed better. During the co-creation, more emotional attachment will be brought up.

The experience-centric service is more like a service process that people cooperation or interact with each other. Through the process new values co-created (Prahalad and Ramaswamy, 2003). Since the experiences in services could not be easily designed for the customers, we need a further basic and objective identification from the customer (Teixeira et al., 2012), which generate the study I and the design for community-based service.

2.4.4 Current community-related service for the elderly

As previous research and references stress that community service is a not-for-pay activity, however for the value co-creation between residents and institutions community service supposed to have further development. For which, Community-based service, the services provided by community members including residents and other organizations to benefit the public or its institutions. Although most of the services in communities used to be provided by the government, they could not take enough care of all the aspects of the elderly' s life due to limited resources. For which，the issue of how to elevate the community members' involvement into services becomes more important.

In Japanese community where lots of social activities are conducted and elderly persons take important roles either as actors or receivers (Muramatsu and Akiyama, 2011) because of a small population of young persons. Regarding the important roles that the elderly taking in the community and the lack of attention to their psychological health, it is necessary to instill the positive emotions of the elderly in community services by integrating prosocial behaviors. At the same time, positive emotion and prosocial behavior, as correlated factors (Denham, 1986), will boost the level of social connections within the community. Here, identifying which prosocial behaviors impact positively the emotions of the elderly is the key point.

Finally, as the previous study covered, resolving a psychological issue in community-based service covered lots of different aspects and disciplinary. For clear the connection between different subjects, the figure 2.9 presented as following, starting from psychological issue and through identifying the perception and affection towards the prosocial behavior and positive emotion to summarize the characteristics into community-based service design.

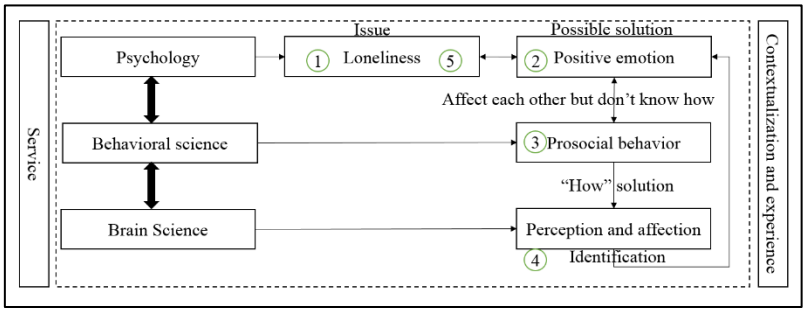


Figure 2.9：Illustration of the connection among those branches in this study

2.5 Summary

This chapter has addressed the social loneliness issue in the aging society. And discussed the negative effects of have a severe loneliness issue. Therefore, in order to give a good solution for this issue and developing our research, we have explored the researches about the reasons caused the loneliness and the significance of resolving this issue by explain the current studies about implying positive emotion into psychological well-being development. Considering psychological well-being requires people get appropriate affective and cognition arousal based on certain social contexts.

Prosocial behavior is a reciprocity relationship, especially empathy will potentially become people's motivation to conduct behaviors benefit others. Also empathy is a positive emotion related mental statements, will be aroused while people have receive certain prosocial behaviors. Regarding no matter as the conductor of prosocial behavior or the recipients of prosocial behavior, there will be positive emotion generated in different degree. Prosocial behavior antecedents probably going to be one of the solution to the loneliness issue of the elderly.

In order to know if the elderly would be psychologically affect and what kind of affection will occur, we need to identify in prosocial behavior context. Therefore, in brain science, prefrontal cortex which controlled people's cognition and commanding behavior need to be measured. Comparing with other brain-imaging methods, we have applied wearable optical topography, which has been proved affective to testify emotion related changes and light for the elderly participant to set.

The whole process from social issue to psychological output identification, it supposed to be planned in a service concept, community-based service as the circumstance of all the prosocial behavior conducting and the main target the elderly lived in. Combining the service design could be better apply the prosocial behavior antecedents and consequences. Community-based service provides the experiences to the elderly and let them earn the psychological benefits from the collaborations.

Chapter 3 :Study I: Perception and preference of the elderly to the prosocial behavior in communities

3.1 Research Sequence

The main idea purpose of this research is to identify what prosocial behavior could applied into community-based service, and in what process how to insert into community-based service. The multiple disciplinary studies are combining into service value co-creation process, the elderly as the main target, involving into the community service from a customer role to an actor role. As Figure 3.1 demonstrated. The research start from a social layer found the gap in an aging society, to solve the loneliness issue, bridging the social connection through a community-based service. While designing the community-based service, prosocial behavior and psychological benefits in a social service view require the brain measurement to identify. Here leads to the first study, the brain measurement to testify the elderly's affective and cognitive process that the elderly has towards the prosocial behavior contexts. Followed the results from brain measurement, the second study implies to testify the motivation and satisfaction in a practical social activity. Combining the two studies, how to apply the process into community-based service design will be answered.

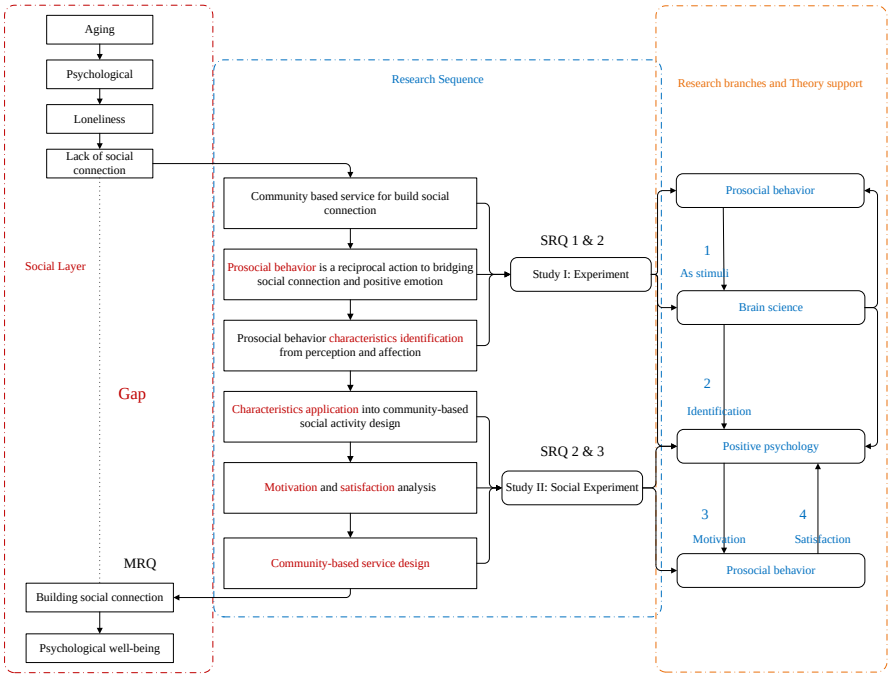


Figure 3.1: Research Sequence and branches

Chapter 3 has stand on the viewpoint of brain measurement to analyze the cognition and affection of the elderly. Based on the identification to summarize and classify the prosocial behavior, applying to the community-based service design theory. Furthermore, this chapter will make a general answer to the SRQ1 and SRQ2. Theoretically, as figure 3.1 shows, the first study mainly focused on the prosocial behavior and psychology aspects by a brain science methodology.

3.1.1 Research purpose

Study I aims to identifying the prosocial behavior affective and cognitive process and characteristics of prosocial behavior and answering the subsidiary research questions (SRQ1): How does the elderly affectively and cognitively perceived the prosocial behavior? To the first research question will be answered from the experiment sequences, and the feedback interviews. Moreover second research question (SRQ2) will be partially answered based on the results from the experiment: How to improve the motivation of the elderly to get involved into community-based service?

Generally, the experiment setting the target as the elderly people aged over 60 either in the pre-investigation stage or the experiment stage. And experiment setting not only from the prosocial behavior viewpoint but also from a service viewpoint, while the elderly regard as

the service recipients. How does they feel and what their requirement or expectation from the providers.

3.1.2 Methodology and research procedures

Affective and cognitive process require a stimuli with context to rise people attention, while the brain processing the information they got the participants' attention aroused and the brain functioning into a response, including behavior judgment or emotion generation (Ochsner, Silver & Buhle, 2012). Because it is a complex process, the research procedures presented like Figure 3.2. Firstly, appropriate context stimuli require to be selected from the prosocial behavior context. Secondly, followed with the context stimulus, this is the key step in the study I, prefrontal cortex which is significantly related with human perception and the temporal memory working tasks (Cardinal et al., 2002). Through a multiple tasks, the changes happens in the prefrontal cortex will be observed. After the brain measurement, the last step is the feedback interview, the subjective explanations from the participant will support the prefrontal cortex imaging results.

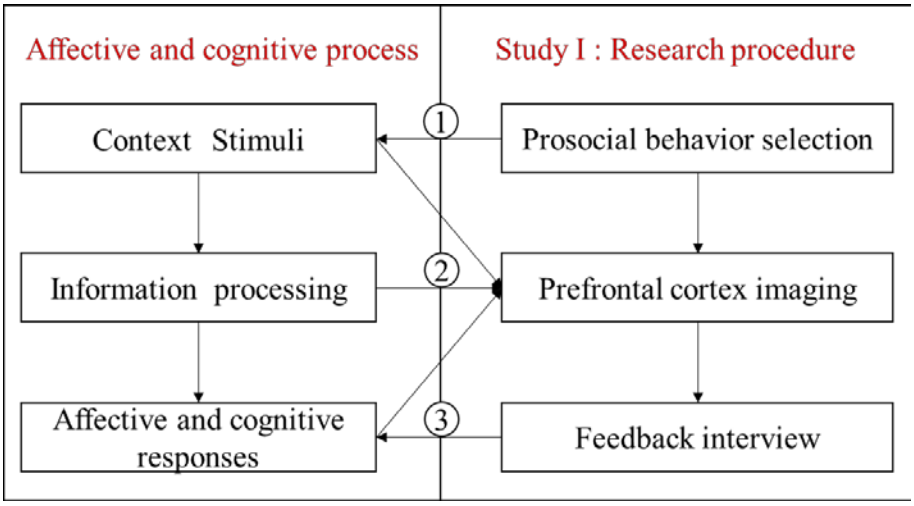


Figure 3.2: Connection of affective and cognitive process to research procedures

From Figure 3.2 step two, brain activity measurement as one of the key segment in the research, it has various kinds of methods to achieve. The top three methods are fictional magnetic resonance imaging (fMRI), magnetoencephalography (MEG) and electroencephalography (EEG)[4]. However, recent studies, near-infrared spectroscopy (NIRS)

[4] Top 3 Devices for Monitoring and Measuring Brain Activity, 2015, last access Dec.26th, https://imotions.com/blog/top-3-devices-measuring-brain-activity/

also been widely discussed. It is a spectroscopic measurement method use the near infrared light to detect the neuronal signals and measurements of the hemoglobin dynamic changes (Gratton, et al., 2005). NIRS was regard as a non-invasive method for infants and adults (Chance et al., 1993; Villringer et al., 1993). In this study the elderly people aged over 60 as the research target, a non-invasive method is easily to be accepted.

Optical topography as one of the specific method study I applied, is one of the development from NIRS technology, measuring the oxygenation and the hemoglobin changes in the cortex from the stimuli controlling (Taga et al., 2000; Taga et al., 2003). A wearable optical topography device (WOT-220), developed by Hitachi, Ltd., was used to measure hemodynamic reactivity in the prefrontal cortex and supported by investigating the emotional states and behavioral preferences. The device as Figure 3.3[5] shows. The device have 22 channels in total, all channels were divided into optic source and optic receiver, through the light radiation, the active section in prefrontal cortex will absorb the radiated light the increasing of blood volume.

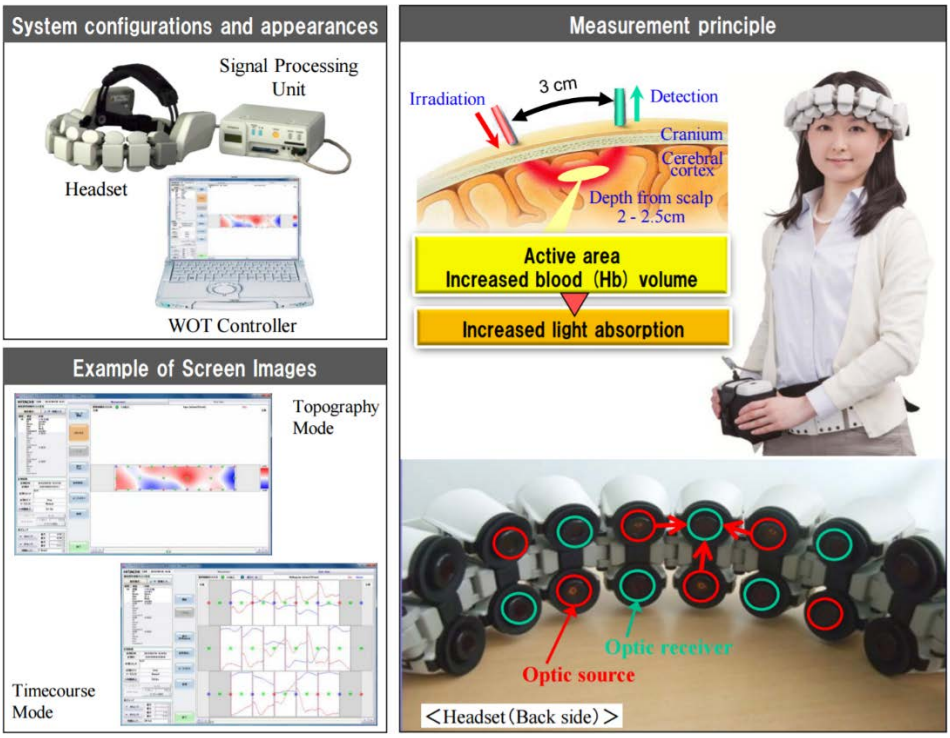


Figure 3.3: Wearable optical topography device working principle

[5] Hitachi High-technologies Corporation,2001, last access Dec. 26th, http://www.hitachi-hightech.com/products/images/8456/WOT-100_EN.pdf

3.2 Prosocial behavior selection

A lot of prosocial behavior prior researchers have shown that it has many different types and that each of these types pf prosocial behaviors has different personal and situational correlates. (Carlo and Randall, 2002) Among all these researches, altruistic prosocial behaviors were defined as voluntary helping motivated primarily by concern for the needs and welfare of another, often induced by sympathy responding and internalized norms/principles consistent with helping others (Eisenberg et al.,1998; Carlo et al.,2003) Altruistic behavior is positively related to the individual's level of empathic responding (i.e., responding to another's emotional state or condition with an emotional reaction congruent with that of the other) or sympathetic responding (i.e., responding to another's emotion or condition with other-oriented concern).

Prosocial behavior has defined in lots of branches, In 2009 Warneken and Tomasello (pp.397), who proposed three basic aspects of prosocial behavior, helping, sharing, and informing, and the prosocial behavior specified as following:

Helping as *helping others achieve their goal by acting for them.*

Sharing to be *sharing valuable goods* ***or services with other people.*** [6]

Informing to be *informing others of things they want to know.*

In the three aspects, the research looked into the local community activities in japan. The activity require to fit in helping, sharing or informing three aspects. The activities also need to have the elderly participated or as the recipient in the social service. The local activities either received good report in the website or news or the activities are the occasionally happens in the local communities.

3.2.1 Prosocial behavior characteristics related community activities

Japanese communities have lots of social activities that has such kind of prosocial characteristics. According the Mizuho Information & Research Institute report in 2012. Japanese social service support including support the elderly people's in daily life, such as shopping, outgoing or go to hospital. There are also some service like rising the frequencies of

[6] The bolded parts are the new interpretation from our point of view to better applied into this research.

the elderly are meeting their friends.[7] Moreover, as Japan Federation of Senior Citizens Clubs report, the community activities received great feedback which are the active seniors are helping each other for the chorus like changing bulbs, repairing plump. Other activities like farming together, strolling activities.[8]

From all of the activities, we could find that in communities, the elderly has taking important roles and most of the activities are related with the prosocial characteristics, which are helping each other, sharing knowledge or communications and informing about the activity information such as they invite their friends to join the activities that they also interested.

Considering the characteristics and the current community activities, the first study start from conducting pre-investigation to the prosocial behavior that has community contexts or social service background. And all the community activities has the elderly as either service receiver or actor. The prosocial characteristic mainly focused on that the elderly involved into the activities actively or potentially developed actively.

3.2.2 Pre-investigation for behavioral context selection

To select representative images related to prosocial behavior, we looked the current community activities that fitting prosocial characteristics. Randomly selected sixty pictures that indicated prosocial behaviors in local community activities (i.e., talking with elderly people, and teaching the elderly how to use an iPad) as Table 3.1 presented. In order to keep the variety of the prosocial behavioral context, the selected prosocial behavioral contexts including animals, robots and human three aspects interaction, at the same time the age layer, pictures including interaction between the elderly and middle ages, interaction between the elderly and children and interaction among the elderly. From the representing method, information also included some manga made contents to check whether the elderly preferences will change or not. As the comparison contents, some examples of non-prosocial behavior also listed.

We randomly selected four elderly people aged over 65 and interviewed them about

[7] Mizuho Information & Research Istitute report, 2012, last access Dec 26th, https://www.mizuho-ir.co.jp/publication/report/2012/pdf/mhlw_08.pdf

[8] Japan Federation of Senior Citizens Clubs report, 2012, last access Dec 26th, http://www.zenrouren.com/siryou/pdf/120418.pdf

their opinion to those sixty prosocial contexts. We firstly ask them to review all of the pictures and answering what their most impressed picture and which pictures aroused their positive emotions and if they have similar experiences before.

Table 3.1: Pre-investigated prosocial context

#	Contexts	#	Contexts
1	Helping the elderly using the walking device	2	Home visiting
3	Voluntarily organized Ashi-yu	4	Help the elderly clean nails
5	The elderly are talking together	6	The elderly are making pottery
7	Different ages are making pottery	8	The elderly are dancing together
9	The elderly hugging a fluffy toy	10	The elderly talking with children
11	The elderly taking participated into activities	12	Younger people involved into elderly care
13	Bus support to hospital (Manga)	14	The elderly caring systems (Manga)
15	Medical support (Manga)	16	The elderly offering a ride (Manga)
17	Sight medical check	18	Voluntary jobs target to the elderly
19	Robotics' physical help	19	Routinely medical check (Manga)
21	Active seniors street visiting	22	Barbecue for the elderly
23	Help the walk disabled elderly	24	Active senior home visiting
25	Help the elderly drink the medicines	26	Security check visiting
27	Care helping for food	28	Blood pressure medical check
29	Birthday celebration	30	Routinely communication with nurse
31	Help the elderly reading books	32	Help the elderly to walk cross the road
33	Help the elderly from the accidents	34	Help the elderly get off the car
35	Teach the elderly using iPad	36	Ride fast when passing the elderly (Manga)
37	Playing games in care center	38	Shopping robot helper
39	Carry robot for disabled people	40	Robot's helper for teaching gymnastics
41	Home visiting with flowers	42	Gymnastic practice
43	The elderly playing drums	44	Fluffy robot talking with the elderly
45	The elderly playing chess with young boy	46	The elderly reading newspaper together
47	The elderly cooking class	48	The elderly yoga class
49	The elderly playing with kids	50	Help the elderly repairing things
51	Help the elderly removing snow	52	The elderly hugging a dog
53	Don't offering seats for the elderly	54	Help the elderly cleaning room
55	Book sharing among different ages	56	Making pottery class
57	Deliver food to the elderly home	58	Help the elderly cutting hair by free
59	Travel caring	60	Enjoying the beautiful flower together

From the questions, the relationship with human perception and affection presented in three aspects. Firstly, ask them to review all of the pictures and answering which is the most impressed one is based on the theory of short-term working memory in prefrontal cortex (Fuster, 2008). According to the memory arouse to know how the elderly recognize the behavioral contexts. Secondly, ask which pictures emotionally impressed them. This is based on the human affection to the perception impact (Codispoti, Ferrari, & Bradley, 2007). Through this process, the ambiguity of the perception to the picture stimuli identified and to know which pictures should be selected for the next step of the experiment. Lastly, ask if they have similar experiences is to know the empathy generation. Because empathy affect human perception and affection in some degree (Eisenberg and Lennon, 1983; Singer et al., 2006). Based on the pre-investigation, and the interview method we concluded some points to select the prosocial behavior experiment contents.

According to the interview results there are twenty pictures were received good feedback results. Those pictures are mostly expressed a neutral or positive atmosphere, which increased their affective and cognitive impression to the prosocial contents. Besides that the manga form of pictures is not easily for the elderly to perceive the original idea that the picture meant. The ambiguity existed among different person, so that manga pictures were excluded from the experiment stimuli in the next step. Since the elderly also expressed their interests to the robotics, one robotic picture also evaluated greatly. Moreover, the community activities that the elderly participated in or generated empathy could be categorized by the activity frequency (occasional and routine), while the final selection required to referring the frequencies.

By further interpreted the interview results and comparing with the prosocial behavior contents, there are six pictures are finally selected. While specifying the informing behavior, expressions of encouragement, caring, or concern have been proved to have a positive psychological effect on participants (Yao et al., 2015). In that case the prosocial behavioral stimulus finalized as Figure 3.4 shows

Here, HO means helping behavior for events that occur occasionally, and it is depicted in an image showing people helping to remove the snow. HR stands for helping behavior that happens routinely, and it is shown as someone helping to clean the house. SO refers to sharing behavior that take places occasionally, and it is depicted in an image showing elderly people gathering together to cook. SR indicates sharing as a routine activity and is

illustrated, as elderly people talking with each other. IO means occasional informing behavior where other people express thanks to the elderly. IR, on the other hand, indicates informing behavior in routine situations and the image shows “caring” message that the elderly persons receive from other people. Furthermore, as a contrast to prosocial behavior, the NB image depicts non-prosocial behavior in which younger people on a commuter train don’t offer their seats to the elderly persons nearby. The RH image depicts a robot attempting to help an elderly person carry groceries.

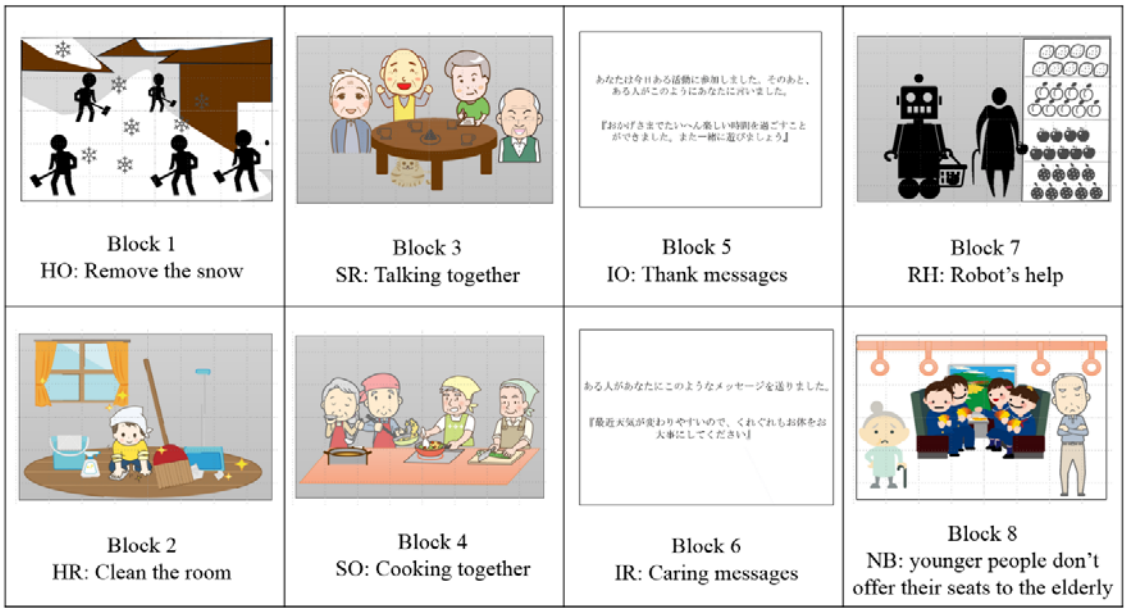


Figure 3.4: Images depicting prosocial behavior[9]

Furthermore, prosocial behavior will be affect if there are some economic or money interface (Vohs, Mead, & Goode, 2006). So that those eight prosocial behavior contents also need the further analyzed in both monetary and nonmonetary cases. In the nonmonetary case, it is described the event as voluntary behavior. In the monetary case, it is described the events as having a specific price tag indicating the payment received by people who behaved prosocially. So the all behavioral contexts were explained as Tale 3.2 presented, in each of them, a specific content has been given to avoid the misunderstanding. Since non-prosocial behavior don’t related with money interface, so that the non-prosocial behavior content doesn’t followed a monetary explanation.

[9] The depicted images were converted from the actual prosocial stimulus that applied in the experiment.

Table 3.2: Description about image

Nonmonetary Condition	Monetary Condition
HO: Considering that shoveling snow places a heavy burden on the elderly, students living nearby and community residents voluntarily help the elderly to do the job	HO: It's difficult for the elderly to remove the snow, but this service could be had by paying 2000 yen per hour for each person.
HR: The younger elderly people are helping elderly who have trouble cleaning the house.	HR: A cleaning service is offered for elderly persons who have trouble cleaning their house, The cost is 2000 yen per hour.
SR: Elderly people in the community regularly gather and share their worries and feelings together	SR: In order to provide a place for the elderly to communicate with each other. Mr. A has collected 1000 yen per month from the participants.
SO: The elderly persons with same hobbies are gathered together in a cooking class.	SO: A has invited the persons sharing the same interest to a cooking class. The cost is 2000 yen per month.
IO: Today you have taken part in one activity, after that one person told you "Thanks to you, I had a great time today, let's have fun sometime"	IO: Today you have spent 500 yen to participate in an activity, after that one person told you "Thanks to you, I had a great time today, let's have fun sometime."
IR: One friend that you have met in one activity sends you a message "The weather is changeable, please take care."	IR: You have spent 500 yen to become a member of a supermarket coop, one day you get message from them "The weather is changeable, please take care."
RH: The helping robot can carry your belongings and talk with you when you are shopping.	RH: The helping robot can carry your belongings and talk with you when you are shopping. It costs 2000000 yen for each robot.
NB: Elderly people stand in the bus, but the high school students just ignore them and don't offer their seats.	

3.3 Perception of the elderly to prosocial behavior

Followed the fixed prosocial behavior stimulus and the matching explanations, the perception of the elderly to the prosocial behavior need to be identified in this period. The perception identification will use the wearable optical topography device to measuring the elderly prefrontal cortex activity while they watching the prosocial behavior stimulus. The stimulus lasting time and the prefrontal cortex activity monitoring period are fixed to keep the consistency with each other.

The connection between prosocial behavior context and experiment design, the whole process as Figure 3.5 illustrated. The experiment process combined the community activity frequencies and the economic conditions, each of the context stimuli summarized start from occasionally happened helping behavior in nonmonetary condition (HON) to the routinely happened robot's help in monetary condition (RHM). After the experiment, a feedback interview will conducted.

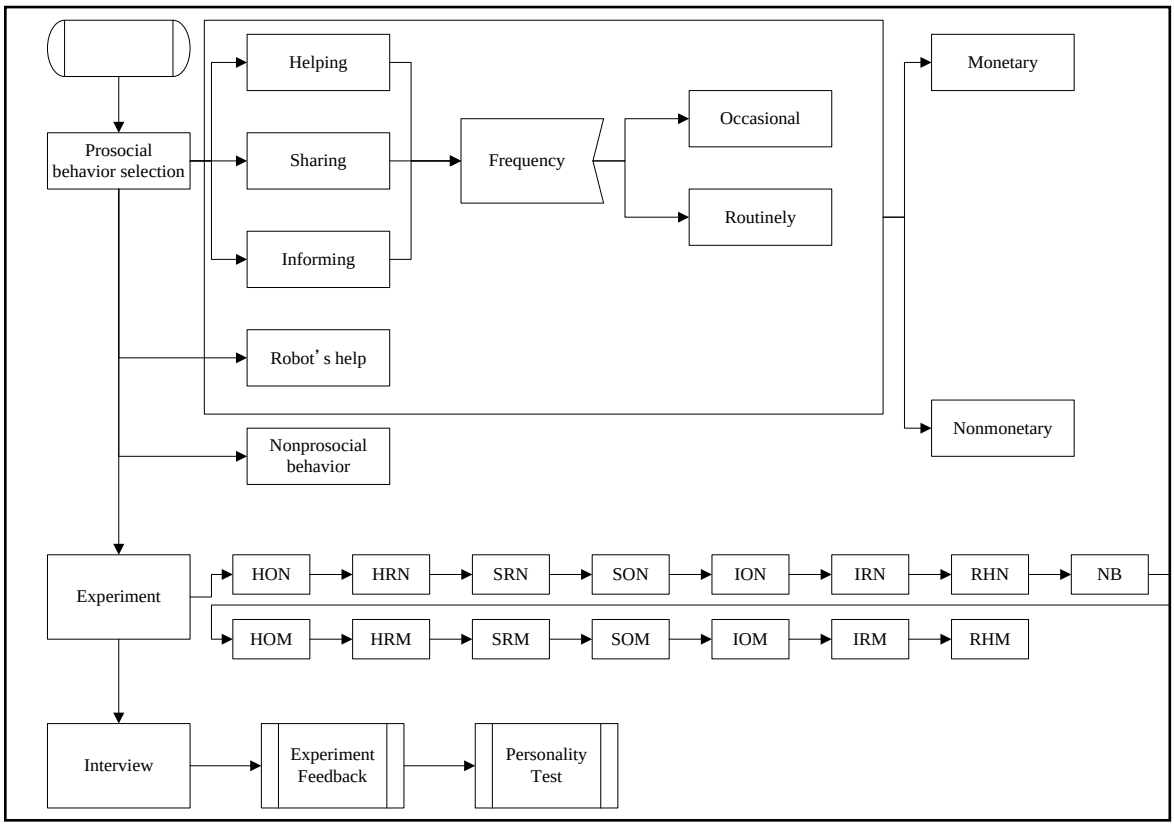


Figure 3.5: Illustration from prosocial behavior context to experiment

3.3.1 Experiment design for perception identification

The experiment applied a block design, with 23 blocks in total, in which each block lasted 15 seconds and there was a 15 second interval in between, as shown in Figure 3.6. Experiment environment should be in a quiet room with less noise affection. And the device need to avoid the light direct interface. Before the experiment started, a probe-checking was done to guarantee that the channels functioned correctly (Shirahada, Suzuki, & Kosaka, 2012). After the check was completed and device adjustments made, the experiment started with a ten second period in which the participants could relax.

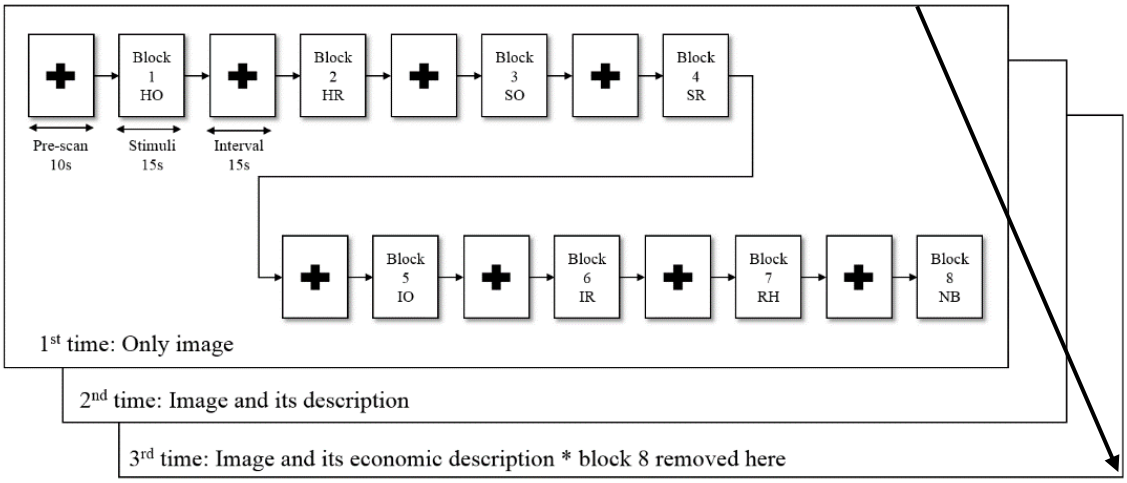


Figure 3.6: Flow of the experiment

In the first round, only the pictures containing prosocial behavior were shown to the participants. In the second round, participants were asked to view the same images but there were descriptions indicating that the motivation for the behavior was nonmonetary. In the third round, participants viewed the same pictures, but this time they were accompanied with notes indicating the motivation for the behavior was monetary. In the last time only non-prosocial behavior stimuli was excluded.

Nine participants between the ages of 60 and 80 years old, (seven males, two females) were recruited from the local communities of Nomi city, Ishikawa, Japan. The information about the participants is shown in Table 3.3. The participants reported no cognitive disorders and had experience participating in community activities. The experiment was approved by the Ethical Committee of the Japan Advanced Institute of Science and Technology (Approved # 27-011). All participants provided written consent beforehand.

Table 3.3: Age and gender information of participants

#	Age	Gender	#	Age	Gender
1	63	Male	6	69	Male
2	66	Male	7	78	Male
3	68	Male	8	65	Male
4	69	Female	9	60	Female
5	80	Male			

Note: n=9, mean=68.7

3.3.2 Data analysis

Dynamics of oxy-hemoglobin

The data were processed by using PoTATO: Platform for Optical Topography Analysis Tools (developed by Hitachi, CRL, and run on MATLAB, from The MathWorks, Inc., USA). A high-pass low filter was used to eliminate the effects of body motion and to cut out high-frequency waves in the brain-activity data that were not appropriate for the subsequent analysis and a moving average standard (5 Hz, 3 seconds) has been set to smoothing oxy-hemoglobin data (Shirahada, Suzuki, & Kosaka, 2012).

Since picture stimuli showing individual prosocial behaviors has followed with a mark, according to that, the data been separated and analyzed. To analyze the effect of the trials, the average state for 5 seconds before the trials started was set as a zero baseline. Moreover, to analyze distinctive features of the data, a polynomial fitting (three-dimensional) was conducted. After preprocessing the data, the marked data of all participants' were compiled and integrated to make average data for each viewing of one image.

To determine the brain activity occurring before and after the images were shown, the data were analyzed in in 5-s segments. In this way, the brain activity patterns could be analyzed over time. In addition, the total brain activities of the frontal and temporal lobes were investigated by summing the amounts of oxy-hemoglobin and computing the average level. MatLab software was used for this and graphs showing summed oxy hemoglobin values of all channels were created. The parts of the brain images showing increasing oxygen-hemoglobin in the prefrontal cortex are red while those showing decreasing oxygen-hemoglobin are blue.

Spatial auto-correlation analysis

In the second analysis, Moran's autocorrelation coefficient (Moran's I) defined by Formula 1, was used for compute the degree of correlation between the channels. The 22 channels were separated into four areas, left, upper central, lower central, and right. To calculate Moran's I, we defined the neighbor list using an edge type rule, as shown in Figure 3.7, that assumed there is a "neighbor" when the edge of a channel connects to the edge of another channel (for example, channel 1 and channel 2 are considered neighbors, while channel 1 and channel 4 are not neighbors). Within the area, the edge effects among the channels were calculated using R (software developed by the R Foundation). Values of I range from -1 to +1, and because positive values indicate positive correlation, i.e., similar movements within the area, we only focused on the positive values in this part.

$$Moran's\ I = \frac{N}{\sum_i \sum_j w_{ij}} \frac{\sum_i \sum_j w_{ij}(X_i - \bar{X})(X_j - \bar{X})}{\sum_i (X_i - \bar{X})^2} \quad (Formula\ 1)$$

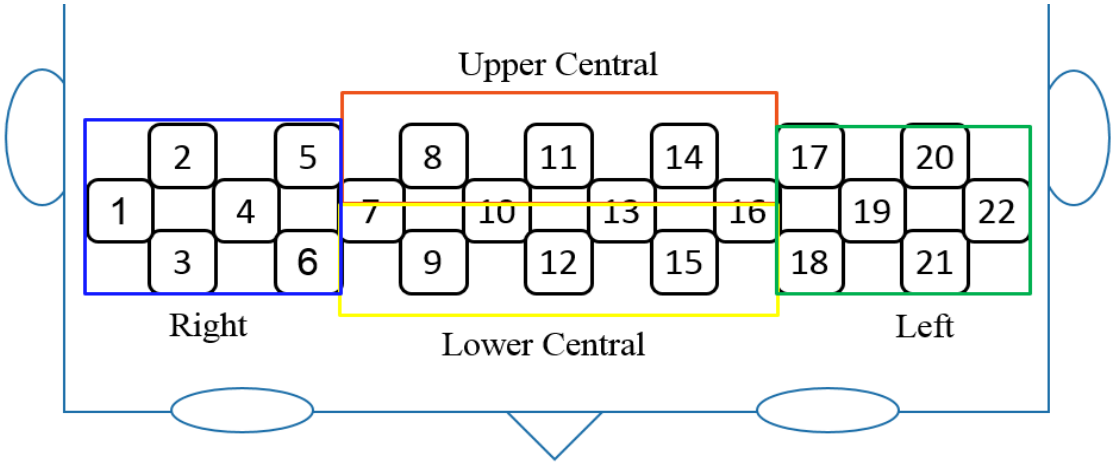


Figure 3.7: Definition of four areas consisting of 22 channels while pre-frontal cortex measurement

3.3.3 Comparison of different contexts

As shown in Figure 3.8, the dynamic average of the oxygen hemoglobin amounts between the HO and HR conditions showed large differences in values and in shapes. In the HR condition, oxygen-hemoglobin kept positive from 0 s to 30 s. During the stimulation (5 s to 25 s) there were barely no negative traces, and the peak of positive value reached 0.099

Mmol. The mapping results presented red parts, especially in the middle of the prefrontal cortex. In the HO condition, oxygen-hemoglobin changed from positive to negative or from negative to positive nine times, the absolute value reached 0.057 Mmol. Although the HO results didn't reach a higher oxygen-hemoglobin volume than the HR results did, the HO results had a wavier form, indicating that the brain had been stimulated.

Both of the sharing behaviors presented certain red parts, meaning that the oxygen-hemoglobin amount increased to some degree. SR changed three times from negative to positive, while SO varies mostly stayed in the positive value area with slight fluctuation to negative values. In the SR condition, the oxygen-hemoglobin amount changed from -0.09318 Mmol to 0.043219 Mmol while in the SO condition, the oxygen-hemoglobin amount changed from -0.03035 Mmol to 0.102683 Mmol, which meant that the SO condition generated more oxygen-hemoglobin during the stimulation time than the SR condition did.

As to the informing behaviors, the IO mapping results are redder than the IR results, this is due to the increase in the amount of oxygen-hemoglobin in the post-stimulation period. Specifically, the IO results have mostly negative values during the stimulation time, reaching -0.06643 Mmol. In the contrast, the IR behavior changes between positive and negative at least two times and is positive more often during the stimulation and higher (0.03122 Mmol) than in the IO condition (0.01488 Mmol). The line plot of the dynamic motion also has various shapes in it.

The plots for the robot's help and non-prosocial behavior each showed several peaks and positive oxygen-hemoglobin amounts. The positive peak of 0.10719 Mmol in the case of RH was the highest average value. The NB results also had a positive peak (0.09806 Mmol) during stimulation, but as it was calculated from two stimulations, it requires further analysis and interpretation.

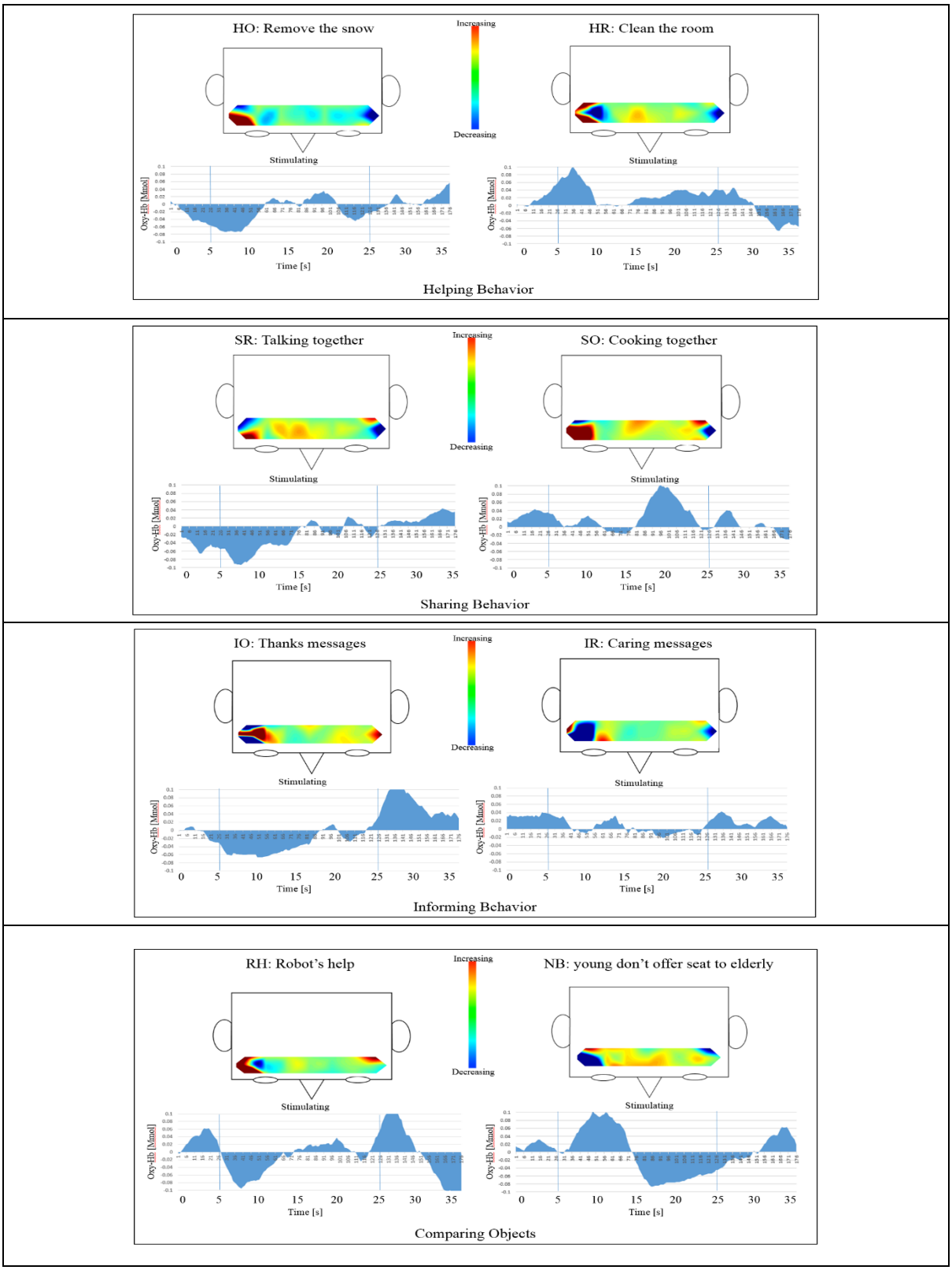
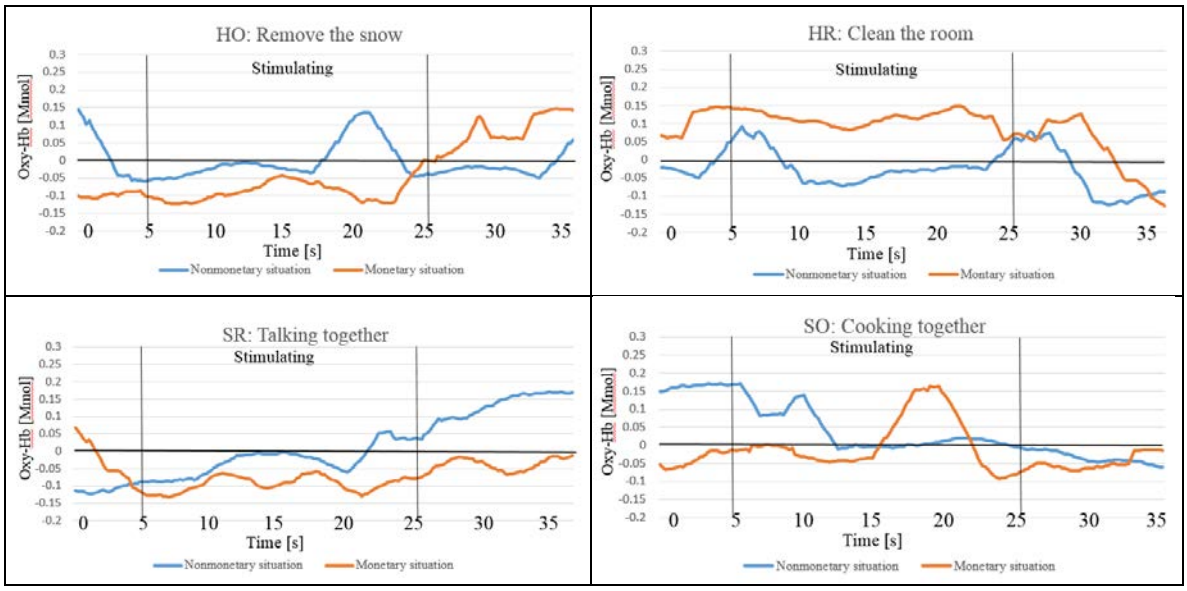


Figure 3.8: Oxygen-hemoglobin (Oxy-Hb) heat mapping and dynamic changes in pre-frontal cortex activity during stimulation

3.3.4 Comparison between monetary and nonmonetary situation

The average oxygen-hemoglobin data changes for nonmonetary and monetary conditions were analyzed as Figure 3.9 shows, the perception vary between conditions. The HO image clearly received a better reaction in the nonmonetary condition, as indicated by several peak waveform and two positive absolute values (0.14570 Mmol and 0.13576 Mmol) in nonmonetary condition, and there is a post increasing curve since 23s (peak reached 0.14592 Mmol) in monetary condition. The active duration for the HR condition was from the very first of the monetary stimulation (0 s-33 s). The nonmonetary condition had two small peaks (0.09325 Mmol and 0.07923 Mmol). SR results for the two conditions were similar, but the nonmonetary condition does show more of an increase from a negative peak compared with the monetary condition. On the contrary, the SO results for nonmonetary condition decrease, but show a large peak in the monetary condition during the stimulation time (0.163503 Mmol). IO results showed an increase after the stimulation and waves after 17s in the monetary situation, the peak is the highest among all the results (0.297257 Mmol). The IR results also showed the biggest reaction for the monetary condition (second highest of all the prosocial behaviors), the peak during stimulation reached 0.233051 Mmol.



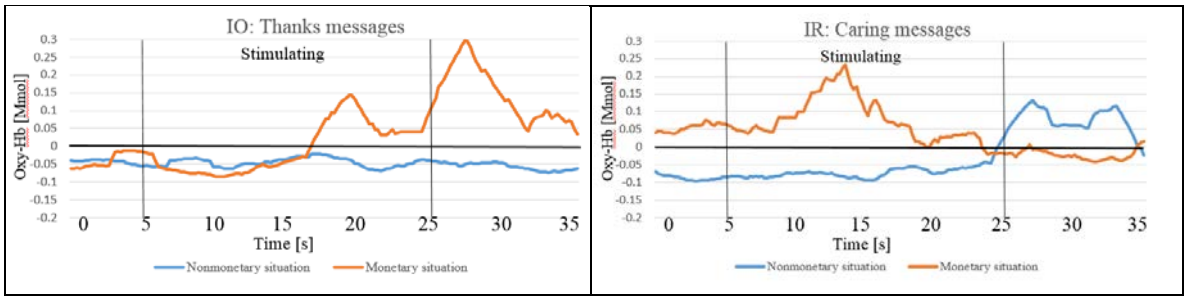


Figure 3.9: Line plots for each behavior in nonmonetary and monetary situations

3.3.5 Autocorrelation coefficient in prefrontal cortex to specific contexts

The distribution of the spatial auto-correlation results of all 22 channels in the four districts was plotted as Figure 3.10 shows. In the right section of channels, most positive values were in the remove snow (HO) situation and the robot's help (RH) picture during the stimulation, which indicates the similar brain activities during those two stimulus.

The caring message (IR) oriented image gave highest frequency of similar brain activities in both central sections, and in each section the positive values are around 0.2, a steady reaction comparing with others. Since large correlation presented in the central sections, each section required further interpretation with their own characteristics. In the upper central section, most positive values focused on the stimulations of the elderly cooking together (SO), receiving caring message (IR), and helping to remove the snow (HO). In the lower central section larger positive values for helping to clean the room (HR), the elderly people talking with each other (SR) and the non-prosocial behavior (NB).

The left part had the smallest positive values especially during the stimulation (5 s to 25 s), which meant that not much similar brain activity occurred in this section among the neighboring channels. Cooking together (SO) picture have two positive values around 0.2, and most of the positive values in this section shown after 15 s.

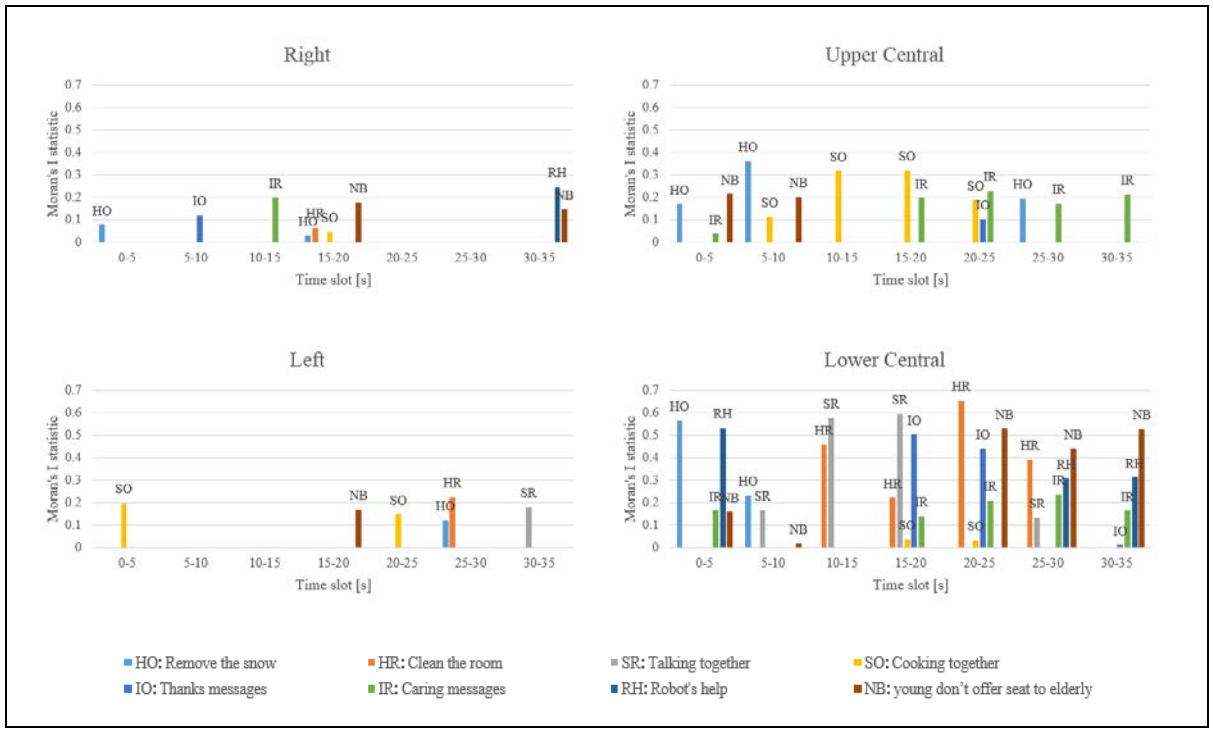


Figure 3.10: Moran's I results for 22 channels divided into four sections

3.3.6 Comparison of gender difference

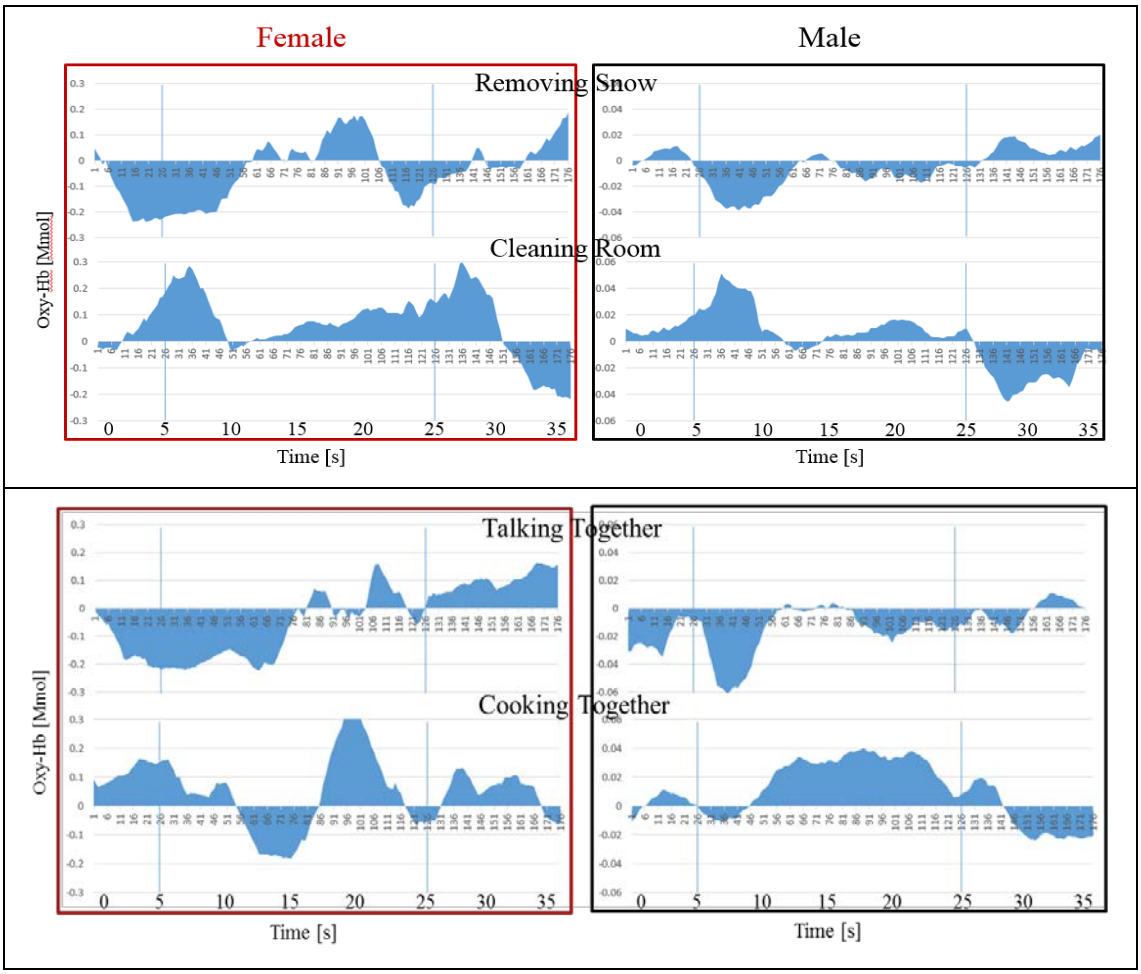
Followed the average data interpretation, the data were separated into different groups to find out the gender differences as Figure 3.11 presented. Although the male group has more number of participants than the female group, the average data still valuable in several degrees.

Generally, from the Oxy-Hb amount, Female group has higher amount than male group, in the average level, female group line plot floated from 0.3 Mmol to -0.3Mmol. However, male group line plot fluctuated from 0.06 Mmol to -0.06 Mmol. Comparing the helping behavior aspect, removing snow female group has better reaction than male group. Female group has been through four times from negative to positive or positive to negative process. Male group mostly under a negative level, not much activation generated, neither much changes from positive to negative nor negative to positive. As for cleaning room behavior, the two line plots indicate very close results. Most of the time the brain kept a positive area, which indicates in this period, their brain keep active but not meant their emotionally perceived the behavior.

In sharing aspect, to the talking behavior male group shown mostly in negative

section. Although female group also presented not much positive results, during the stimulation, two positive peak shown in the post period. Female group in this talking behavior stimuli presented a gradually increasing trend. In cooking behavior, two line plots presented positive values and good shapes, male group have a lasting active time than female group, on the contrary, female group performed better in fluctuation.

In informing aspect, two behavioral contexts also expressed a totally different performance. In thank message part, male group has a significant increasing after 15 seconds of the stimulation, female group mostly has a negative period especially during the stimulation. In caring message part, neither of the group has a significant activation results. Male group is smoother and more positive values than female group, while we comparing the fluctuation and peaks female group has five peaks negatively and positively.



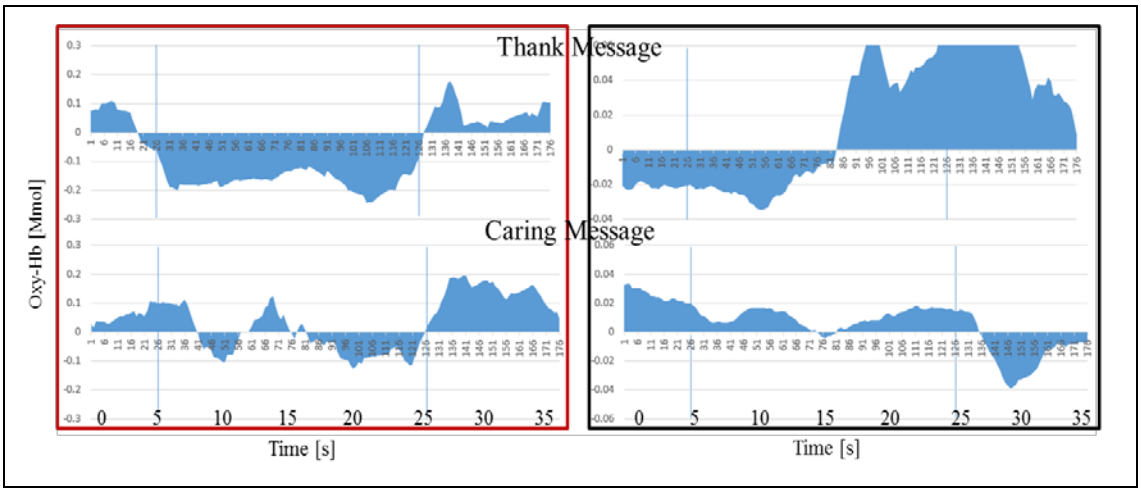


Figure 3.11: Average line plots with gender differences

Comparing the three aspects in each context and the differences in the two groups, the two groups presented better in different level, male group has more comparative characteristics in each group prosocial behavioral aspect. Female group has more fluctuation representing the more consideration in this period. In helping, removing the snow, it is a heavy load for them even more than male group. In cleaning room, female kept active regarding they are taking more chorus works in daily life. In sharing, talking which is obviously more preferred by female, they could have more enjoyment from the behavioral context. In cooking behavior, although male don't good at cooking, they still have shown the interests to the cooking behavior and comparing with their brain activity in talking context, male group does appeared a big difference. In informing aspect, the two groups don't have that much differences, male group more like the expression of thanks, female would like the expression of caring in a daily life.

3.4 Preference analysis

After the general brain activity comparison in different aspects of the prosocial context, the perception analysis revealed many possibility for applying prosocial behavior context in a community-based service development. However, after the basic identification of the elderly perception, we need to detect the reason that the brain imaging presented. Thus the preference analysis need to be done to further interpret the data for better application into community-based service design.

3.4.1 Feedback Interview

A semi-structured interview was conducted after the experiment, contents as Table 3.4 shown. First of all, the participants were asked to rank the stimulus by the degree in which it made them feel happy. Then, based on the ranking, more questions were asked. To compare the monetary and nonmonetary conditions, the participants were asked if the money tags changed their mood and if they felt that the intrinsic motivation was elevated because of the extrinsic rewards.

Table 3.4: Interview Contents

Experiment contents	**Answer Type**	**Experiment contents**	**Answer Type**
Please rank the pictures by the degree made you feel happy	Ranking	How you feel when you saw the image that younger people don't offer the seats to the elderly persons	Open-ended
Reasons for select this subject as 1st place	Open-ended	Have you received any prosocial behavior that shown in the pictures? And how does that feel?	Open-ended
Reasons for ranking the two helping behaviors	Open-ended	Have you conducted any prosocial behavior that shown in the pictures? And how's the frequency?	Open-ended
Reasons for ranking the two sharing behaviors	Open-ended	Will you participate actively if you could get some reward from the participation?	Open-ended
Reasons for ranking the two informing behaviors	Open-ended	What do you think about paying for other people's prosocial behavior?	Open-ended

3.4.2 Interview interpretation based on brain imaging data

The objective ranking result during the interview was statistically analyzed by using the scores for the rank place (i.e., 1st place rank was given 8 points. 8th place was given 1 point). The ranks were weighted by the number of rating given (e.g., HO was rated in 1st place five times and 2nd place four times, its score is 5*8+4*7). Table 3.5 shows the ranking, from high to low.

Table 3.5: Subjective ranking results

Subjects	Points	Rank Place	Subjects	Points	Rank Place
HO: Remove snow	62	1	IO: Thank you message	33	7
HR: Clean room	47	3	IR: Caring message	35	5
SR: Talk together	50	2	RH: Robot's help	34	6
SO: Cook together	46	4	NB: Non-prosocial behavior	17	8

The interpretation below are derived from the analyses of the oxygen-hemoglobin amount, wave shapes, spatial autocorrelation, and the interview. Regarding the helping aspect, the participants had a more positive reaction to the HO event (remove the snow) than to the HR event (clean the room), because they would like to do the housework by themselves if possible. On the contrary, the HO event was regarded too heavy a workload for them, if other people could offer such help during snowy days, they would be very happy. Although the NIRS measured brain reactions about helping behaviors are not the most significant pair of prosocial behaviors, the emotional evaluation towards helping was higher than those of other groups. Therefore, relieving a physical burden is important.

Regarding the sharing aspect, the SO event (elderly people talking together) received better reactions than the SR event (elderly people cooking together) did. This means, for the elderly, talking and collaborating with each other is accompanied by positive emotions, especially, when people sharing the same hobby. Therefore, in this group SR which is a doing-type of activity was preferred than talking-type of activity. In the other words, no matter the expectation of talking with people in other age groups or collaborative work within the same age group, the elderly focus on the variety of the activities while they are engaging in the behavior.

Regarding the informing aspect, generally both of the behaviors carried feedback from certain activities, but IR circumstance (caring messages) received better reactions than the IO circumstance (thanks messages) did. Unlike the thanks messages, the caring messages remind the elderly about their health, which make them feel that the sender is genuinely caring instead of merely a courtesy.

From the Moran's I results, we could compare measurements taken from different prefrontal cortex section. One important finding is that most of the positive values appeared in the central part of the pre-frontal cortex. The IR results in the central part indicated the elderly people have a self-cognition about health. As for other positive values, occasional events like SO and HO concentrated in the upper central section; routine events like SR and HR concentrated in the lower central section (i.e., the comparison and routine events).

The two behavioral situations, nonmonetary and monetary, received different amounts of attention. Stronger reactions for monetary condition of the SO (cooking together), IO (thanks message), and IR (caring messages) stimulations. The participants reacted strongly towards the monetary condition in the caring message event. The interview data can be interpreted as that the elderly think that money doesn't matter in regard to their participation or payment for prosocial behaviors. However, they do feel happier when they can receive some sort of payment, e.g., souvenirs or snacks. Moreover, if they are required to pay money; under 1000 yen is an acceptable amount for them. All in all, the participants made specific decisions in the special contexts, and in each context, their role changed from the behavior provider in the nonmonetary condition to behavior receiver in the monetary condition.

3.5 Summary

This study has proved that prosocial behavior has different impacts on the elderly depending on the specific contexts. The neuronal study showed evidence of the perception and preferences of the elderly towards the social activities and illustrated the use of near infrared spectroscopy to detect emotional changes (i.e. identify the emotion arousal from the stimulus). It sees that such studies would be useful in marketing studies examining decision-making behaviors (i.e. preferences towards certain products) and in designing new products based on customer perception (Glimcher, 2002; Glimcher & Rustichini, 2004; Fellows & Farah, 2007; Bruce et al., 2014). This study considered the implications of using the NIRS methodology in social science and for designing social service.

The experimental analyses identified how the elderly participants were emotionally affected by other people's prosocial behavior. Basically, most were happy to receive any kind of prosocial behavior. Specifically, as for the helping and sharing behavior, the elderly would like to be more involved in occasional events, especially those that relieve physical burdens and provide entertainment. As for the informing behavior, routinely receive caring messages will bring with them positive emotions for the elderly, who appreciate information about their health, in particular. The robot's helping behavior, which had an emotional impact to a certain degree, showed the potential of robotics as a means of elderly care and providing community services. However, exploration of such potential will require greater levels of acceptance and user-friendly considerations. Overall, the data show the implications of prosocial behavior in evoking positive emotion in a specific context when delivering social service.

From a marketing perceptive, the comparison of the nonmonetary and monetary conditions of the prosocial behavior context points to the preferences towards monetary sharing behavior (cooking together) and informing behaviors (thanks message and caring messages) in monetary condition. For instances, the possibility of social service design with economic factors has been identified, service like caring messages could be sent by local supermarkets to their customers to notify them of poor weather and take care reminder. At the same time, elderly customers would be happy to receive such messages even if they are required to pay, and this would also raise their level of satisfaction with the supermarkets that provide the service.

As the outset of this study, we made a summary about the emotional effect of prosocial

behavior and behavioral preferences of the elderly. The results suggest that a marketing or social service can be developed to encourage the elderly to get involved in social activities and raise their satisfaction level through emotional impact. Furthermore, by implementing such a service, a third party like a local supermarket could profit from greater involvement with customers. This study showed a meaningful application of NIRS to social stimuli. Exploring the relationship between social events and perceptive reaction in prefrontal cortex may lead to new applications of near-infrared methods. At the same time, near infrared methodology has shown advantages in making possible convenient and successful tests in life-like environment.

After the basic identification of the elderly perception to the prosocial behavioral context, next study need to actual implies the characteristics of the prosocial behaviors to clarify the mechanisms underlying social stimuli in practical social activities of dyad circumstances.

Chapter 4 : Study II: Implicative investigation in community activities

4.1 Current community activity

The objective of the second study is applying the neural imaging experiment designing a social activity in the same community of study I investigating the motivation and satisfaction of the local resident's participants. From this method, the second subsidiary research question, how to improve the motivation of the elderly to get involved into community-based service will be answered combining the study I data result. The third subsidiary research question, how to apply the prosocial behavior antecedents and consequences into community-based service for serving the elderly will be answered from the process design of the community activity.

In this section, the study start from the summary of the previous community meetings of the local activity that could be further improved in this community and there current problems about this community activity. From the results of study I, searching some characteristics summarized and applied into the study II. The implication not only aiming to solve the problem in the current community activity but listing some potential application into the community-based service design.

4.1.1 Community activity in Nomi city

According to the social survey results about local action, social movement and citizen and administrative collaboration conducted by Nomi city in 2015, the social participation of local community activity increased 6%. From gender comparison, male group has more participants than female group, from that point that the roles of male citizen get involved into the community activity and social services should be focused. From the age aspect, although the middle aged community clubs are very popular and most of citizens have involved into the community activities in this age level (30-50). Moreover, the involvement of volunteer activity or other related prosocial social activities, people aged over 60 is significantly higher than other groups.[10] From the three communities (Neagari, Terai, Tatsunokuchi) of Nomi city comparison, Terai has the average level is every aspect concerns community activities and the citizen coordinator's activity is not enough.

Looked into the Terai community activity, there are prosperous history about Kutani, which is the key assets in Terai community, has held the Japan Exchange and Teaching Programme activity[11]. It is the chance to introduce the community to more foreigners about the place. From the series of community like festival of Kutani products, some local wound straight forum in Nomi[12], we could notice that all of the community activities have a key points which is solving the local community problems and spread the spirit or the cultural background to more people.

In Every year Terai community meeting, they will discuss the current issues in the community and provide some potential solution to the issues. The latest committee meeting mentioned four teams that holding the community activities. Comparing other teams, Team for social connection and activation of local community has proposed their issues including the target identification, insufficient process and the unclear activity plan. Those issues caused their strolling activity hasn't received a good feedback.

[10] Nomi city, 2015, Nomi citizen satisfaction report section 8, Local action, social movement and citizen and administrative collaboration, last access on Jan.1st, 2017, http://www.city.nomi.ishikawa.jp/data/open/cnt/3/5258/1/7_tiikikatudou.pdf
[11] Ishikawa JET Resource, last access, Jan 1st, 2017, http://ishikawajet.wikia.com/wiki/Nomi
[12] Nomi city, 2016, last access, Jan 1st, 2017, http://www.city.nomi.ishikawa.jp.e.bg.hp.transer.com/chiiki/collaborative_community_development/machizukuri.html

4.1.2 Data implication

Considering those issues, from study I there are several prosocial behavior characteristics that could apply to sort the problems in the current Terai community activity issues. The prosocial behavior characteristics that concluded from study I are helping behavior that help the elderly release the physical burden, sharing behavior that people have a same goal and working together for the goal, informing behavior that expressing the thank or caring feelings, offering robot's help and providing souvenirs instead of money reward to the elderly people. All of those characteristics received good impression or feedback from the elderly with the investigation of asking them as service receiver or service provider.

Considering the Terai strolling activity is a long-term plan. It is planned start from 2015 and complete by 2019, in the long strategy setting process, there are a potential to apply the theories from study I. First of all, the target issue, Terai community has confused about how to set the strolling activity target, the community committee has mentioned to target at the foreigner tourist. Although the JET has used to apply Terai Kutani village as the tourist place and the participants said that they enjoyed making Kutani products, targeting at foreigner tourist is not the best way to keep the community service for a long run. Every tourism has differences regarding to the seasons, climate or temperature (Amelung & Viner, 2006), strolling activity is not a variety activity in community-served activity. This restriction limited the sustainable development of community service. On the contrary, the local residents are living in this community and all of them are contributed into the construction of this community, which meant a lot for the whole community. Therefore, target the strolling activity in a long-term strategy, target at the local residents will be better.

Secondly, currently Terai community has held some strolling activity or related activities, such as inviting the high school students to draw pictures about the local buildings. Those activities have provided some materials for the community strolling activity design. The community committee and Nomi City Planning Division have proposed mapping for the strolling activity. Some plans such as finding Kutani-related assets. The original activity map as Figure 4.1 presented.

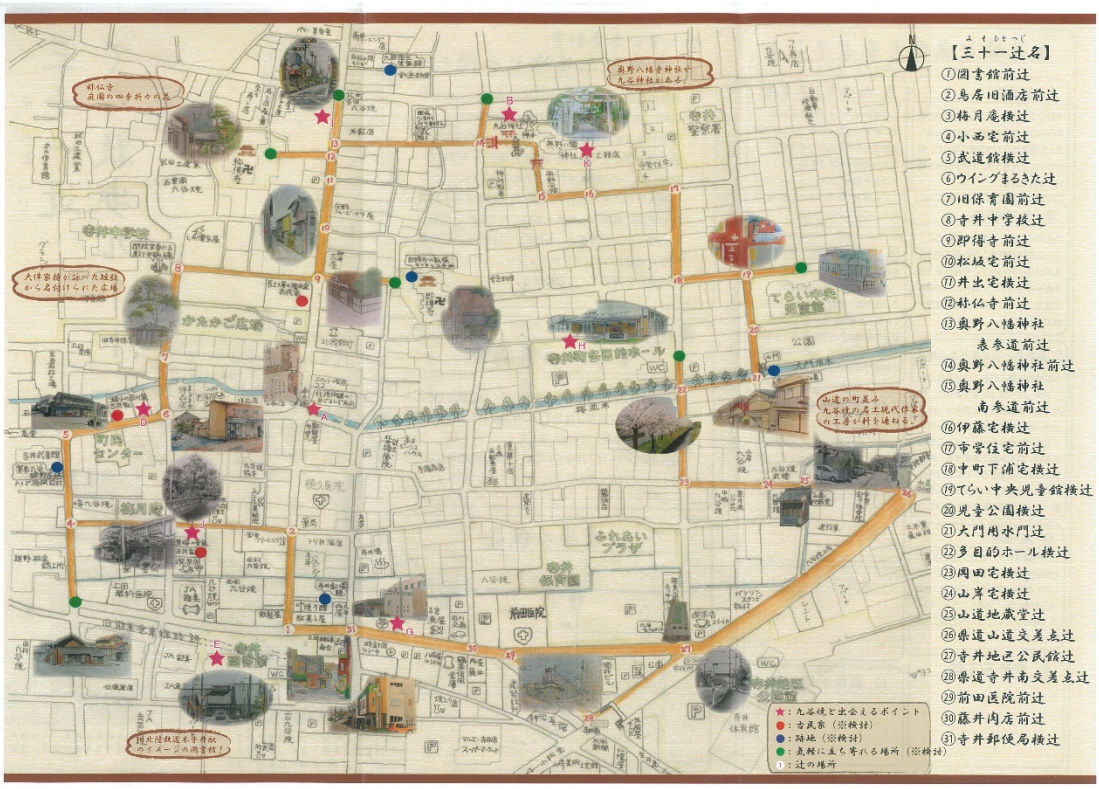


Figure 4.1: Original map for the strolling activity

This map demonstrated the route is formed into a circle. Following the circle people could walk through all of the places worth to visit. At the right side lists the name of all the places or assets. While the map is suitable for people who can read Japanese. Which is the biggest problem for applying to the foreigners. At this point, the map is also more suitable for the local residents. Therefore, since the local residents already familiar with the assets and places, how to improve their interest into the community strolling activity clearly become a point need to be tackled. Regarding our study I data, sharing behavior characteristic, letting people having a same goal in one activity and letting them to work together through a teamwork is a good way to improve people psychological wellbeing. Not only feeling the enjoyment but also sensing the accomplishment from the activity.

Thirdly, the Terai community used to applied this map and had a strolling activity before, they has aiming to name the route as walking for strengthen the people's health. However, personality caused people has different perception to the strolling event. Besides that people's perception is difficult to keep a same average level, which caused the difficulty to the organizers to summarize the process detail problem and the gap of participant's satisfaction with the organizer's intention. The data from study I has interpreted by the

average perception of same community members. Study I also interpreted the data based on the personality identification questions, such as *you would like to communicate with other people, you always have a specific goal to working or doing something.* Therefore, applying the data in the first study, the community activity need to clarify the process and all of the details in the activity to make sure the participants could be perceive same understanding and achieve the goal that the organizer planned.

As conclusion for this part, study II need to focus these three aspects to implicate study I data set. From the general viewpoint, the community activity require to target at the local residents. Mainly focusing on the elderly people combining with the multiple generation communication to keep the variety of the process. Regarding the process viewpoint, clarify the activity goal and let the participants also well-known the goal and process of the activity supposed to be done at the beginning of the activity. From the activity details, three aspects of prosocial behavior, helping, sharing and informing need to be designed into the community-based activity and service.

4.2 Event design

In activity theory, as for keep the consistency of individual and the group has a same perception in the same context, it requires pay attention to the reciprocal process (Engeström, Miettinen, & Punamäki, 1999). Therefore, for implying the data interpretation, we attended the meeting of Terai committee about how to use the map to the activities to ensure the results designed in a right way. Based on the requirement of the activity that the want to clarify the effectiveness of the map marks and routes, this treasure hunt event was designed. Combining the study I data explanations, the details of the whole process finalized. About the place selections, basically followed the original map marked places, several back up places prepared for the changes of the segments during the event. And all of the segments designed by considering a dual or multiple communication to sustaining the event into a psychological well-being circle.

4.2.1 Event process and illustration

This Treasure hunt event designed aiming to promote the communication among different ages, by using the map to let the local residents find out the attractiveness that they didn't noticed in the daily life. Considering it is a trial to applying the theory, the participants planed recruiting twelve people in Terai community, containing six aged over 60 elderly. Finally there are totally sixteen people recruited from the local community. All of the participants need to split into two groups and working the whole process by a team.

The event process as Figure 4.2 illustrated. It started by grouping all of the participants. Since the main target is people aged over 60 and followed the people in other ages, while grouping we need to ensure the each group could have same amount of elderly people. And one of the elderly was assigned to be the team leader of the group. The leader duty is receive the task assignment from the assists and lead the whole team to finish the task at assigned places. Every group will get a route, in each of the route there are three assigned places need to visit. About the places they need to know which the place is and how to arrive by which road and direction.

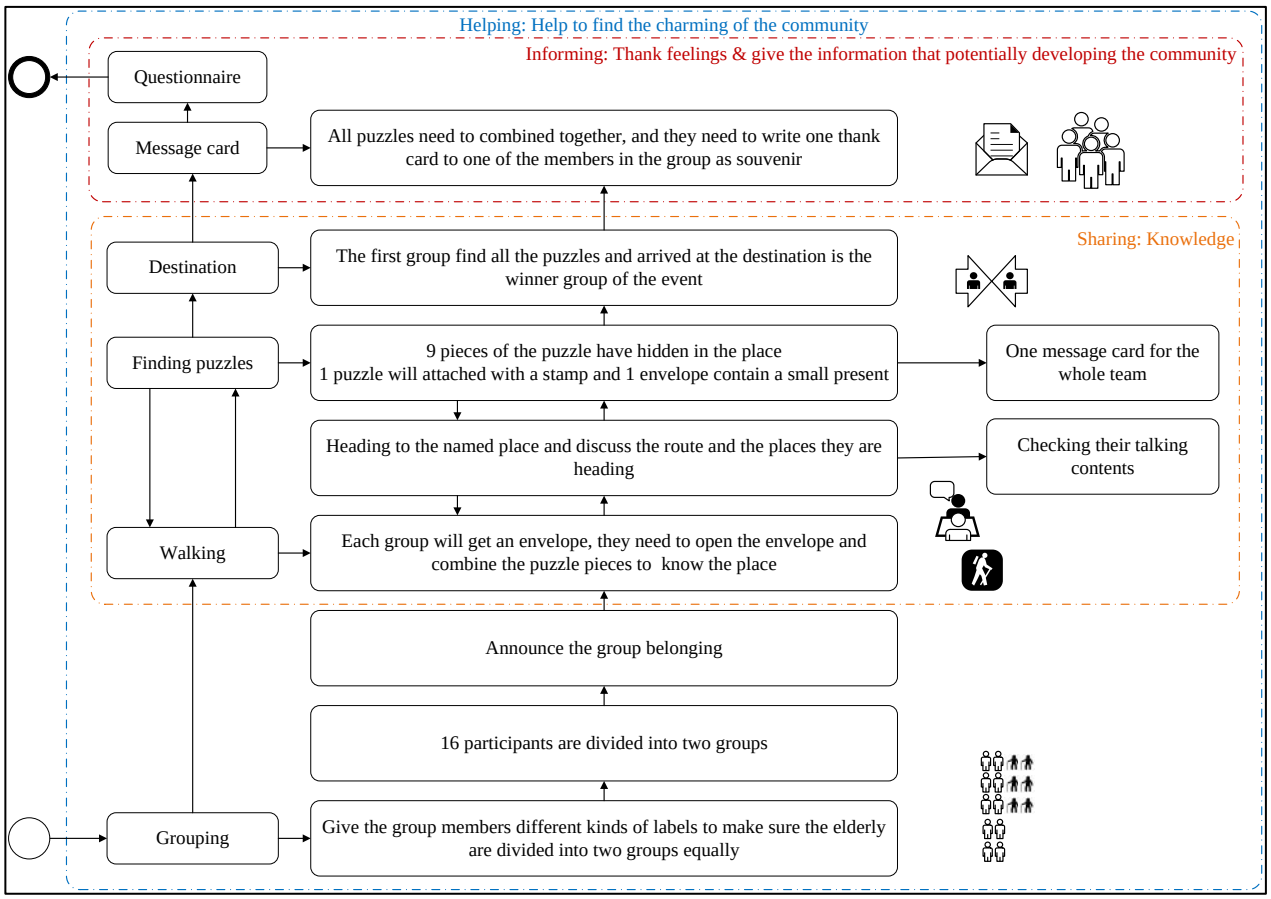


Figure 4.2: Event process (start from the bottom with the symbol of ○)

After the task assignment, every group will get an envelope that contains the puzzle pieces. The puzzles have two side, at the front side is the picture of the assigned place, and at the back side is the illustration of the route they need to follow. Totally nine pieces to ensure that more people could be involved into the piece together process. After they combined the pieces together, they need to move to the next assigned place. At the place there are also some puzzles hidden, the participants need to find them and a hidden message card. The message card contents related with the final quiz answer, after they get the message card they will discuss with other people in the same team. Since at every place they need to do the same procedure, so the process in the orange circle is a loop. In this part, it is designed for knowledge sharing while they are piecing the puzzles and discussion about the message card.

After the two team arrived at the final place. The first group arrived at the destination will get the last message card hint for the final quiz. Then all participants seated around and discussing about the message hints to answering the quiz “What’s the treasure of this community”. The group get the right answer could get the presents from the organizer. After

the group quiz, the participated were required to write the message card about expressing their thank feelings or they want to say to the people seat next to him. Generally, this part has referred the informing behavior process, the discussion about the message card is a recall process in brain science. The message hint will leads people recall the places that they visited, combining the experiences or knowledge they have to answering the quiz. Writing message card is the chance to let people express thank feelings to each other.

The whole process is referring helping behavior process, it's a process that help the local residents to find the attractiveness of the community. At the same time, help the community get benefit from the local residents' feedback of about the community activity design.

4.2.2 Detail selection and prosocial connection

The details of the community activity process concerns four key points, firstly is the place selection, as last segment mentioned, the Terai community has a long history background about Kutani, all the original map marked places also related with Kutani assets. Therefore, keep the original design of the map, we kept the places as Figure 4.1 map illustrated. With the cultural background and the process design, we need to choose the places that easily to hold the activity that we planned.

The places need to fit those characteristics: cultural background or social background that could rise people memory or the attachment to the community, the places need to allow to hidden the puzzles and message card that people walked in don't need to worry would interrupt other people or public. Besides that in order to be fair enough and keep the two routes have same distance, the route need to be measured and well-designed as Figure 4.2 presented. Two routes marked in different colors and assigned places selected as Baigets, the place that has held the community activities before and people left lots of good memories. Gatagago Square, a small park that people could taking rests or having fun. Kutani Park which is a symbol of Terai community. Multi-functional Hall, usually used for citizen or organization having activities, where also displayed the Kutani precious products. And the final goal is Okunohachiman Shrine, where has contained both history background but also social background of the community.

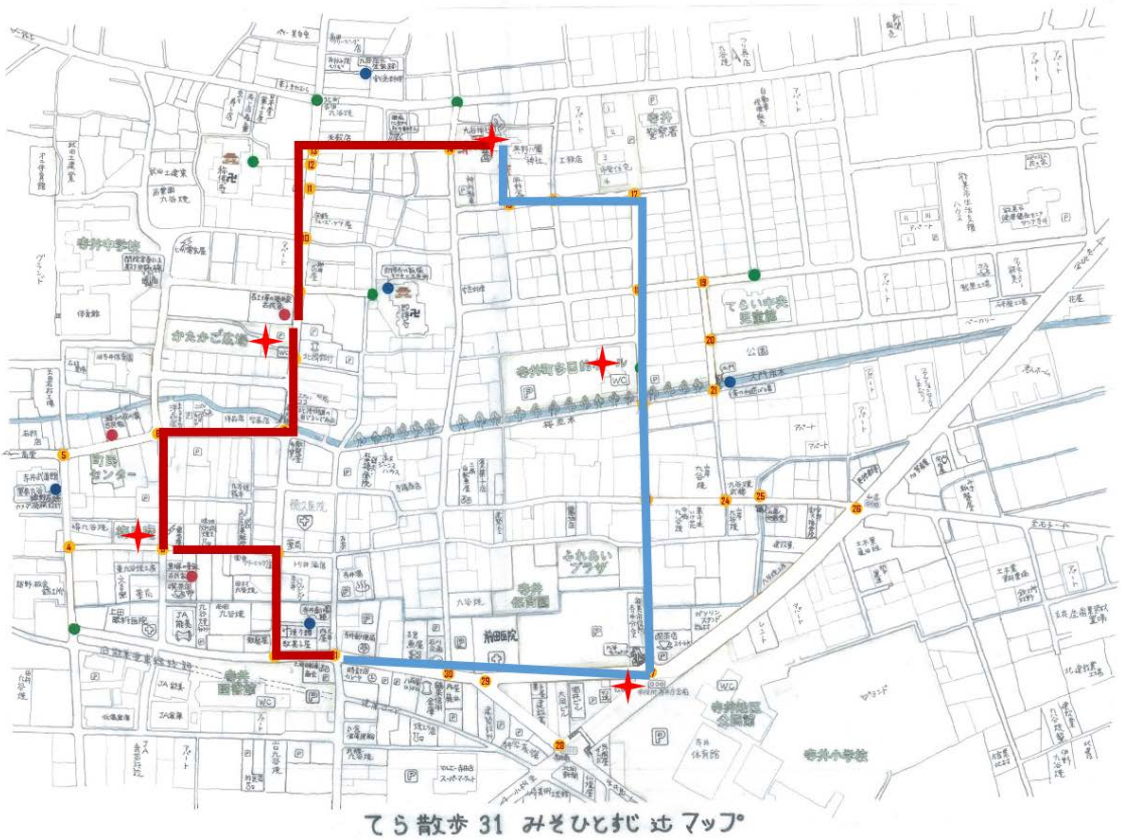


Figure 4.3: Applied map, route and assigned places

The second point is the puzzle design, the picture need to make the participants sensing the beauty of the community and comparing with the actual picture, processed pictures will be better to fresh the people perception towards the old street that they lived in every day. The pictures that applied in the event as Figure 4.4 demonstrated. The left side is the Red route assigned place, the right side is the Blue route assigned place. Same goal selection make the two routes contains into a circle. Red route mainly focusing on the social background of amusement. Blue route mainly focusing on the cultural background of Kutani.

The third point that directly affected from the first two, which is the message hint selection. Since the final quiz is “What is the treasure of this community”, the message hint need to relate with the view and places they visited at that day. There are five message hints in total, which are *culture, legacy, history, activation* and *connection*. The right answer is *People*. Because all of the culture and history were made by people and no matter how great the assets are, people is the key to access all the precious things in this community. Same as the goal of community-based service, no matter what kind of service that are designing, the customer, the recipients always stands in the first place of the whole process of service. Let the local

residents notice that they are the precious treasure of the community also fit with the informing behavior characteristic which is reminds people about their connections with other people or the community.

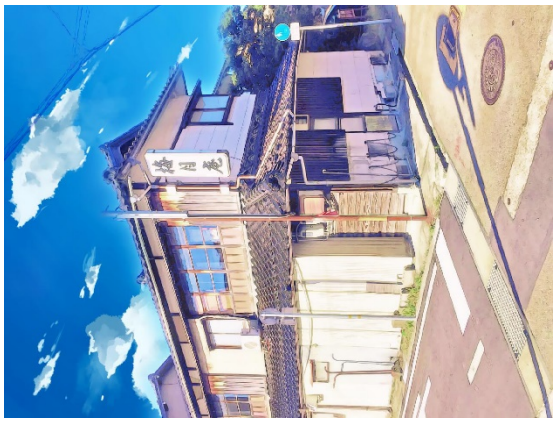
Route Red	Route Blue
	
	
	

Figure 4.4: Puzzles applied picture of two routes

The fourth point is the post segment of the event process, after the event, every participant could get a hand-made bookmarker as the souvenir as Figure 4.5 shows. In the study I, the elderly said they prefer some souvenirs instead of money reward. Souvenirs

affecting participants' satisfaction in an event (Yoon, Lee, & Lee, 2010), which directs this design of bookmarker. The contents in the bookmarker also has its meaning representing. All the pictures that applied are the landmarks of the community and hasn't been used as the assigned places. The picture also processed into a same style with the puzzle. The words written on the bookmarker are also referring the data from the study I. This is used for reminds people of their experiences and feelings that they get involved into the community activity before. Through this way encouraged them into the community activity.

Figure 4.5: Bookmarker design

The whole event was conducted at December 10th although the weather is not as good as expected, the rainy weather provided a chance for the participants to help each other. From our observation, some of the participants have held the umbrella and reminds their team member to be careful about the road or cars. Moreover, there are some unexpected behavioral and verbal feedbacks from the local residents. For the further interpretation, all of the detail information will be discussed with the data analysis.

4.3 Motivation and satisfaction analysis

In motivation theory, researchers have mentioned that how does people perceive the goal will affect their motivation and the satisfactions that they involved into some activities (Higgins and Kruglanski, 2000). After the whole process of the event, the data was analyzed from a cross-comparison of the motivation and the satisfaction. The interviewed data also been referred in the data interpretation.

4.3.1 Questionnaire setting

The questionnaire has four main parts in totally. The first part is basic information of the participants. Questions like Gender, Age, local residents or not, the route they selected, physical exercises frequencies and volunteer activity participation. According to the annual report from Cabinet Office, in an aging society, prosocial characteristics included volunteer activities are encouraged and supported by government.[13] Among all of the voluntary participation, the elderly take significant ratio. Considering the elderly has the concerns about their health or physical condition while they involve into some local activities (Kimura, Morimoto, & Terada, 1991), questions about the sport frequency[14] has been added. Besides that previous research has pointed that most of the elderly take participated in to local activities motivated by intrinsic reasons (Vallerand, 2007). Therefore connecting to the basic information the second part motivation has been investigated.

Motivation investigation has referred from the previous literature. According to motivation theory, people get involved into social activities mainly from wanting (Higgins and Kruglanski, 2000). In self-determination theory, motivation classified into different categories according to the objectives (Ryan and Deci, 2000). Mostly, it could be distinguished by intrinsic motivation and extrinsic motivation. Intrinsic motivation refers to those motivation based on personal interest or enjoyment, extrinsic motivation refers to those based on extra outcomes (Harackiewicz, 2000; Jarjoura, 2014). Therefore, in this part of questionnaire, it referred the opinion poll from the Cabinet Office, kept the nine motivation

[13] Cabinet Office, Government of Japan, Annual Report on the Aging Society: 2015, Chapter 2 Situation Regarding Implementation of Measures for the Aging Society, last access at Jan.12th http://www8.cao.go.jp/kourei/english/annualreport/2015/pdf/c2.pdf

[14] KOETOMO, 2015, Sport and fitness club questionnaire, 調査レポート［運動やフィットネスクラブに関するアンケート（2015 年)］,last access at Jan.12th, http://www.koetomo.jp/questionnaire/20150123/

selection from SQ3[15] and add one more, because the event sounds interesting (Motivation 9). Since motivation highly related with the human performance (Humphreys and Revelle, 1984; Erez and Judge, 2001), According to the motivation, we could further compare the performance of the participants.

Performance in this research is measured from the combination of the self-evaluation of the satisfaction degree of the participants and the observation recording of supporters. From the self-evaluation, there are twelve items and summarized as Table 4.1 presented, the characters applied for a better interpretation in the further data analysis. All of the items are consisted by five point Likert scale (1= strongly disagree, 5= strongly agree) for participants to evaluated (Li et al., 2005), the satisfaction items referred from previous research that done by the Cabinet Office, partially selected from SQ11[16]. Besides that some of the items are related with the specific arrangement of this event which we derived from Study I, such as the items about *Accomplishment*, *Team work* and *Message card*. The observation recording items include the time they spent for finding the puzzle, time they spent for walking, the key words related with puzzle, routes, spot and community that they mentioned while they strolling around.

The last part includes five subjective questions. Firstly is about the attractiveness of this community, followed with questions as the most enjoyable thing from the event with reasons, if they have attend such kind of strolling activity? Comparing with previous strolling activity how do they feel about this time, if they would like to attend again for similar activities and their other suggestion or expectation from this event. Combining the answers to better interpreted the self-evaluation part and their motivations.

[15] Opinion poll, SQ3 and SQ10, Cabinet Office, Investigation of social participation, last access at Jan. 12th, http://survey.gov-online.go.jp/s59/S60-02-59-20.html

[16] Opinion poll, SQ11, Cabinet Office, Investigation of social participation, last access at Jan. 12th, http://survey.gov-online.go.jp/s59/S60-02-59-20.html

Table 4.1: Questionnaire key points

Observation Contents	Questionnaire items
Motivation selection-1	For contributing to the local community and society
Motivation selection-2	Well used my knowledge
Motivation selection-3	Want to have a meaningful day
Motivation selection-4	Want to make some close friends
Motivation selection-5	Increasing new knowledge
Motivation selection-6	I have been bothered recently
Motivation selection-7	To get exercise and good for my health
Motivation selection-8	Recommended by other people
Motivation selection-9	This event looks interesting
Motivation selection-10	Other reasons
Satisfaction-Enjoyment	I really enjoyed this event
Satisfaction-Tiredness	I feel tired after I walk this long
Satisfaction-Refresh	I'm refreshed after I walked around
Satisfaction-Proudness	Belongingness of this community
Satisfaction-Conversation	I talked with a lot of people
Satisfaction-Knowledge	I've learned some knowledge by talking with other people
Satisfaction-Meaningful	I've spent a meaningful time
Satisfaction-Teamwork	Comparing walking alone, it's more delightful with a team
Satisfaction-Accomplishment	A sense of accomplishment felt after combining all puzzles
Satisfaction-Message card	I'm happy to receive message card from other team members
Satisfaction-Attractiveness	I found something new attractiveness about the community
Satisfaction-Bonding	I felt the belongingness and love to this community

4.3.2 Data Analysis

The Event totally has 16 participants, all recruited from local residents of Terai community in Nomi City. The basic information like Table 4.2 shows. This part of study consists of the results analyzed from the obtained questionnaire data of the event. To briefly explain, the data were analyzed using descriptive statistics function of SPSS® program to organize 16 participants' responses to the question sets. There are six categories about the participants' age range from 20 to 80. Four female and twelve male participants, ten elderly people (aged over 60) has involved in total.

Table 4.2: Basic information of the participants

Age	Gender	Route	Age	Gender	Route
20-30	Male	Red	60-70	Female	Red
30-40	Male	Blue	60-70	Male	Blue
40-50	Male	Red	60-70	Male	Red
40-50	Male	Blue	60-70	Male	Blue
50-60	Male	Red	60-70	Male	Red
50-60	Female	Red	60-70	Male	Blue
60-70	Female	Blue	70-80	Male	Blue
60-70	Female	Blue	70-80	Male	Red

Note: n=16

Statistical results

Reliability Statistics about the Objective questions in the questionnaire presented generally the questionnaire Cronbach's alpha is .812, which means the questions are reliable to proceed the further data analysis. The motivation items are statistically described as Table 4.3 and the satisfaction items are statically described as Table 4.4. From the two tables we could derive that the motivation one (56.3%), eight (37.5%) and nine (75%) have more frequencies than other motivations. While in Table 4.4, the high evaluated satisfaction items are *Enjoyment* (M=4.44, sd =.512), *Meaningful* (M=4.31, sd =1.014), *Teamwork* (M=4.31, sd=1.014), *Conversation* (M=4.25, sd=1) and *Message card* (M=4.25, sd=1). The reliability of the twelve satisfaction items Cronbach's alpha is .950. Since *Tiredness* is the negative item with other items, the Cronbach's alpha will become .960 if the item deleted, out of the expectation, while *Enjoyment* item deleted, the Cronbach's alpha also raised into .955.

Table 4.3: The motivation Statistics

#	Frequency	#	Frequency	#	Frequency	#	Frequency	#	Frequency
1	9 (56.3%)	3	4 (25%)	5	4 (25%)	7	2 (12.5%)	9	12 (75%)
2	1 (6.3%)	4	3 (18.8%)	6	0 (0%)	8	6 (37.5%)	10	2 (12.5%)

Note: n=16, multiple choice

Table 4.4: The Satisfaction Statistics

Contents	**Mean (Std.)**	**Contents**	**Mean (Std.)**	**Contents**	**Mean (Std.)**
Enjoyment	4.44(.512)	Conversation	4.25(1)	Accomplishment	4.06(.998)
Tiredness	1.19 (.403)	Knowledge	4(.966)	Message card	4.25(1)
Refresh	4.19(1.328)	Meaningful	4.31(1.014)	Attractiveness	4(.966)
Proudness	4.06(.998)	Teamwork	4.31(1.014)	Bonding	4.06(.998)

While we looking back to the satisfaction items, we could found that the first motivation "For contributing to the local community and society" related with the satisfaction items about *Proudness, Attractiveness and Bounding*, the reliability of the first motivation with these three satisfaction items the Cronbach's alpha is .720 which is acceptable (Cortina, 1993). The eighth motivation "recommended by other people" related with the social interaction, connected with satisfaction items *Conversation, Knowledge, Teamwork* and *Message card*, the reliability of this motivation with these four satisfaction items the Cronbach's alpha is .847, which is good. The ninth motivation "This event looks interesting" related with the self-efficacy, connected with satisfaction items *Enjoyment, Tiredness, Refresh, Meaningful* and *Accomplishment,* the reliability of this motivation with these four satisfaction items the Cronbach's alpha is .727, while the Tiredness items deleted, the reliability will rise into .784.

Means and standard deviations for the three motivations appear in Table 4.5. This is used for detecting the participants who has chosen the motivation, their satisfaction evaluation towards the different items. The red colored data are the top three evaluated in each motivation. In motivation one, the top three satisfaction items are *Enjoyment, Refresh, Teamwork.* In motivation eight, the top three items are *Refresh, Proudness, Conversation, Meaningful, Accomplishment* and *Message card*. In ninth motivation, *Enjoyment, Conversation* and *Teamwork* are highly related. Generally, in three conditions, the *Enjoyment, Refresh, Conversation* and *Teamwork* are the items that been highly evaluated twice. *Enjoyment* is the mood and *Refresh* are the distinct feeling investigation that connected to their motivations. *Conversation* and the *Teamwork* are the items that related with the participants' motivation of want to get contribute to the community and recommend by others to have a social interaction with other people.

Table 4.5: Means and Standard Deviations by Key Motivations

	Motivation 1 (n=9)	**Motivation 8 (n=6)**	**Motivation 9 (n=12)**
Enjoyment	4.67 (0.5)	4.33 (0.516)	4.33 (0.492)
Tiredness	1.11 (0.333)	1.17 (0.408)	1.25 (0.452)
Refresh	4.78 (0.441)	4.67 (0.516)	3.92 (1.443)
Proudness	4.44(0.527)	4.50 (0.548)	4 (1.128)
Conversation	4.44(0.527)	4.50 (0.548)	4.25 (1.138)
Knowledge	4.22(0.667)	4.33 (0.516)	4 (1.044)
Meaningful	4.56 (0.527)	4.50 (0.548)	4.17 (1.115)
Teamwork	4.67 (0.5)	4.33 (0.516)	4.25 (1.138)
Accomplishment	4.22 (0.667)	4.67 (0.516)	4.08 (1.084)
Message card	4.44(0.527)	4.50 (0.548)	4.17 (1.115)
Attractiveness	4.33 (0.5)	4.33 (0.516)	3.383 (1.030)
Bounding	4.44(0.527)	4.33 (0.516)	3.92 (1.084)

Factor Analysis

According to the satisfaction items have received excellent Cronbach's alpha (0.95), factor analysis which is a statistical technique that reconstruct all of the items (Gliem and Gliem, 2003). By using factor analysis, the interrelationships among different variables could be identified. Thus the data were analyzed by using the Alpha Factoring, and Promax rotation to extract the key components that could classified the factors (Pivac et al., 2011; Shirahada and Hamazaki, 2013). The factor analysis results shown in Table 4.6. There are totally two key factors extracted from the 12 satisfaction attributes. These two factors explained 74.30% of the Variance. The Kaiser-Meyer-Olkin measure of sampling adequacy is 0.718 which is middling (Kaiser, 1974) and Bartlett's Test of Sphericity is significant (p=0.000).

The first factor labeled as Connection which not only referring the connection with people but also the connection with the local community they lived in. Moreover the first factor contains most of the items, the ten items factor loading ranged from 0.707 to 0.928 and the Cronbach's α also reached 0.966, which is significantly related with each other. In the first part the four items *Attractiveness, Meaningful, Message card* and *Proudness*. These four items are contents from the main goal of the event, "Find out the attractiveness of the community". In the second part, those variables *Knowledge, Conversation, Accomplishment, Bounding* and *Teamwork* are related with the multiple social interactions by using their knowledge, from their own experience to sensing the connection with other people. At the same time they agree

that they had a meaningful time with other local residents. Therefore, while they received the message card, they also highly evaluated it. By achieved the goal of the event, finding the attractiveness of the local community and receiving the message card from other team members, they perceived it as a meaningful time and feeling deepen the social bonding with the community.

Besides the four key items that highly related with the fist Connections factor, other items also received high factor loading (>0.7), which referring the first factor is strongly contribute to those variables (Osborne and Costello, 2009). Among those variables, *Knowledge*, *Proudness* and *Accomplishment* are related with the participants themselves, from their own experience to sensing the connection with other people. *Teamwork* and *Conversation* are the physical process of their communication with others. *Refresh* differentiate from other variables, it's the feedback from the connection with others. Therefore, refresh item although not significantly related with second factor, still higher than other items above.

Table 4.6: Factor analysis of satisfaction items

Items	Factors	
	I - Connections	II - Mood-related
Message card	.928	-.037
Meaningful	.925	-.026
Proudness	.920	-1.42
Attractiveness	.914	.036
Knowledge	.907	-.123
Accomplishment	.888	.080
Conversation	.858	-.139
Bounding	.849	.177
Teamwork	.804	.147
Refresh	.707	.171
Enjoyment	.064	.970
Tiredness	.160	-.493
Correlation between factors I	1.00	
II	0.341	1.00
Total Variance (%)	64.650	9.649

Extraction Method: Alpha Factoring.

Rotation Method: Promax with Kaiser Normalization.

The second factor is mood-related information, Since the *Enjoyment* and *Tiredness* factor loading are highest two variables and totally differentiate from each other. *Enjoyment* presented into a positive value and *Tiredness* presented into a negative value, which referring in this Mood-related factor, the participants didn't feel tired and they pretty enjoyed the whole event.

For further interpret the data, here is the correlation matrix of the twelve variables in satisfaction part as Table 4.7 presented. Most of the ten variables under the first factor *Connection*, have presented positive correlation coefficient with significant level (p<0.01). In this matrix, we could perceive that only *Tiredness* had received negative dependencies with other variables. The reason for Tiredness presented no correlation and totally different answer refers to that the elderly are pretty enjoy the activity, moreover according to the subjective question results, this "Treasure hunt strolling activity" didn't cause any physical burden for them. The mean scale of this item is 1.19, which explained the activity design in the physical aspect is reasonable.

Table 4.7: Satisfaction variable correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12
1-Enjoyment	1											
2-Tiredness	-.424	1										
3-Refresh	.459	-.070	1									
4-Proudness	.334	.135	.796*	1								
5-Conversation	.163	.041	.515	.651*	1							
6-Knowledge	.135	.000	.572*	.692*	.759*	1						
7-Meaningful	.361	.010	.696*	.770*	.706*	.816*	1					
8-Teamwork	.361	-.153	.548	.638*	.838*	.884*	.806*	1				
9-Accomplishment	.204	-.031	.594*	.799*	.718*	.830*	.836*	.704*	1			
10-Message card	.423	.041	.665*	.718*	.800*	.759*	.904*	.772*	.852*	1		
11-Attractiveness	.404	.000	.832*	.830*	.690*	.786*	.816*	.748*	.761*	.828*	1	
12-Bonding	.595	-.031	.846*	.866*	.718*	.692*	.770*	.770*	.665*	.785*	.898*	1

* p<0.01 (1-tailed)

Among the correlation matrix, the highest one is between *Message care* and *Meaningful* (0.904). Message card as one of the key segment that applied from the data of the

first study, has received an impressive evaluation highly related with the feeling of spent a meaningful time means a lot for this whole research. Besides that, *Meaningful, Message card* and *Attractiveness*, three of the variables have five high correlation (>0.8) with other variables. Attractiveness especially, have highest correlation with Bonding (0.898), which means that from the participant's viewpoint while they achieve the goal of the event, they could deepen the social bonding with the community. Moreover, *Teamwork* and *Knowledge* (0.884) also higher than other groups. The design of Teamwork content is based on the consideration of have a collaborative work for people share their knowledge, therefore, in this sharing aspect, it has received a great feedback from the participants.

4.3.3 Data Interpretation

With the analysis of the questions about motivation and satisfaction. The data need further interpretation in the subjective data and our observed data. Generally, there are two subjective questions have been investigated, the first one is question about "From your point of view, what's the attractiveness of this community" presented as Table 4.8. From the key words of all participants, there are three main aspects of their answers.

Table 4.8: Subjective result about community attractiveness investigation

#	**Contents**	#	**Contents**
1	Interpersonal relationship & Kutani	9	Beautiful scenes & comforting
2	Residents who cherish the legacy	10	Interesting activities
3	Interpersonal relationship	11	Interpersonal relationship
4	Convenience of facilities	12	Various communications
5	Cultural assets and social bonding	13	Residents love the community
6	Interpersonal relationship	14	Art home liked street
7	Interpersonal relationship	15	Convenient & Cultural background
8	Interpersonal relationship	16	Convenient

Social connection, is the first perspective containing the key words like *Interpersonal relationship, Residents* and *Social boding.* This answer referring that the participants have noticed that this community's attractiveness people-centric which is related with the quiz answer. It also fitting our main purpose which is bridging the social connection among the

local citizens and at the same time let the elderly get benefit from the social connection.

Cultural background, the second perspective containing the key words like *Kutani, Legacy* and *Assets*. This answer referring that the local residents have confirmed the values that belongs to this community. Which directing the results of high level social bonding and attractiveness evaluation.

Convenience, the third perspective, this is a new point that people cherished. Mainly because while the participants walking around, it shorten the perception about distance. They also told the observer, it is a good opportunity to notice that they have lived in such a convenient places, that it didn't take so long to walk around, but in daily life, no matter how long the distance is, they will just drive to the there. From the event they have start to consider to walk more in daily life if the distance is not that far.

The second question is "What's the most enjoyable thing for you from the event and why". The subjective data in this part shown in Table 4.9. In this part we could see that the most frequently mentioned point is they are satisfied about the combination of have the opportunity of talking with the local community residents and walking around to do things with a same goal. The age generation difference hasn't be referred from the results. And they are enjoyed the activity and sensed the beauty of working with others. Same as the answer from the first question mentioned above, people is the most significant thing in the community activity design. This event also proved that the participant could get satisfaction from the new combination of the community activity segments.

Table 4.9: Subjective result about event enjoyment investigation

#	Contents	#	Contents
1	Sensing the interpersonal relationship and smiley faces	9	Have find lots of beautiful places that didn't notice before through walking
2	Strolling around with local residents	10	Talking with others while walking
3	Talking with lots of people	11	Talking with others while walking
4	Talking with different ages	12	Impressed by student's idea and action
5	Holding same goal to work with others	13	Working by a team
6	Talking with others while walking spent a meaningful time	14	Treasure hunt is interesting
7	Had an enjoyable conversation with people who met for the first time	15	Not much this kind of activity that let residents contribute into community

8	Treasure hunt is interesting	16	Talking with people while walking

4.4 Summary

Generally this chapter has well applied the characteristics of prosocial behavior that we summarized from Study I, helping to find the attractiveness of the community, let the participants sharing a same goal to collaborate with each other, write and send the message card to each other among all of the participants. By applying these characteristics and discussing with the government servants, the study II event has been planned dedicated to ensure the satisfaction degree of the participants. And by fitting the elderly people's requirement of want to have a communication among different ages, this study has kept the elderly as the main group, inviting some other ages people get involved.

From the evaluation from this study, the three prosocial behavior characteristics, attractiveness in the satisfaction items received a pretty good result, especially in the factor analysis, which is highly related with the connection bridging. Moreover, affecting by the design of the quiz answer we planted, the participants have start to notice the importance of people, comparing with have a good development for the whole community, let the local resident more enjoy the community life is what more important for them. Some of the active seniors also expressed from now on, they could design more activity like this to focus on the people.

Sharing the same goal have presented at the teamwork, communicate with other people and sharing knowledge with others. In these aspects, the participants have agreed that the valuable point to have a very clear purpose to ask the participants to do. During the process, not only the elderly, but also other aged people agreed sharing same goal make their behavior more motivated and it creates some common topics for them, even some people that they are not familiar before.

Writing message card part received a better evaluation in correlation matrix. Lots of the evaluation have highly related with the message card they received. As a new designed segment, writing message card is a good opportunity to let the participants getting closer. Let the participant to know that express their feelings is important to themselves and also has a significant affection to other people. During the message card writing, every participant has become a card receiver and giver. Therefore they are not only experienced the feeling to conduct the prosocial behavior but also feeling to get prosocial behavior from others. Basically, these three prosocial behavior characteristics have been well proved sufficient in a

community-based service design.

Additionally, from the motivation, 75% answers are the participants are take participated into the event because it sounds interesting. Combining the satisfaction, they also high evaluated about they think they have spent a meaningful time with others and the sense of high accomplishment while they are collaborate the task with other people. From the study II, the participants also deepened their social attachment and connection with the other residents and the community they lived in. Most importantly, this is an enjoyable process for them.

Chapter 5: Community-based service model for the psychological well-being of the elderly

5.1 Community-based service model

Community-based service, the services provided by community members including residents and other organizations to benefit the public or its institutions. Since community-based service requires to be adopt into a social context and aiming to contribute into the community (Edvardsson, Tronvoll & Gruber, 2011), this community-based service model combined social structures. In social construction theory, for bridging the social connection in the community service model, the social perception which related with the appropriate way to activated (Baldwin, 1992) need to be applied and reconstructed. Chapter three and four already testified in which prosocial behaviour context could receive better social perception and from the context to extract supposed to apply into community-based service model. Second study as the expansion of the first one data results, it has further interpreted the characteristics in the service process. From the service process, the service customers and recipients are changeable in different contexts. Different contexts created values also differentiate from each other. Therefore, this community-based value will referring the service model that already exist, also the concept of value-in-context. From the layer changes to interpret the model and discussing how to attract the community members involve into community-based service.

5.1.1 Data interpretation of study I and study II

These two studies have followed the research sequence, starting from a social layer found the gap in an aging society, to solve the loneliness issue, bridging the social connection through a community-based service. The first study, the brain measurement to testify the elderly's affective and cognitive process that the elderly has towards the prosocial behavior contexts stimulus. The stimulus diverted into several layers, helping, sharing and informing three main aspects of prosocial behavior further classified with the frequency identification and economic interface.

From the study one, based on the emotional evaluation and the brain activation result, there are the characteristics summarized as following, helping occasionally (HO) has the characteristic of physical burden release, helping routinely (HR) has the characteristic of do housework by themselves. Sharing occasionally (SO) has the sharing same goal character, sharing routinely (SR) has the talking with different ages character. Informing occasionally (IO) has the gratitude or courtesy character, sharing routinely (IR) has the self-cognition character. As recipients of prosocial behavior, money under 1000 yen is preferred by the elderly participants. As provider or participants, rewards like snacks, souvenirs are preferred.

Followed the results from brain measurement, the second study implies to testify the motivation and satisfaction in a practical social activity. It derived three characteristics, helping as help to find the charming of the community, sharing as share the knowledge and same goal, informing as thanks message and information about potential community develop. From the study II, motivation, want to contribute to the community or society highly related with the satisfaction. Satisfaction, positive emotion and attachment with the community highly related. Receiving message card highly related with social attachment and social interaction with other people are interpreted.

From a service process viewpoint, these two studies data requires further reconstruction the make the community-based service model easily to understand. The integrated resources combined the behavioral characters and the emotional output. Through the interpretation to find out what is the psychological well-being that could be perceived from the community based service.

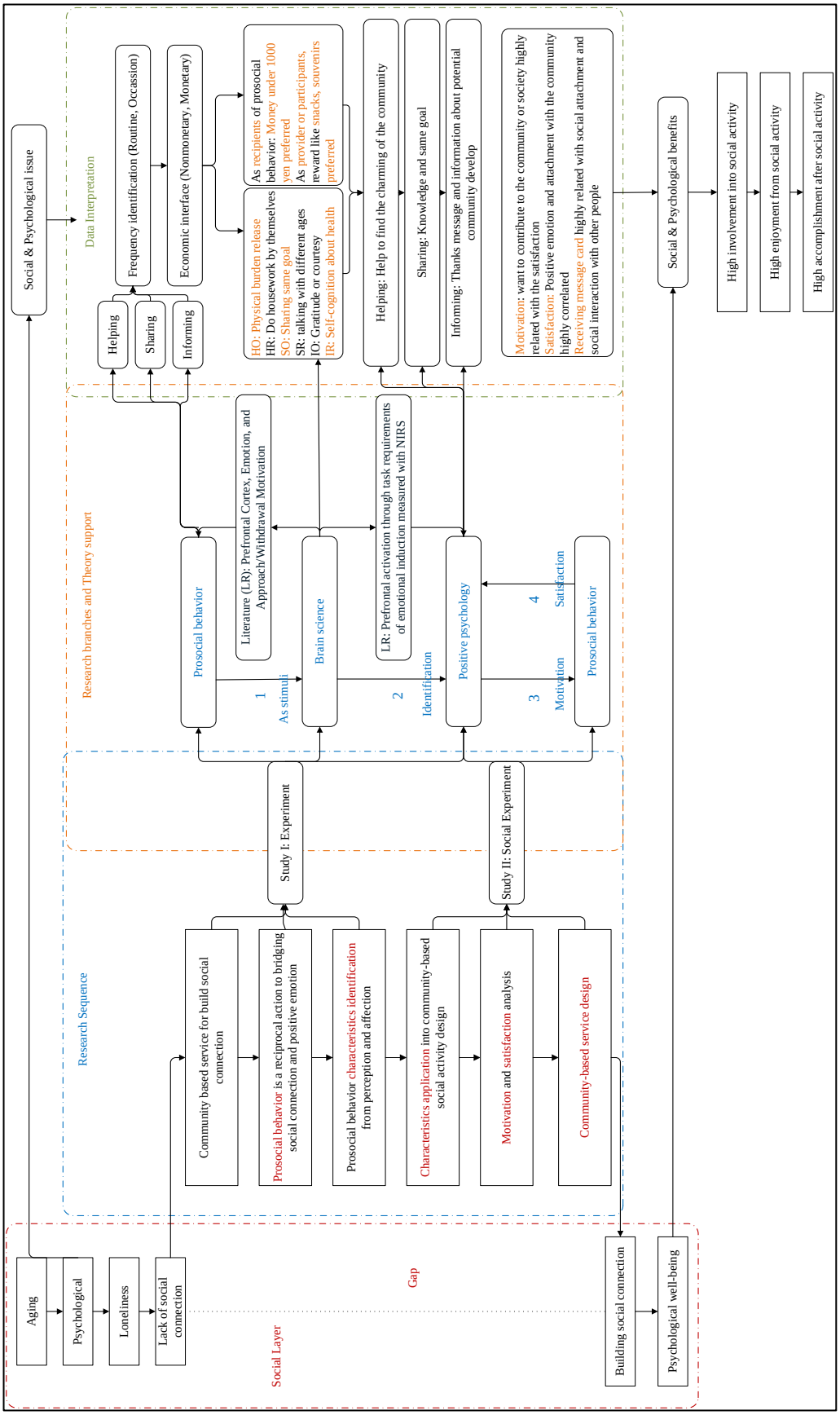


Figure 5.1: Research sequence and data interpretation

5.1.2 Community-based service model

In 2004, Vargo and Lusch have proposed that from a service view point, it is a series of social and economic processes that creating values. The value co-creation process is a collaboration between customers and partners to produce and sustaining values (Lusch, Vargo & O'Brien, 2007). The collaboration divided into four segments, *co-create service offering, co-create value proposition, co-create conversation & dialogue and co-create value network & processes* (Lusch, Vargo & O'Brien, 2007, pp.7). The core part of the collaboration process fitting a service demand of having more interaction between customer and provider, however in some occasion, the co-create process has different layers. In each of the layer, provider and customer will have different perception. Therefore, for developing a better collaboration, community-based service kept the original core of the collaboration process combining social interface and task requirement into the core concept. Moreover, by identifying the perception of the customer the demand from the customer has been well-applied.

Customers in the value co-creation process are partners that developing the segments of the service (Prahalad and Ramaswamy, 2004). Community as the foundation of developing community-based service, the recipients are the elderly residents lived in the community, as one aspect they are the resource integrator in the other aspect, they are also the resources itself. For this community-based service, the main value benefit derived for the elderly is psychological well-being. The psychological well-being defined as the people has the positive emotion generation and encouraged by other people's prosocial behavior to conduct prosocial behavior also in their daily life or social events.

An experience design in a service could build the emotional connection with customers by carefully setting the tangible and intangible resources (Pullman and Gross, 2004). The resources also changeable according to the goal that the provider want to achieve and the context it requires. Different experiences will arouse the customer different perception results and emotional outcomes (Voss, Roth & Chase, 2008). Contexts related with customer experience has been researched in *Servicescape,* which pointed connected to physical environment, human psychology and behaviors (Bitner, 1990; 1992; 2000). Among all these contexts, social context significantly impact on the customer behaviors and performances (Pullman and Gross, 2004). Therefore, this community-based service model classified by phases and summarized the elderly's performance according to the context.

This community-based service model shown in Figure 5.2. The model is applied for service provider designing the services and value co-creation[17] between provider and recipient for cultivating and contributing to the residents' psychological well-being. For this research, it's mainly targeted the elderly people and in the Study II, with the requirement of the elderly, the age groups of the recipients has been diversified, still the elderly as the main.

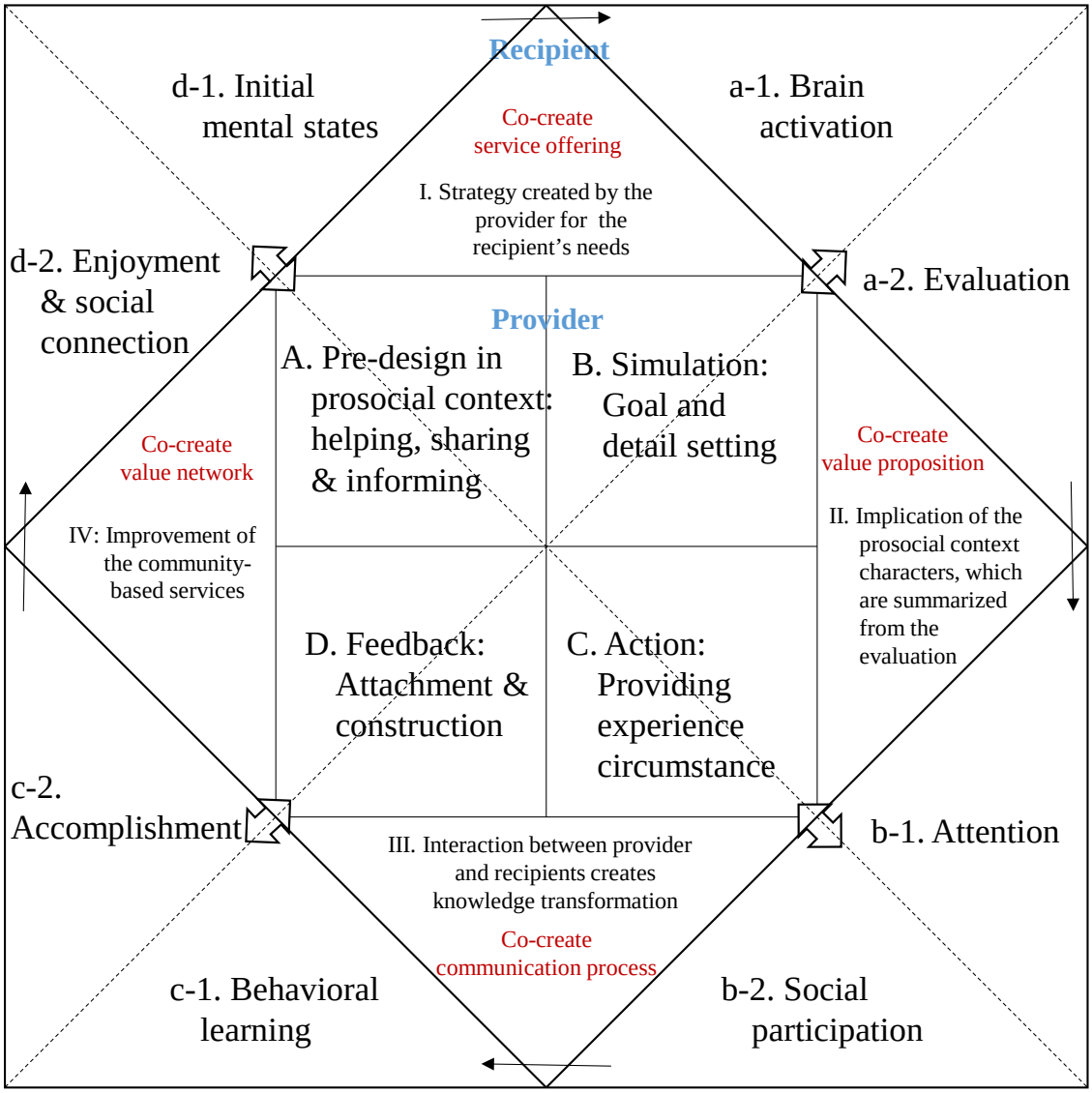


Figure 5.2: Community-based service model for the elderly's psychological well-being

Considering the structure of the model, it is designed into a multi-layer nested square for illustrating the connection of the recipient, provider and the co-creation they've made. In the central layer demonstrates the provider strategy, the out layer is recipient's mental

[17] The value co-creation mainly referring Lusch, Vargo & O'Brien, 2007, pp.7, only the third one, co-create conversation & dialogue changes into co-create communication process

statement (x-1) and outputs (x-2)[18]. The value co-creation happens in between. Since the connection among them are not happen singularly, therefore, each of the co-creation happens with the combination of two steps in recipient layer and two steps in provider layer.

According to the co-creation process there are four sections in total, in the first section is about the co-create service offering, which in this research is the provider creates strategy for the recipient's needs (I). Therefore, firstly, provider need to know what does the recipient want. The start point of this research is the initial mental states (d-1) of the elderly is not good enough act as drifting from the social connection, which affect their psychological well-being.

For tackling this social needs and improve the elderly's psychological well-being, the provider designed the community-based service model applying the prosocial behavior context (A). While for designing prosocial behavior context into the community-based service, it requires to identify how the elderly affectively and cognitively perceived all of the prosocial context. Here is the birth of the first study, by activating the elderly brain (a-1), especially the prefrontal cortex to basically get the idea about the prosocial contexts. From the brain activation of the elderly the provider could partially know the basic demand of the elderly and use it to setting the prosocial context into practical goals (B).

Then the second section is about co-create value propositions, which is interpreted as summarizing and implying the prosocial behavior context's characteristics (II). It is start with the unfinished simulation strategy in the first section. For simulating the goal and the detail of the event in a practical level, the brain activation data is not enough, it also requires the elderly's evaluation (a-2). With referring the evaluation, a complete simulation strategy of the provider will be constructed.

In study II the goal of the event set as find the attractiveness of the local community and enjoy the communication among different ages, which were simulated based on the evaluation of the elderly about their expectation to have more interaction with younger ages. At the meantime, the goal need to be finalized (B) by replicative discussion between provider and recipient. After the goal and the segments of the event has been confirmed, the provider need to use the designed proposal for attract the recipient to take participate into the activity. Which in this research raised the elderly people's attention (b-1), by the motivation analyzed data, the participants expressed they participated into the activity based on they want to contribute to the local community and they also think it is an interesting event. After recruit

[18] x-1: mental states of the recipients including the contents of a-1, b-1, c-1, d-1;
x-2: outputs of the previous mental statements including a-2, b-2, c-2, d-2

and settling the date, provider need to move to the action step (C) for implying the prosocial characters which are designed and well-planned.

The third section is about co-create communication process, which interpreted as the interaction between provider and recipients creates knowledge transformation (III). Since it is an interaction, first of all, it requires the participants get involved into the community activity that has been designed, which is the step in the recipient layer, so called social participation (b-2). Moreover, before and during the involvement, the provider need to carry out the action for create an experience circumstances to the recipients (C). In this research, it has divided the event into several segments, including ask the elderly find the puzzles and pieced them up through the teamwork which derives from the prosocial sharing context, while the provider give the participants such kind of order, their social participation behavior become controllable. During the social participation, they also give some information to the provider unconsciously such as they have been had an activity before in this area or they have shared one umbrella with each other while it's rainy. For the provider, they could know there are unexpected prosocial behaviors in the prosocial context background.

While the provider give the instructions, the recipient also have a behavior learning (c-1). Since human behavior learning is a synthesis of cognition, emotion and judgement (Payne, Storbacka, & Frow, 2008). In this research, the recipient's behavioral learning happens while they obtained some inspiration from the provider's hint embedded segments, such as the quiz which is asking what the treasure in this community. Each of the team has given an answer after a group discussion. The discussing process is one kind of behavior learning among the recipients, at the same time, while the provider give the right answer of the quiz, the recipients expressed that it is a new viewpoint that they haven't considered before, which for them is another behavioral learning process. After the event, there is a feedback questionnaire investigation about their feeling and satisfaction about the event and each of the process in details. It is a knowledge transformation from the recipient to the provider. They have applied their experience in the short term memory, implicit knowledge and interpret them with answers to the questions, explicit knowledge.

The fourth section is about co-create value network, which interpreted as the improvement of the community-based service (IV). Been through the process of participating the event and learning the hints that given by the provider and communication with other team members, the recipient could get a sense of accomplishment. Which is also a part of the

satisfactory evaluation of the participants. Accomplishment is a direct feeling after the experience and according to the feedback (D) information, the recipient is not only get accomplishment but also some others like the sense of spent a meaningful time with others. For the provider, cultivating such kind of mental senses and feelings to the recipients could benefit for them to construct the community activities and services better.

As mentioned earlier, provider perceived the feedbacks from the recipient, after analysis, there is a deepen relationship between the recipients accomplishment and other senses, the co-creation and the factor analysis tells that some other positive emotion statement has been highly evaluated such as the enjoyment and refreshment from the event (d-2). In the latter part questions, the recipients also expressed their willingness of involving into similar local community activities. From this, a better cycle for the social interactions and connections was built. For the provider, by referring the recipient's expectation and the insufficient of the events could further design another context applied service design for the community (A).

The outline information in the community-based service model summarized as the Table 5.1 presented. In the left part illustrated the co-creation processes, according to each of the step, there is step interaction happened. Details with explanation demonstrated in the right.

Table 5.1: Details and implication of Community-based service model

Co-creation	**Step interaction**	**Implication with examples**
Co-create service offerings (I)	d-1→A→a-1→B	➢ Confirm the main target: the elderly Select method: Applying prosocial behavior characteristics Find the demand of the elderly Identify by the brain measurement
Co-create value proposition (II)	a-2→B→b-1→C	➢ Combining the brain data results and evaluation to find out how to apply prosocial behavior context Proposal of applying prosocial contexts and rise people attention (Place selection, detail controlling)
Co-create communication process (III)	b-2→C→c-1→D	➢ Controlling each segment details during social participation Behavior learning: among recipients (searching for puzzle)/ between recipient and provider (hint)
Co-create value network (IV)	c-2→D→d-2---A	➢ Recipient get sense of accomplishment from the whole process Collect feedbacks Analysis the evaluation items to get the further connection

Since the model is a multi-layer nested square, before, we stood up at the viewpoint of the co-creation processes, which is the main idea of the whole model. Specially, this shape of the model make the connection between provider and recipient clearer as Figure 5.3 shows, while in each of the step, there are two sections contained. As we mentioned, x-1 refers to the mental statements and the x-2 refers to the outputs. Which also means that for each of the step, there are expected results followed.

In section I and IV, the provider face to two same mental statements (d-1, a-1) or outputs (c-2, d-2). Which is because in the first section, they for improving the initial mental statement, and planning the appropriate service for the target recipients group, it need to also start from mental statement. In the fourth section, the provider need to summarize from the practical events into the psychological well-being. Therefore, in the last section, there are more outputs come out. On the contrary, the section II and section III have both mental statements and targeted outputs (a-2 with b-1; b-2 with c-1). In the second section, since the provider well-applied the evaluation from the recipients and act the prosocial characteristics into an action, the recipients are easier to get the attention about the event. In the third section, while the recipients are involved into the social event, with instruction from the provider and the interaction with other recipients, they will put themselves into a behavioral learning process.

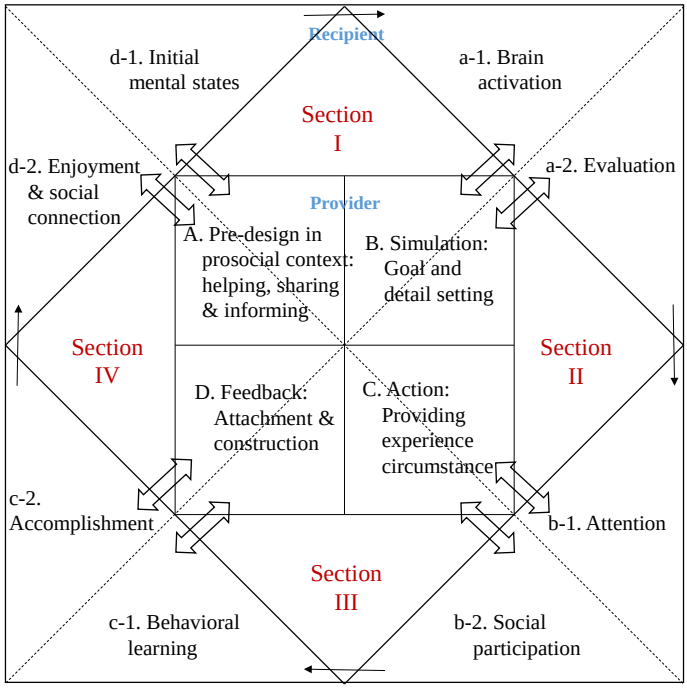


Figure 5.3 Connection between recipient and provider in the community-based service model

In the main central layer, the provider strategy steps illustrated, different from the recipient layer, there is no division for each of the co-creation section. The provider layer only has four steps for the whole strategy. However, the steps are not working alone, there is a dependency among them. Like the first step in provider layer, while the provider want to conduct the predesign of applying prosocial contexts into community-based service (A), they need to review the shortage of the past events (D) and think about the possible solution to the improvement and after the confirmation, they need to simulate it by asking the target groups suggestion and expectations (B). While the provider move to simulation step (B), they need to keep the original design about implying the prosocial behavior context (A) and also assume to put the goals and plans into an action (C). In the action step, the provider need to refer the goals and planned details (B) and also send the questionnaire to the recipients to get their feedbacks and evaluations (D). As the last step in the provider layer, feedback (D) is not only include their observation from the whole event process (C) but also the recipient's opinions. After the summarization about all of the information, the information could be saved for next time a new design about the community-based service.

For this community-based model, in each of the layer, there are connection bonding with each steps and among the different layers, there are also important integration happened for a psychological well-being. Therefore, this community-based service model for the elderly's psychological well-being as Figure 5.2 presented has been formed. For this research, there is an interpretation about the community-based service and the psychological well-being outputs.

Community-based service is a series of value co-creation social activities that happens among the local community residents and benefits for constructing the social connection of the community.

The psychological well-being in the community-based service is

A series of psychological factor based outputs, including high social participation, high accomplishment and high enjoyment to build the social connection in community-based service.

5.1.3 Community-based service model and social connection

Community-based service as we mentioned before, it is a value co-creation process, community with the geographical advantage easily to let the members come closer under a close value and beliefs. Elevating the local resident's satisfaction through the process of the community-based service is a sufficient way to running the social connection bridging. For prosocial behavior, it is a series of behaviors the people conduct for bring the benefits for others. Besides that, prosocial is a word combined by *Pro* and *social*, *pro* has the meaning of approaching something based on one's favor[19], while people conduct prosocial behavior, it is a way to show people's intimacy with the community or society. Prosocial behavior in a positive loop will have a reciprocity generation, which keep the sustainable of the community-based service development.

In community-based service model, the social connection presented in two aspects, on the one hand, it is the connection between service provider and recipients. They are experiencing this process to derive the demand from each other. After knowing the demand the provider could design a behavior circumstances for the participants, which directing the recipients to receive the value output. On the other hand, it is the connection among the provider, recipients and community. In this aspect, the provider and recipients are a same group as the human resources or the actors in the community. The actions they conducted will brings the prosperous to the community. Moreover, cultivating the bonding and the sense of contribute to the local community with the collaboration strengthened the recipients and providers' belongingness to the community.

[19] Oxford dictionary, last access on Jan. 15th, http://www.oxfordlearnersdictionaries.com/definition/american_english/pro_4

5.2 Model for psychological well-being of the elderly

In previous studies, psychological well-being defining as the combination of the mental health, positive interpersonal relationship and good life span (Ryff, 1989; Ryff and Keyes, 1995). In this research, psychological well-being mainly focusing the mental health of positive emotion generation, the interpersonal relationship of social communication opportunity with other local residents, the good life span of social participation.

5.2.1 Psychological well-being

For positive emotion, it has defined as the subjective sensations cognitively and affectively (Cohn and Fredrickson, 2009). Community-based service applied prosocial behavior antecedents and consequences because the prosocial behavior has been proved to have benefits for people rise their attention to get into social participation and generate affections like the sense of accomplishment. Prosocial behavior also could be diffused while people received similar behavior before (Dovidio et al., 2006). In community-based service applying such kind of reciprocal behavior will benefit to make the service process more sustainable. Positive emotion as one of the psychological well-being output from this community-based service model has been discussed in these three aspects. The happy and joy feeling while the elderly receive the prosocial behavior, which identified in Study I, the elderly's brain activation and emotional evaluations. The satisfaction of having a social participation, including the enjoyment and feel spent a meaningful time testified in the Study II. The emotional expressions as we derived the characteristics of informing behavior from Study I and the implantation by ask the participants to write the message card to each other in Study II.

For the interpersonal relationship of social communication opportunity with other local residents, it is one extension of the positive emotion. In Study I, the prosocial behavior contexts are conducted based on the connection with other people or organization. According to the data like the high evaluation about get the sharing behavior (the elderly people are cooking together) has proved that the elderly paid attention to the prosocial behavior that could have a same goal with others and collaboration with each other. In Study II, there are also some feedback information for interpersonal relationship development. In motivation

part, the selection of involve by recommend by friends, representing that for a social involvement. Some other satisfaction items like they have appreciated the teamwork like the collaborative spirit summarized from Study I. From that we could figure that in the elderly people's behavior, no matter the start point of their motivation or the land point of their satisfaction, interpersonal relationship is a key word in the recipient view of community-based service.

For the good life span of social participation, referring the recipient's behavior decision and their social bonding with the community. Previous research has mentioned that the changes in human perception could change people's emotion and positive emotion could be an incentive to encourage people get into the social actions (Pessoa, 2009). This research in Study I has been testified that while the elderly perceived the prosocial behavior, they are also willing to conduct the similar behaviors. From the output of Study I, the elderly extended the viewpoint not only as a prosocial behavior recipient but also a prosocial behavior actor. Therefore the Study I data has been proved that people are not only just perceived the prosocial behaviors but also emotionally aroused and expressed their determinacy to participate social actions. Moreover, in Study II, the satisfaction items like the participant's finding about the attractiveness of the local community they usually lived in and based on their new findings, the connections with the community have been strengthened.

5.2.2 Implication of the psychological well-being

Based on the three outputs of the psychological well-being, for the elderly especially, solving their psychological issues will benefit for their physical health also. No matter physical or psychological health, having troubles to get into the social activity is always a significant problem for the society especially for the aging societies. This community-based service produced psychological well-being firstly have considered the elderly people's mental output including sensations, recognition. Then it has contribute the elderly people's physical output including social activities like strolling. By combining the mental output and the physical output, applying community-based service for psychological well-being have significant meaning.

Moreover, this community-based service combined the prosocial behavior antecedents and consequences, means a lot for the development of psychological well-being. For the

theories of motivation, prosocial behavior and the outputs of the psychological well-being are affecting each other. Especially the good life span of social participation will highly encouraged the elderly or local residents to get involved into the community-based service or further develop the construction of the community. The interpersonal relationship also bridged the social connection among people.

While applying the psychological well-being, there are also two points that need to be pay attention. One is about the gender distribution, in the study I, the brain data representing that the elderly have different perception according to the context changes. Under the gender differences, female group presented better prefrontal cortex activation, which refers that the female group is easier to rise the attention to the prosocial behavior and they also more emotionally would like to involve into the community. And in Study II, the female members performed active roles in puzzle searching and teamwork process. Therefore besides the social context perception, taking the advantage of gender differences by activating the roles of the female elderly could perceive a good output of psychological well-being.

The other point id about the Public policy that the government paid attention. Applying the prosocial behavior context in the short-term requires the significant help and cooperation from the local government or organizations. Like the Study II, in the Simulation step of the provider's cycle, the provider has discussed the contents and places with the local government staffs to make sure each of the segments could receive a good result as expectation. In that case, the community-based service will be well implicate and produce more positive values in the psychological well-being output.

5.3 Summary

This community-based service model designed and structured based on the data interpretation of the two studies. By referring the service-dominant marketing value co-creation process to constructing the roles of the providers and recipients in different steps. The whole model start from the current aging psychological issues, the provider combining the service process to design a good service for solving the psychological performance of the elderly. While during the value co-creation process, the provider has some interactions with the recipients. In the recipient's cycle, the psychological well-being output values presented.

Applying this model could contribute to the elderly's psychological well-being development but also benefits for the community construction. In the provider and recipient's cycles, this research applied the prosocial behavior antecedents and consequences. For the future community-based service design or for other output, the context could be changed and cultivating more values for the elderly or local residents. Such as implicate communicate technologies like robots that we have identified have positive feedbacks to the elderly. Although this time in Study I we only list this context as the comparative subjects, the data results indicate it still have potential to further researched in the community-based service model like we proposed.

Chapter 6: Conclusion

6.1 Answers for research questions

This research aiming to improving the psychological well-being in the community-based service, combining the prosocial behavior characteristics into the service designing and the process implementation. Study I has identified the characteristics of the prosocial behavior based on an objective dataset to explain the cognitive and affective process of the elderly. Study II has implemented the characteristics derived from the Study I to the service offering process. According to the social interaction among the participants and the evaluation of the satisfaction items, the value outputs of the psychological well-being has been interpreted. By the two studies' results and explanations, we have computed the community-based service model and the psychological well-being outputs to answer the research questions.

SRQ1: How does the elderly affectively and cognitively perceived the prosocial behavior?

This first subsidiary research question has mainly answered from the Study I data results. Study I has applied the optical topography to identify the elderly's attention arousal and the emotional responses about the prosocial behavior contexts. The prosocial behavior contexts including helping behavior, sharing behavior and informing behavior. In the three behaviors there are occasional and routine frequency differences and the extrinsic money involved affections. From the data, in each aspect of the prosocial behavior there are some

characteristics that highly been evaluated by combining the affection and cognition. Therefore for answering the SRQ1, there two parts consisted.

Firstly, experimentally, while the elderly people watching the prosocial behavior stimulus, the prefrontal cortex will presented with the rising of the oxygen-hemoglobin changes, which is a process that rise one's attention and let it think about themselves or the experiences that they had before. Combining the prefrontal cortex, the deep reason about their reaction towards the prosocial behavior contexts have been investigated. The investigation is a process to recall their short memory about the perception and subjective affection.

Secondly, from the contents, in prosocial behavior, the affection is about the subjective evaluation, cognition is about the brain activation. Here is the specific contents:

Helping behavior had the characteristics of release the elderly's physical burden (HO: remove the snow) and activating their roles in the daily life (HR: doing housework) are appreciated from the elderly.

Sharing behavior had the characteristics of letting the elderly has the collaborative spirit (cooking together) is the most cherished no matter the male group or female group. Although the other sharing behavior didn't receive a very high evaluation, the elderly expressed their expectation to have various age groups talking together.

Informing behavior of thank message and care message didn't show much differences, but they do appreciate the messages that expressed more genuinely.

Nonmonetary and monetary condition comparison shows that both of them have significant meaning for the elderly in different way. As for a recipient, the nonmonetary is obviously preferred and money around 1000 yen is acceptable for them. As for a provider or an actor, the monetary condition like receive some souvenirs or totally as volunteer is highlighted by the elderly.

SRQ2: How to improve the motivation of the elderly to get involved into community-based service?

From our viewpoint, improve the elderly to get involved into the community-based service, it requires firstly regard the elderly as the recipients of the service, start a service design process based on the demand or requirement of the elderly. Since Study I already identified the prosocial behavior characteristics for generate the positive emotion for the elderly, the basic demand for specific outputs have been clarified. Designing the services for

the elderly especially in social activities could attract the elderly to get involved into the community-based service. After the design of the event in Study II, the motivation of the elderly has been identified.

For this question the first point is to make it interesting. While the elderly involve into the community-based service, they are working not only a recipient but also an actor. In order to let them activated and satisfied, the service need to be attractive enough. Variety like increasing the age groups to give the circumstance for the elderly to communicate is one of the key points. Besides that well-applying the characteristics of prosocial behavior and considering the specific conditions of the local residents to detailing the process and segment is the other one.

The second point is to make the theme and goal as let the participants feel their little effort will contribute to the community they lived in. it could also be explained as bonding to the community, more importantly is the mindset of self-achievement or achievement to construct the community.

The third point is to take the important role of the elderly in interpersonal relationship. With more elderly are active in the community, take the advantage of their interpersonal relationship with other community residents is a key point. Comparing with the providers, the elderly lived in the local community are more familiar with each other. Therefore, the recommendation from friends is another key motivation for the elderly to involve into community-based service.

SRQ3: How to apply the prosocial behavior antecedents and consequences into community-based service for serving the elderly?

As two studies data interpreted, prosocial behavior in helping, sharing and informing behavior has been applied and it does received positive prosocial behavior consequences. While implicate into the community-based service, it needs the two stands consideration, one is from the stances of the service provider, the other one is from the stances of the service recipient.

From the service provider stance, the provider need to consider the variety of the prosocial behavior contents to keep the sustainable of the service and actively inquiring the recipients' demand. When the provider considering the prosocial behavior context, they're also the actor of the prosocial behavior because they are doing the service design and

providing for benefiting the recipients. Moreover, the provider need to offer the prosocial behavior circumstances by the service process and focus on the different value proposition outcomes

From the service recipient stance, it requires the active seniors to get involve at the first place. From their first involvement, they will give valuable opinions and information to the provider for a better service design of prosocial behavior antecedents. After they participate to the service process, their satisfaction will encouraged them to conduct the prosocial behavior or high involvement into the community-based service.

MRQ: How does psychological well-being can be perceived for the elderly in community-based service?

Community-based service defined as a series of value co-creation social activities that happens among the local community residents and benefits for constructing the social connection of the community. And the psychological well-being referring to the high involvement, high enjoyment and high accomplishment to the community-based service.

Therefore, for answering this major research question, it need two process. One is the service design process, in this process the elderly are receiving the mindset of the prosocial behavior. While the elderly involving into the social activities, they are providing the values about their understanding about the prosocial behavior contexts. Moreover, after the elderly's perceived the positive emotion output of prosocial behavior context they will highly involve into the community-based service.

The other one is service participation process. Since all of the service process is a value co-creation process, no matter the elderly's motivation to involve or the satisfaction the provider expect the elderly to receive, it requires the attention of the recipient idea and the careful application into service. Strengthen the social bonding to the community, including improve the service details and offering appropriate segments for the elderly, it will let the elderly perceive the psychological well-being easily.

6.2 Theoretical Implication

This research is a multiple disciplinary study, the combination of the brain science, psychological science, social science and service science. Starting from the lack of community-based service definition and design, focusing on the psychological well-being output and applying the brain science and social science methods.

From service science viewpoint, with the service research development, transformative service focusing on the collaboration with the customer and improving their well-being has been mentioned (Anderson et al., 2013). In order to expand this theory into the social service, this research has proposed a community-based service model for the elderly. Community as the entities for the main consumer which in this research is the elderly has provided a potential sustainable environment for the service develop. This community-based service suggested the value co-creation into different phases. The service design phase and the service offering and output phase. For a service design and implicative service process model, this research is achieved a combination of a community-based service from a design to an implication.

From the psychological viewpoint, as the service goal setting, this research aiming to improve the elderly psychological well-being. Firstly, this research has defined the psychological well-being concept into the community-based service. Specifically the output of good life span of social participation, which could resolve the lack of social connection caused loneliness issue. Form the psychological well-being theories, this research also evaluated the positive emotion generation towards the social behavior contexts. Moreover, it implies the positive emotion as the potential motivation and lists other three motivations such as designing the service segment in an interesting way, take important roles of the elderly and the take the intrinsic motivation of contributing to the community.

From the social science viewpoint, in previous research they have pointed that the human social activities need to ensure the goal is sustainable and the value output supposed to be measured based on one’s contribution (Costanza and Folke, 1997). In this research, in study II after setting a collaborative goal, the participant’s contribution evaluated to prove the psychological well-being value outcomes are sustainable. Another point which is also one of the originality of this research is applied the antecedents and consequences of the prosocial behavior as the social context into the community-based service for the benefits of the elderly.

In this research it is a new angle to interpret the prosocial behavior into service process, the service provider is offering the prosocial behavior for the recipients' good and at the same time, the recipients affected by their prosocial behavior to conduct same behavior also. The dual process become a reciprocity for the elderly towards the community they lived in.

From the brain science viewpoint, differentiate from the previous study has applied the brain science into the marketing of customer perceptions. This is a new trial to use the near infrared spectroscopy method to measure the elderly people's perception to the social contexts. Which is also been proved it is an effective method to get the objective data from the participants through the prefrontal cortex activation (oxygen-hemoglobin changes) and the ranking evaluation. Besides that this research also achieved the implication of the cognitive control of emotion process (Ochsner, Silvers & Buhle, 2012), stimulated the cognition by the behavior stimulus and detect the prefrontal cortex information processing and get the results about the elderly's evaluation and expectation about the prosocial behavior contexts.

All in all, this research as a full entity has contributed into the various disciplines in different ways. Especially the service viewpoint to the social issue for the psychological benefits and the brain-imaging method in the process identification.

6.3 Practical Implication

On the one hand, this research start aiming to solve the loneliness issue of the elderly by bridging the social connection of the elderly to the community and other local residents. Study II practically implemented the theory of prosocial behavior design in the community. From the satisfaction items of the participants that through the activity they have found some attractiveness of the community and their social bonding to the community also been rise up. The elderly people also expressed they have greatly enjoyed the activity. From this research data and process, it could be applied in the future community activities or have same kind of strolling activity to more local residents.

This research proposed community-based service, the service design phase could be used for the government and the local community organizations to providing the service for the elderly. This time for study II we have applied only three characteristics of the prosocial behavior contexts that highly evaluated. There are more potential characteristics could be used such as applying information delivery in the member card system of the local supermarkets, implying the sporty kind of services for the elderly to improve their health and the expression of caring about the elderly's life. And besides the characteristics, the service process also could be applied in future design, including how to receive the elderly's requirements and how to satisfy them in a social activity.

6.4 Limitation and Future research

This research as a multiple disciplinary study, combining the different studies, the only limitation of this research is in the study II not all of the characteristics derived from study I could be applied. We only selected three most highly evaluated by the elderly into the study II event design. Since this research has put the target as the elderly, it caused the research lack of variety in Study I. Our study I has focused on the elderly's perception and evaluation, for the further benefit of community-based service, receiving more perception from the different age groups will be benefit for the service development.

In the future, the proposed community-based service model could be expanded in the practical community activities and make the service value co-creation process complete by increasing more age differences. Moreover, the future research also applied the process in other social context, not only prosocial behavior but also some other empathy related context to maximize the participant's satisfaction and enjoyment from the community social participation.

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Appendix A: Semi-structured interview contents

向社会的行動についてお伺い(構造化インタビュー)　　No____

「向社会的行動」とは,「外的な報酬を期待することなく，他の人や他の集団を助け，役立とうとする行動」のことを意味します．対人的なつながりを積極的に求め，促進する行動のことです．なお，これに対して,「反社会的行動」は，集団の規範や人間関係を妨害したり，拒否したりことによって，対人関係を破壊する行動のことです．
※最初に向社会的行動の意味が分かるかわからないかを聞いて，上記の説明をするかを判断．

- あなた自身についてお聞きします．

1. あなたの性別をお答えください．

   □男　　□女

2. あなたの年齢をお答えください．

   □60-65　□65-70　□71-75　□76-80

3. 新しい環境に慣れて違和感を持たなくなります。

   □全く当てはまらない　□当てはまらない　□どちらともいえない　　□当てはまる　　□非常に当てはまる

4. 常に目標を持って行動しています。

   □全く当てはまらない　□当てはまらない　□どちらともいえない
   □当てはまる　　□非常に当てはまる

5. 人と話しをするのが好きだ

   □全く当てはまらない　□当てはまらない　□どちらともいえない
   □当てはまる　　□非常に当てはまる

6. 人と協力して，物事を成し遂げるのが好きです。

   □全く当てはまらない　□当てはまらない　□どちらともいえない
   □当てはまる　　□非常に当てはまる

7. 他人の優れた特徴を言い当てることが得意です。

□全く当てはまらない □当てはまらない □どちらともいえない
□当てはまる □非常に当てはまる

8. 自分よりも，仲間を大切にしています。

□全く当てはまらない □当てはまらない □どちらともいえない
□当てはまる □非常に当てはまる

9. 知らない人と話をすることは，苦になります。

□全く当てはまらない □当てはまらない □どちらともいえない
□当てはまる □非常に当てはまる

10. あなたはこれまで，奉仕活動などの社会活動に参加したことがありますか？

□はい（11 番と 12 番を答えて下さい）□いいえ（13 番を答えて下さい）

11. どんな活動に参加しましたか？

（ ）

12. 何回参加しましたか？

（ ）

13. 社会活動に参加しない理由を教えてください.

（ ）

➢ 実験に関してお聞きします.

1. 先ほど，いくつかの向社会的行動がありましたが，印象が深い画像はどれですか？

□除雪のこと □掃除のこと □ある人が知人と話している
□一緒に何か作る □励みをもらうこと □心遣いの言葉をもらうこと
□席を譲らない □お助けロボット □なし

＊まず始めに何も手がかりなしで記憶を想起してもらい，その後，提示した画像刺激の一覧表を出したうえで答えてもらう.

2.　先ほど,提示した画像の中であなたは嬉しい程度によってランキングして下さい。

☐ 除雪のこと

☐ 掃除のこと

☐ある人が知人と話している

☐一緒に何か作る

あなたは今日ある活動に参加しました。そのあと、
ある人がこのようにあなたに言いました。

『おかげさまでたいへん楽しい時間を過ごすことができました。また一緒に遊びましょう』

☐励みをもらうこと

ある人があなたにこのようなメッセージを送りました。

『最近天気が変わりやすいので、くれぐれもお体をお大事にしてください』

☐心遣いの言葉をもらうこと

☐ 席を譲らない

☐ お助けロボット

3.　上記するランキングした理由を教えてください.

(　　)

4.　上記する向社会的行動の中で参加したことがありますか？

(　　)

5.　席を譲らない画像を見るとどんな気持ちが持っていましたか？

(　　)

6.　ロボットのことを見て，どんな気持ちが持っていましたか？

(　　)

7.　他の人に助けることがありますか？あったら教えてください.

(　　)

8.　他の人から手伝うがもらうことがありますか？あったら教えて下さい.

(　　)

9.　これからどんな手伝うがもらうと期待していますか？

(　　)

10. 最後に，今回の向社会的行動の画像を見た感想を教えてください.

(　　)

以上でインタビューは終了です．ご協力ありがとうございました.

Appendix B: Questionnaire for Study II

当てはまる箇所にチェックしてください。

1. 性別をお聞かせください。

   □男　　□女

2. 年齢をお聞かせください。

   □20 歳未満 □20－30 □31－40 □41－50 □51－60 □61－70 □71－80 □80 歳以上

3. 寺井町内に住んでいますか？

   □はい　　□いいえ

4. 貴方のルートを教えてください。

   □赤ルート　□青ルート

5. あなたは普段どのくらい運動をしていますか？

   □週に 4 日以上 □週に 2-3 日 □週に 1 日 □月に 1-3 日 □2-3 か月に 1 日以下

6. あなたがこの活動に参加した理由について，以下の中から当てはまるもの <u>すべての数字に ○</u>をつけてください.

1	地域や社会のために役立ちたかったから
2	自分の知識を生かしたかったから
3	自由時間を有意義に過ごしたかったから
4	親しく付き合える人をつくりたかったから
5	新しい知識を得たかったから
6	身近に問題が起きて困ったことがあったから
7	健康や体力を高めたかったから
8	人からすすめられたから
9	このイベントが面白そうだったから
10	その他（理由を教えてください）
11	特に理由はない

7. あなたはこれまで，奉仕活動などの社会活動に参加したことがありますか？

□はい（質問 8 番・9 番を答えて下さい）□いいえ（質問 10 を答えて下さい）

8. どんな活動に参加しましたか？

9. 参加頻度はどのくらいですか？

□週に 4 日以上 □週に 2-3 日 □週に 1 日 □月に 1-3 日 □2-3 か月に 1 日以下

10. 社会活動に参加しない理由を教えてください.

11. 今回の【宝探し】の各項目の満足度をお聞かせください。各項目について，**あなたの考えに最も当てはまる数字にそれぞれ１つだけ○を** つけてください.

		1 全然そう 思わない	2 そう 思わない	3 どちらでも ない	4 そう思う	5 とてもそう 思う
1.	このイベントに参加して楽しかった	1	2	3	4	5
2.	ルートを歩いて疲れた	1	2	3	4	5
3.	散歩するのは気持ち良い	1	2	3	4	5
4.	自分の街だという認識（誇り）が深まった	1	2	3	4	5
5.	みんなで色々な話しができた	1	2	3	4	5
6.	他の人の話しを聞くことで知識が増えた	1	2	3	4	5
7.	自由時間を有意義にすごすことができた	1	2	3	4	5
8.	一人で散歩するよりチームでする方が楽しい	1	2	3	4	5

9.	全部のパズルをつけた時に達成感があった	1	2	3	4	5
10.	チームメンバーからメッセージカードをもらって嬉しかった	1	2	3	4	5
11.	イベントを通じて新しい街の魅力を見つけることができた	1	2	3	4	5
12.	イベントを通じて地域への愛着が深まった	1	2	3	4	5

12. この街の魅力は何だと思いますか？

13. このイベントについて一番楽しかったことは何ですか？理由とともにお書きください.

14. 散歩イベントには参加されたことがありますか？

□はい　　□いいえ

15. 「はい」とお答えの方：以前の散歩イベントと比べていかがでしたか？感じたことについてお書きください.（例）宝探しが面白かった、他の人と話し合って楽しかった、パズルをくっつけるのが良かった　など

16. また【宝探し＊散歩】(同じようなイベント)に参加したいですか

□参加したい　□わからない　□参加したくない

17. このイベントに対して、ご意見・ご要望がございましたらお聞かせください。

以上でアンケートは終了です. ご協力ありがとうございました.