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THE e-COMPANIONSHIP IMPACT MODEL

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Kirsi Ronkainen, kirsi.ronkainen@laurea.fi

Anne Äyväri, anne.ayvari@laurea.fi

Laurea University of Applied Sciences



CONTENTS

1	Introduction.....	3
1.1	The Companion solution in a nutshell.....	3
1.2	The concept of mobility.....	3
1.3	The aim of the report.....	5
2	The e-Companionship Impact Model.....	6
3	The outcomes: Improved quality of life of the Travellers.....	9
3.1	Improvements in perceived functional capacity.....	10
3.2	Strengthened travelling self-efficacy.....	13
3.3	Strengthened social connectedness.....	15
3.4	Better accessibility of the services and resources in the environment.....	16
4	The anticipated societal impacts.....	18
4.1	Towards the transformation of the care service system.....	19
4.2	Active agency of older adults.....	19
4.3	Savings in social and health care costs.....	21
5	References.....	22
	APPENDIX I.....	27

I Introduction

I.1 The Companion solution in a nutshell

e-Companionship is a new service targeted at older adults suffering from mild or moderate difficulties when moving outdoors. Due to cognitive or physical impairments, many older adults perceive feelings of unsafety and fear, especially when moving outdoors alone. They worry that something bad might happen to them while on the move. Their loved ones worry about how the older adult is coping outside the home.

The Companion solution supports older adults in overcoming these perceived worries by providing them with reassurance and personal support on the move. The solution, e-Companionship, allows older adults to digitally hold hands with relatives, friends or professionals from a care organization. Hence, e-Companionship helps people overcome worries that prevent them from doing things they like to do or that will be good for them (increasing their quality of life) by virtually holding hands with a companion.

The core features of e-Companionship are:

- The users (called 'Travellers') and their Companions have the Companion application on their smart phones.
- When the Traveller is going out and he or she would like to have an e-companion, he or she sends an invitation to his or her Companion (a relative, friend, or professional care-giver).
- Once the Companion has accepted the invitation, e-Companionship is constructed.
- The Companion is able to localise the Traveller on the map of his or her smart phone and discreetly follow the Traveller's journey.
- The Traveller is able to see his or her present location on the map, which helps in finding the right way.
- The Traveller and the Companion can either phone or send a text message within the application when being connected via e-Companionship.
- Relatives and friends of the older adult can pass on e-Companionship to a local care organization.

I.2 The concept of mobility

The most important aim of e-Companionship is to maintain or even increase the mobility of older adults. The International Classification of Functioning, Disability and Health by WHO (2001) defines mobility as the capacity to move "by changing body position or location or by transferring from one place to another, by carrying, moving or manipulating objects, by walking, running or climbing, and by using various forms of transportation". In the COM'ON project, we

have adopted a wider perspective on mobility, following the ideas presented by Metz (2000), Mollenkopf et al. (2006), and Kaufmann et al. (2004).

According to Metz (2000), the concept of mobility covers the following:

- Travel to achieve access to people and places.
- Psychological benefits of movement – of "getting out and about".
- Exercise benefits.
- Involvement in the local community – yielding benefits from informal local support networks.
- Potential travel – knowing that a trip could be made even if not actually taken.

Mollenkopf and her colleagues (2004) conducted a study among older adults, and they concluded that older adults' mobility is a manifold concept, physical movement being only one aspect of it:

- Physical movement (a basic human need)
- A basic emotional experience
- Movement in natural surroundings and observation of nature
- A social need
- An expression of personal autonomy and freedom
- A source of stimulation and diversion
- A reflective expression of one's personal life force.

In addition to the above-mentioned concepts on mobility, we have been inspired by the concept of motility introduced by Kaufmann and his colleagues (Kaufmann et al., 2004; Flamm & Kaufmann, 2006). Motility can be defined as how an individual or group takes possession of the realm of possibilities for mobility and builds on it to develop personal projects (Flamm & Kaufmann, 2006, p. 168). The three major features of the motility concept are: (1) access (the conditions under which available options can be used), (2) skills (required in order to use these options), and (3) cognitive appropriation (the evaluation of the available options vis-à-vis one's projects) (ibid., 169). Kaufmann and his colleagues (2004) argue that motility may be considered an asset, and it thus represents a form of capital similar to economic, cultural, or social capital – and a new form of social inequality.

Based on the insights adopted from Metz (2000), Mollenkopf et al. (2006), and Kaufmann and his colleagues (2004, Flamm & Kaufmann, 2006), we have concluded that when aiming at enhancing mobility, we are actually aiming at improving the quality of life among older adults. Therefore, maintaining mobility is an important aspect when considering active ageing, dynamic and independent lives, and participation in the community.

I.3 The aim of the report

The aim of this report is to provide a systematic view, based on the research literature, on how the use of the Companion solution may lead to results on the individual, communal and societal levels (the so-called theory-based evaluation of effectiveness; see Chen, 2005; Dahler-Larsen, 2005). When reviewing an intervention's effectiveness, it is essential to pay attention to not just the end results, but also to the process (Paasio, 2006; Chen, 2005; Dahler-Larsen, 2005). Therefore, we have adopted the logic model structure (W.K. Kellogg, 2004): it is assumed that there is a connection between the usage of e-Companionship (input), the user experience (output), the health and quality of life among the elderly (outcomes), and the long-term effects on the societal level (impacts).

2 The e-Companionship Impact Model

The input of the e-Companionship impact model consists of the Companion application, Traveller and Companion activities related to the usage of the application. The most crucial activity of the Traveller is sending the invitation to the companion chosen to accompany him or her on the next journey. The private or professional companion has to accept the invitation. Otherwise, no travel companionship is constructed. (See Figure 1.)

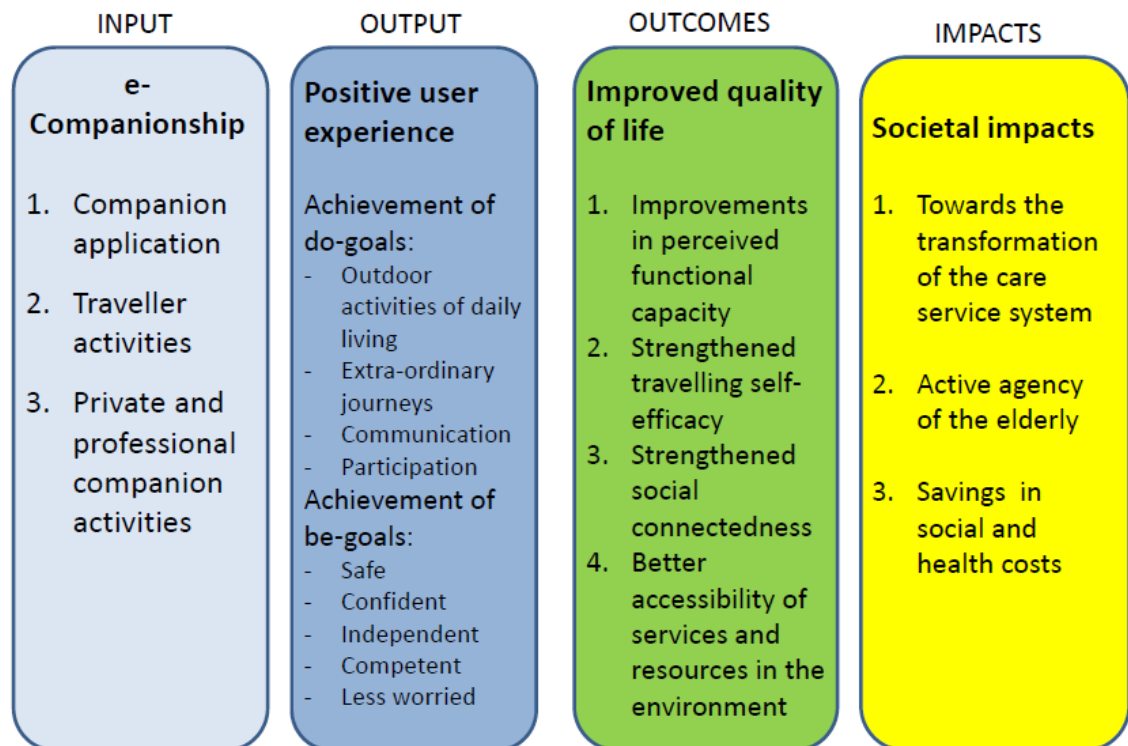


Figure 1. The e-Companionship Impact Model

In general terms, the outputs are the direct results of the intervention or program activities. They are usually described in terms of size and/or scope of the intervention and products delivered or produced by the intervention. They are indications of whether the intended “dose” within the focus group is achieved (W.K. Kellogg, 2004.) It is not possible to describe the “right doses” of the use or the exact usage times needed for the expected results of e-Companionship because Travellers are individuals with their own specific needs. However, we conclude that without a

positive user experience and consequent commitment to using the Companion solution, positive results in the quality of life of the Travellers are not achievable.

A positive user experience emerges, and the interaction with the Companion solution continues, when the solution supports the user's personal well-being and when his or her feelings while interacting with the application are positive. From the perspective of user experience, it's important that people can accomplish their personal goals when using the product (Wessman et al., 2013; Hassenzahl, 2008).

Hassenzahl (2008) assumes that people perceive interactive products and services along two qualitative dimensions: pragmatic and hedonic. Pragmatic quality refers to the solution's perceived ability to support the achievement of "do-goals", like in the context of e-Companionship sending an invitation to the chosen private companion or sending a message to the companion while on the move or making a journey to a previously unknown destination. Pragmatic quality calls for a focus on the solution – its utility and usability in relation to potential tasks. Hedonic quality refers to the solution's perceived ability to support the achievement of "be-goals", such as "being competent".

It can be concluded that to produce the expected outputs, e-Companionship has to succeed in helping the Travellers to achieve both their do-goals (accomplishing outdoor activities of daily living and extraordinary journeys, and tasks related to communication and participation) and their be-goals (feeling safe, confident, independent, competent, and less worried).

Hassenzahl (2008) argues that the fulfilment of be-goals remains the ultimate source of positive experiences. Furthermore, it has been suggested that the basic needs behind the well-motivated usage of new technology among the elderly are especially the safety needs and the needs of being connected to other people (Wessman et al., 2013). Thus, the potential of new technology is based especially on its ability to support social connections and safety. New technology creates new possibilities for the elderly only if it is experienced as relevant, well-integrated in daily life, easy to learn, and affordable (Wessman et al., 2013).

Positive user experience as an output of e-Companionship is a requisite for continuous usage of the solution. Without continuous and long-lasting usage of the Companion solution, the positive outcomes of e-Companionship will not be reached. The main outcome to be expected is the improved quality of life of the Travellers, building on the following effects: improvements in perceived functional capacity, strengthened travelling self-efficacy, strengthened social connectedness, and better accessibility of the services and resources of the environment. These parameters of QoL will be thoroughly discussed in the next chapter.

Finally, the e-Companionship impact model presents the anticipated societal impacts. The impacts on the levels of communities and the society as a whole can be reached when a large number of older adults adopts the e-Companionship solution and uses it for several years. We

propose three issues on which the long-lasting usage of the Companion solution can have an impact: the trend towards the transformation of the care service system, active agency of older adults, and savings in public and private social and health care costs. These issues are discussed in the last chapter of this report.

3 The outcomes: Improved quality of life of the Travellers

Quality of life should be an important aim and outcome measure when evaluating the power of health intervention, care (Pieper & Vaarama, 2008; Metz, 2000) or the implications of technology on the aged (Sparrow & Sparrow, 2006). Without considering the impact on the quality of life of older adults, the offering based on the use of technology is unethical where services for the elderly are concerned (Sparrow & Sparrow, 2006). e-Companionship can be seen as a preventive and compensative intervention or part of a rehabilitation process that supports the quality of life and health of older adults as Travellers.

The quality of life of the elderly is a multi-dimensional concept that varies between individuals and within different life situations (Vaarama et al., 2010). The quality of life of older adults encompasses many physical, social, psychological, and environmental dimensions. First of all, it consists of subjective inner experiences and evaluations, but objective elements are significant, too (Vaarama et al., 2010; Pieper & Vaarama, 2008; Xaviera et al., 2003).

The quality of life of older adults consists of four key areas (Vaarama & Tiit, 2008; Metz, 2000):

1. Subjective health and functional abilities, especially physical performance
2. Psychological performance and self-efficacy
3. Social networks, participation and leisure and productive activities
4. Accessibility of living environments and desired people and places.

Vaarama and her colleagues (2010) state that functional problems, dependence on other people's help, inappropriateness of the received help, impaired ability to manage cognitive tasks, and feelings of being unsafe weaken the quality of life of older adults the most.

Quality of life among the elderly is strongly intertwined with their environment, and the most influential interventions are improving the feasibility and accessibility of the environment for the elderly. Table 1 describes how the different dimensions of quality of life can be enhanced with technology. It is rarely that all the different entities of quality of life are equal drivers of technology development, but this has been the case in the development of the e-Companionship solution.

Table 1. Basic elements of technological solutions and care supporting quality of life among the elderly (Vaarama et al., 2008).

Dimension of quality of life	Tasks of technological solutions and high quality of care
<ul style="list-style-type: none"> • Functional capacity and health • Social connectedness • Self-efficacy • Accessibility of the resources and services in the environment 	<ul style="list-style-type: none"> • Supporting mobility • Emotional closeness and support • Supporting autonomy, sense of control and self-respect • Support services, changes in living environment

3.1 Improvements in perceived functional capacity

Health and functional status is a strong indicator of quality of life among older people (Pieper et al., 2008). Self-reported (or perceived) and performance-based health are distinct but complementary concepts. Vuorisalmi (2007) shows clearly how self-reported health is significantly predictive in subsequent changes in health and the usage of health services. Physical performance measurements explain only 25–50% of the variation in health-related quality of life, and psychosocial factors have a significant role in moderating physical performance and health-related quality of life (Stretton, 2006).

Physical activity is an important factor when achieving and maintaining functional status and health. Strong research evidence shows that physical activity promotes health, slows disease progression, and prolongs functional independence (Physical, 2008). Lifelong physical activity prevents heart diseases, high blood pressure, non-insulin dependent diabetes, osteoporosis, and cancers of the breast, colon, and reproductive organs. Other positive effects are good lifelong weight control as well as functional independence in older adults (Brehm & Lannotta, 2013; Yorston et al., 2012). Physical activity also helps to maintain healthy bones, muscles and joints and increases stamina and muscle strength, which are important in preventing falls (Yorston et al., 2012; Yokoya et al., 2007). In addition, physical activity contributes to good mental health, the alleviation of depression, and an improved body image (Brehm & Lannotta, 2013; Yorston et al., 2012). The benefits of physical activity outweigh the risk of adverse events such as musculoskeletal injuries and cardiac arrhythmias. Still, adverse events are common, especially among vulnerable people like the aged and may cause anxieties among them and reduce participation (Physical, 2008). Low-risk activities (walking and gardening) are often preferred by the aged (Heikkinen, 2010).

Outdoor mobility is a prerequisite for taking care of daily activities. Instrumental activities of daily living (IADL) are the tasks basically performed outside the home, such as banking, shopping, and travelling. They are usually threatened before functions included in the basic activities of daily living, for instance bathing, eating, and going to the toilet (Lawton & Brody, 1969, in Valta, 2008; Vaarama et al., 2010). A decline in instrumental activities makes women more vulnerable than men and at an earlier stage (Hammar, 2008). A deficit in IADL functioning is typically manifested as a subtle change in an older adult who might otherwise appear capable and healthy. Consequently, the need for IADL activities are not always appropriately recognized in health care (Vaarama et al., 2010).

One of the early predictors of the physical disability of older adults is their confined mobility in their own surroundings. Among home-care clients, difficulties in moving hamper daily living and quality of life, and quite often these difficulties are the reasons behind initial home care demands. Vilkkö and his colleagues (2010) proved that 3/5 of men and 2/5 of women among home care clients can move outside the home without help. 20% of the elderly are missing the support in outdoor walking in summertime and only 26% of those who need the support receive it. Usage of transportation and outdoor moving is quite easily affected by functional limitations and subsequent feelings of unsafety (Salonen, 2009). Anaby et al. (2009) conclude that confidence in one's balance and capacity for mobility explain the participation in social roles, too. Hence, it is important to motivate older people to be active, and treatment should already target functional deficiency when it is new.

Based on the literature (Hanson et al., 2012, Gauvin et al., 2012), it is possible to identify two types of walking: recreational and utilitarian. Recreational walking refers to extraordinary journeys and physical activity taken to enhance quality of life. Utilitarian walking is personal transportation while doing everyday tasks. Support to walking is useful for the elderly because walking reduces the risk of mortality, cardiovascular disease and mobility limitation among the elderly. Many studies show that a few hours of brisk walking significantly decreases the risk of losing functional independence (Yorston et al., 2012). Harris et al. (2013) have shown how walking has a positive effect both on the quality of life and self-efficacy.

The influence of physical exercise is stronger when its volume and intensity increases (Yu et al., 2013; Laudani et al., 2013; Blankevoort et al., 2010, Physical, 2008). Therefore the daily options for physical activities outside the home and their accessibility are critical issues from the perspective of health and functional capacity of the elderly. Yokoya et al. (2007) indicate that the frequency of leaving the house and outdoor moving is very important for reducing fall risks regardless of physical function and age. New solutions may have remarkable effects on the prevention and rehabilitation of mobility disability of the elderly (Shumway-Cook et al., 2003).

Table 2 describes the positive qualities of support that the Companion application can bring to the elderly's physical activity if the companion is available during the trip. The use of the Companion can provide support for physical and human outdoor activities and encourage outdoor walking in neighbourhoods or in nature surrounding homes, but this depends on the willingness of friends and family members to join in using the Companion while travelling if there is no professional companion available. If the e-Companionship solution succeeds in supporting the continuation of an active lifestyle, the usage of the Companion can help prevent health problems such as a poor gait and falls. Vulnerable older people can be more confident in moving and travelling when contact with another person is available during a trip, not only for help in reaching a destination but for offering help if unpredicted attacks of illness occur during the trip.

In Table 2, the restrictions are described in terms of the Companion's support to mobility. There is a lot of evidence on how the maximum effect of a physical activity on health can be achieved if frequency and duration increase and multiple forms of physical activities are taken (Laudani et al., 2013; Blankevoort et al., 2010). The Companion application does not offer direct support for those dimensions of health-related physical activity.

Table 2. Potential and restrictions of the Companion solution to support physical activity.

Potential of e-Companionship	Restrictions of e-Companionship
<ul style="list-style-type: none"> • Supports outdoor walking • Can prevent health problems such as poor gait and falls • Safer trips for those with disabilities and health deficits • Quick help in case of unpredicted attacks of illness during a trip • Supports an active lifestyle 	<ul style="list-style-type: none"> • Does not directly support the frequency, duration and multiple forms of physical activity (for example, focusing on muscular strength or agility) • Support for physical activity is dependent on availability of positive companionship during a trip

3.2 Strengthened travelling self-efficacy

Self-efficacy is a core belief and the degree to which someone believes that they can be successful in achieving a goal (Pascucci et al., 2012). It is an individual’s perceived ability to cope and the confidence in their own ability to manage, despite vulnerabilities and potential barriers. Personal core beliefs about control are crucial when initiating, organizing, performing and maintaining activities (Stretton, 2006; Lindelöf et al., 2012) and how specific challenges, vulnerabilities and available solutions are perceived (Shutz & Wurm, 2012). Individuals hold efficacy beliefs of varying strengths across different life domains and tasks, for example travelling, exercise and social activities.

Firstly, self-efficacy is an important predictor of physical performance, health and quality of life among the elderly (Simpson & Jones, 2013; Cha et al., 2012; Stretton, 2006). Psychosocial factors such as self-efficacy have a positive influence on mood and feelings of safety (Simpson & Jones, 2013), illness-specific representations (Schüz & Wurm, 2012), self-management of diseases (Simpson & Jones, 2013) and health behaviour (Morowatisharifabad et al., 2006; Dionigi, 2007), especially physical activity and exercise (Kaasalainen et al., 2013; Warner et al., 2011) among the aged. Additionally there is some evidence to suggest that self-efficacy acts as a main determinant of functional performance in many different fields (Konopack et al., 2008). Positive self-evaluation is a key factor also in the use of technology among the aged and in the performance of technology-based tasks (Schmidt et al., 2014).

Secondly, self-efficacy is affected by the actual performance of an activity, encouragement or other social influences, and physiological or emotional conditions (Lindelöf et al., 2012). It is often used as one of the most important evaluative criteria in assessing the effects of care, support and technology in the lives of the elderly (Schmidt et al., 2014). On the other hand, self-efficacy is a key factor in predicting health-related behaviour, and it is positively affected by the action – for instance exercise and physical activity (Dionigi, 2007). Therefore, an active lifestyle supports self-efficacy and subsequent well-being in various ways.

The elderly need support to cope more effectively with the psychological effects of their vulnerabilities. According to strong research evidence (Schmidt et al., 2014; Pascucci et al., 2012), the focus of health management interventions should be in strengthening self-efficacy. It is suggested that the strength of intervention is based on attitudes and needs towards the action under study and particularly in participants' self-efficacy following intervention (Lagana, 2008). Therefore, experience in competence building is the main component of a successful intervention in increasing self-efficacy in mobility and travelling activities in general. The program that utilizes both training and mastery experiences can effectively improve self-efficacy (Schmidt et al. 2014; Cheal & Clemson, 2001). Liu (2012) identifies four defining attributes of self-efficacy that have to be supported during intervention: (a) cognitive recognition of requisite specific techniques and skills, (b) perceived expectations of outcomes, (c) confidence in the capability to perform, and (d) sustained effort and activity. Research shows that a positive social environment and feedback and problem-solving techniques increase self-efficacy and support changes in health-related behaviour, especially among the elderly (Schmidt et al., 2014; Kaasalainen & Kasila, 2013; Simpson & Jones, 2013; Warner et al., 2011).

Self-efficacy is behaviour-specific and is focused on beliefs about personal abilities with regard to carrying out a particular behaviour such as exercise or travelling. Consequently, self-efficacy expectations are highly context- and situation-dependent. (Resnick & Jenkins, 2000.) There are no available specific definitions or measurements of self-efficacy related to travelling or moving (not available from databases such as Ebsco, Emerald, Ovid, and ProQuest), but it is well-documented that the elderly have many fears and anxieties concerning outdoor moving, and many of them cannot achieve their personal aims in moving and exercise (Rantakokko, 2011).

The Companion solution fits reasonably well the aforementioned dimensions of intervention aimed at supporting self-efficacy (see Table 3.). e-Companionship is aimed at supporting autonomy, freedom of choice, activity, and expanding the life circle outside the home environment by enabling other people's support during trips. Concerns during travelling decrease when the contact, encouragement and help are available all the time and offered only when needed. Support of another person can make adverse and unpredictable events during the trip or walking outdoors more manageable. In an e-Companionship, it might be easier to find the right way after losing it and receive help in case of illness. Technology can bring relief, feelings

of safety and freedom but in some occasions also embarrassment, fear, and challenges to the functional abilities of the elderly (Wessman et al., 2013). One controversial belief is the potential threat to privacy. However, Travellers are able to select their private or professional companions themselves and to ask them each time to join into the e-Companionship. Furthermore, there is no information saved about previous trips that could read by the companions.

Table 3. Potential and restrictions of the Companion solution to support travelling self-efficacy.

Potential of e-Companionship	Restrictions of e-Companionship
<ul style="list-style-type: none"> • Supporting, encouraging and confirming messages sent by the companion while travelling • Lowering the threshold to leave home and more options available for leisure-time activities • Reducing feelings of dependence on other people • Preferred and unfamiliar destinations more easily accessible • Perception of easier travelling by public transportation • Less likely to lose one's way while travelling • Easy to learn and use by the elderly 	<ul style="list-style-type: none"> • Small touch screen and the small size of device might cause difficulties • Being well-informed about the benefits and restrictions before consenting to use an application is a critical issue

3.3 Strengthened social connectedness

Research shows that unmet social needs are more harmful for the aged than for younger generations (Coudin & Lima, 2011; Hawkey & Cacioppo, 2007) and fulfilling the social needs of the elderly has a strong influence on their psychosocial well-being (Heikkinen & Kauppinen, 2004; Cacioppo et al., 2006; Cornwell & Waite, 2009; Luo et al., 2012) and their physical well-being (Luo et al., 2012; Momtaz et al., 2012; Zhang et al., 2007; Pressman et al., 2005; Fratiglioni et al., 2000). The size of the social network is not as important as the emotional quality and a feeling of closeness in social relationships (Löckenhoff & Carlstensen, 2004).

It is vital that the frail aged can rely on the care and help of their loved ones. One dimension of positive social relationships is the confidence to get help, which promotes autonomy for the elderly. The important qualities of help are sufficiency, timing, availability, focusing and

intensity. They are best ensured by the collaboration of formal and informal caregivers. Adequate support and help are key elements that support social connectedness and alleviate loneliness, too (Vaarama et al., 2010).

In the population of older adults, relationships between relatives turn out to be tight: 75–80% of the elderly have contact with their children, 40% have contact with their grandchildren, and about 50% of men and 65% of women communicate with their closest friends at least once a week. The older they are, the more likely they anticipate getting help from close friends and relatives (Vilkko et al., 2010). Basically, the helpers at home for the elderly aged 79 and over are their relatives (48%), spouses (14 %) and professional care givers (20 %) (Vaarama et al., 2010; Vilkko et al., 2010).

By using the Companion solution, old people can reach an increasing number of contacts, which is extremely important if they have previously felt bound to their homes. Users can maintain their autonomy for social relationships when they themselves can choose the companion before the trip. From the relatives’ point of view, it could be impressive to integrate the help of the old relatives to workday activities more easily. However, it is well-documented that the most important social needs of the aged cannot be satisfied through technological devices (Sparrow & Sparrow, 2006). The wish of the aged is that human contacts should not be dependent only on technology (Wessman et al., 2013; Sparrow & Sparrow, 2006). See Table 4.

Table 4. Potential and restrictions of the Companion solution to support social connectedness.

Potential of e-Companionship	Restrictions of e-Companionship
<ul style="list-style-type: none"> • Increasing number of contacts • Can support and convey emotional safety • Can convey help when needed • Can offer continuing support • Relatives can easily offer their help and emotional support during working hours • Private + professional support 	<ul style="list-style-type: none"> • Can replace regular face-to-face visits and contacts • Does not convey non-verbal messages

3.4 Better accessibility of the services and resources in the environment

The ecological models of health have described a concept of person-environment-fit and shown how person-environment interaction is one of the key elements of the quality of life for the elderly. Salonen (2009) defines accessibility as a relationship and interaction with the

environment that enables the meaningfulness and fluency of daily life. The main point is how individual needs, competencies and preferences fit with the changing recourses and demands in the environment. The environment refers not only to the physical environment but also to the emotional atmosphere and services such as transportation, leisure activities, support of family members and health care. Many researchers have proved how men and women have different patterns in person-environment interaction (Davey, 2007; Salonen, 2007). Women move shorter distances than men but need more assistance in moving and travelling because of widowhood and a higher incidence of physical impairments (Hammar, 2008; Davey, 2007). Accessibility and barrier-free options for all are important goals in society (Kemppainen, 2008).

Salonen (2009, 2007) describes how the environment of the elderly consists of different zones. In everyday lives, the home and its surrounding is a core environment where the elderly spend an increasing amount of time. In the second zone, the elderly meet other people and do errands. In the outermost zone, occasional travelling and moving occurs. Fluent moving between zones enables the strongest autonomy and diverse relationships.

Difficulties in travelling, reaching for faraway destinations, and running errands in the neighbourhood are described as threats for a quality of life among the elderly (Vaarama et al., 2010; Rantakokko, 2006). Vilkkio et al. (2010) describe the results of the study conducted among elderly aged 79 and over in Finland. 64% of the respondents need help in their daily affairs outside the home, but only 13% of those in need receive help. The focus in the assessment of needs has basically been on physical functionality and management in daily tasks inside the home (Vilkkio et al., 2010), but it has to expand toward an evaluation of agency of the elderly in their environment (Salonen, 2009). Sometimes reducing encounters with environmental challenges leads to a drastic reduction in the movement of an individual, and this causes deterioration in physical status and social interactions (Shumway-Cook et al., 2003).

Nonetheless, even frail old people can utilize their environment if its structural and qualitative properties are planned for their needs and assistive technology and other aids compensate for their vulnerabilities (Kemppainen, 2013; Salonen, 2009). New approaches and solutions are needed to help people to preserve or regain their performance and ability to encounter physical and mental challenges to mobility, go out of their home, and reach the resources not available or familiar earlier but offered in society (for example public transport, libraries, and swimming baths) (Salonen, 2009, 2007; Shumway-Cook et al., 2003). The Companion solution can be a part of that environment and support.

Table 5. Potential and restrictions of the Companion solution to support accessibility of the environment.

Potential of e-Companionship	Restrictions of e-Companionship
<ul style="list-style-type: none"> • Better fluency and flexibility in life when everyday spaces are reachable • Easier to get to know, get familiar with, and utilize new services and resources in the environment outside the home • Encourages enlargement of the zone of movement outside the home • Decreases perceived risks related to the environment 	<ul style="list-style-type: none"> • Navigation facilities are not available

4 The anticipated societal impacts

In this article, the concept of impacts refers to the results that are widespread and anticipated in the community or the society in seven to ten years of e-Companionship usage (c.f. W.K. Kellogg, 2004; Rajavaara, 2006). Impacts are often called “societal impacts”. According to Rajavaara (2006), the societal impacts are not only the sum of the effects on individuals. For instance, new technology could be inefficient for individuals but produce some benefits on the community or societal level. The societal level consists of civil society, public sector and private companies. Societal impacts are able to be evaluated through changes in the population and its living conditions and capacities, and changes in political arenas.

Societal impacts are uncertain, long-term, and occur under specific conditions (W.K. Kellogg, 2004). They are often related with intermediate results such as partnership-based cooperation and improvement of products (Bornmann, 2013). Social impact evaluation of current applications should focus on the conditions under which societal impacts are able to be generated rather than on the final future impact. Whenever there is productive interaction between stakeholders (for instance the public, policymakers, practitioners and professionals, health and social service providers, civil society organizations, and private business), this also generally results in a societal impact. Eerola and Kivisaari (2001) argue that new solutions may limit the rise in health care costs only if they are successfully integrated in the health care system and available services. It is not an easy process because national schemes to assist the aged with travelling are rare (Davey, 2007).

We propose three major societal level impacts. First, as the e-Companionship service consists of a bundle of services produced by a network of actors representing many sectors, it can be one of the innovations leading the way towards the transformation of the care service system. Second, the Companion solution promotes the active agency of older adults. And finally, when e-Companionship proves to be a successful preventive intervention, cost savings will be achieved as the need for social and health care services are postponed.

4.1 Towards the transformation of the care service system

The Companion solution has been developed in the strategic network of private companies, in close collaboration with potential users, the older adults themselves, and in collaboration with care organizations. At first glance, it is like any commercial mobile application. It must be emphasized that if it were nothing but a stand-alone application, the impacts proposed in the model would not be realized. The key innovative idea behind e-Companionship is that it offers new opportunities for new service eco-systems to be built around the core concept.

As mentioned earlier, e-Companionship can be integrated into preventive, assistive and even rehabilitation services to be offered in new types of networks consisting of users, their relatives and friends, private care companies, third-sector organizations, public bodies, and the technology providers. When the public sector is struggling with diminishing resources, availability and accessibility of sufficient services are threatened and new, more efficient solutions are welcomed. The beneficial movement would be a transformation of services towards collaboration and networking between formal and informal care.

New solutions are especially needed for allocating the resources of relatives and family members in a way that they can easily integrate their help to given services and take responsibility for supporting their loved ones. Working life consumes the resources in the families, and it is often difficult to find time and energy to physically meet their old parents in person (Kuusi, 2001). e-Companionship enables the sharing of responsibility for care services among professionals, family members, and friends. For instance, professional care personnel can offer their help during the day and during holidays. The use of the Companion solution can result in the more reasonable use of public services when family or informal care is more available for the elderly.

4.2 Active agency of older adults

Participation in daily activities and social roles are considerably explained by personal physical and mental abilities (Anaby et al., 2009). If e-Companionship can provide support for independency, freedom of choice, participation, caring and the dignity of the elderly, it can make a positive impact and a more equitable society for all citizens. Kaufman et al. (2004) see links

and synergies between spatial and social mobility and consider them as a resource. Socio-spatial mobility forms capital that “can be exchanged for other forms of capital”, such as economic, cultural and social capital (ibid, p. 754.). On an individual level, spatial moving and activity spheres demarcate social roles and utilization of environmental resources. On the macro level, migration and segregation is based on environmental accessibility of different groups.

The Companion solution has the potential to enable old people to achieve a stronger agency in society. According to Pekkarinen (2005), a strong agency consists of independency and willingness in decision-making and freedom to make their own, sometimes non-accustomed, choices. People with strong agency are –highly motivated to function as an active member in society, free to take initiatives and contacts and to struggle to reach their own personal aims. Through an active agency of the elderly, the age-sensitivity in families, communities and society is able to increase.

The main potential of gerontechnology from a societal perspective is suggested to be impeded in its ability to support positive contacts between peers and different generations and participation and also in its ability to support movement in the elderly (Hämäläinen, 2006; Kuusi, 2001). It is noteworthy that general safety services have been proved to alleviate fears, and typically they are encouraging independent movement only in the home environment (Pekkarinen 2005; Kuusi, 2001).

If a new technology is targeted only at the safety needs of the aged, it reinforces the image and stereotypes of the elderly as passive and helpless (Pekkarinen, 2005; Kuusi, 2001). Hämäläinen (2006) concludes that the satisfaction of higher needs is too often withheld from the aged. The usage of the Companion can compensate for physical and mental deficiencies and bridge the elderly’s way to new hobbies and relationships and encourage rethinking the image of the passive elderly often held by other people and institutions (Pekkarinen, 2005).

A good person-environment relationship attaches the elderly to different groups of people, communities and society (Salonen 2007, 2009). Through communication with loved ones and supported travelling and moving outside, the elderly can receive an opportunity to expand their roles as family members, consumers, and citizens. According to Hämäläinen (2006), weak social bindings are typical in the urban lifestyle, and they do not compensate for the relationships between family members and friends. Social capital in society is based mainly on close relationships, and the usage of the Companion solution could have a positive impact on them. In the vision of the project team, the user’s commitment to the Companion can lead to increasing and sustainable mutual rapport despite a scarcity of time and long distance from relatives and friends.

4.3 Savings in social and health care costs

As discussed in this article, e-Companionship has the potential to fulfil current service needs of the elderly related to moving outside and travelling, which are essential for their physical, psychological and social well-being. The aim of the Companion solution is not only to support physical activity, but to strengthen both self-efficacy and social connectedness, which are strong determinants of the elderly's health and well-being. The usage of the Companion solution can delay and prevent age-associated physiological and behavioural changes that restrict human functioning and health with minimal risk. At present, professional support and help is focused on supporting the elderly to work out in publicly funded gyms and health clubs (for instance free tickets and professional counselling), but support for outdoor moving is not a very evident part in care plans and services. It is variously arranged, often by charity organizations. Nonetheless the costs of physical inactivity are a big concern in the health sector and in political discussions (Puska, 2014).

At best, the use of the Companion solution can postpone the needs for heavier and more expensive medical and institutional care services. Lighter and foremost timely services are able to restrain the costs of social and health care and alleviate the deficit of caring personnel (Hämäläinen, 2006; Fozard, 2005). e-Companionship is targeted towards the needs of older adults living at home, and savings mediated by enhancing moving will most probably be seen first in home care costs (cf. Metz, 2000).

In the appendix of this report, there are two examples of potential costs savings. These examples are based on the two portraits constructed in the beginning of the COM'ON project: Anna (the Dweller) and Mary (the Determined). When Anna and Mary succeed in maintaining their mobility or even increasing it with the help of e-Companionship, the risks already present in their lives will not be actualized, and their needs for social and health care services will remain the same as before. However, if the risks are actualized, their mobility will rapidly decrease and they will very soon need more social and health care services due to new disabilities and illnesses. The costs of these services can be regarded as potential savings when e-Companionship proves to be a successful preventive intervention. To calculate the net savings, the price of the solution and the monthly fee paid for the professional e-Companionship service have to be deducted from the sum of all the potential savings.

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APPENDIX I

APPENDIX 1.

Potential savings in social and health care costs

Kirsi Ronkainen

Laurea University of Applied Sciences

6.8.2014

Anna, the Dweller

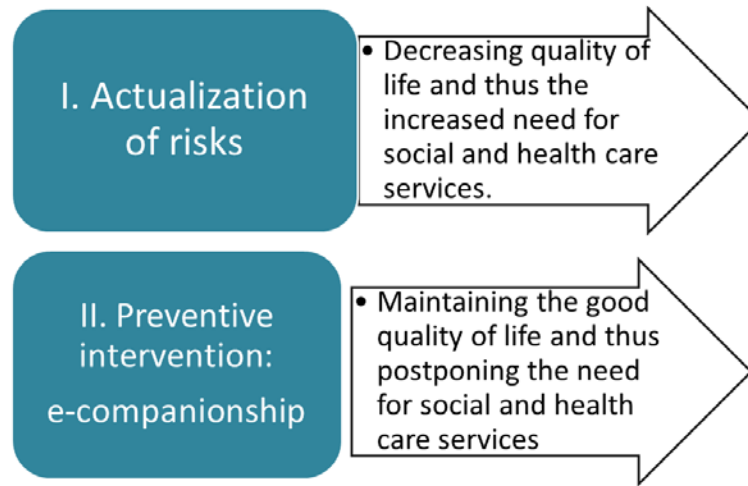
Anna's resources

- **Connectedness:** Daughter, son, and five grandchildren, to whom she feels very connected. Three girlfriends whom she meets at least once a week. Children help her when needed, especially her daughter who is a housewife.
- **Self-efficacy:**
 - Peaceful acceptance of certain limitations related to aging
 - Regular activities in daily life:
 - Dance classes
 - Works as a volunteer.
- **Physical performance:** walks outdoors alone although prefers to have a companion especially when using public transportation, attends a dance class once a week (with her friends).
- **Environment:** urban environment, familiar with public transport but enjoys car rides with her friends or children as she is afraid of falling when the bus driver leaves the bus stop too fast.

Risks for the quality of life

- A widow, lives alone, few close friends.
- When moving outdoors fears for crime and falling in the bus.
- Mental and physical fluctuations while moving outdoors: losing the sense of direction, dizziness, weak knees, fatigue.
- Is not willing to travel to the city centre on her own.
- Not familiar with technological devices.

Two scenarios for Anna



4

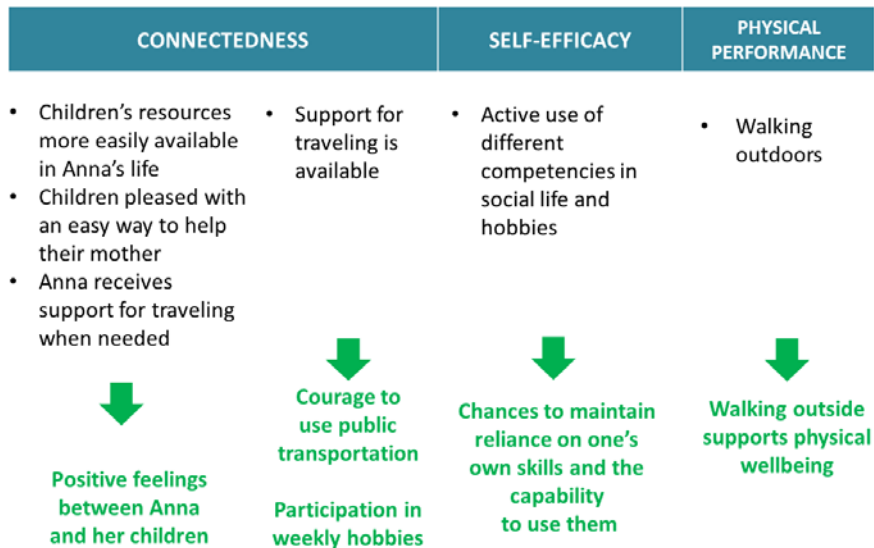
1. Actualization of the risks and fading of the resources within one year

CONNECTEDNESS	SELF-EFFICACY	PHYSICAL PERFORMANCE
<ul style="list-style-type: none"> Anna's closest friend dies. Her daughter takes a full-time job. The children become key persons in Anna's social network Burden in children's lives increases: they are worried all the time Relationship between the children and Anna begin to be loaded with needs of help and support 	<ul style="list-style-type: none"> Support for travelling is not available as easily as before Uses public transportation rarely No participation in hobbies 	<ul style="list-style-type: none"> Different kinds of fears begin to dominate Anna's life and her activities Risks of cognitive decline and depression grow Abilities needed in social relations deteriorate gradually
<p>↓</p> <p>Children arrange municipal home care services for Anna / Average domestic care 1.200-4.400 € / year / customer¹</p>	<p>↓</p> <p>Getting lost when outside home / Police services 300 €²</p>	<p>↓</p> <p>Depression / Treatment of mental problems 2500-6200 €³</p>
		<p>↓</p> <p>Falling and hip fracture / Treatment of hip fracture 15 000 € during the first year⁴</p>

In Anna's home town the services for the older adults are well organized. One day the nurse calls Anna and suggests a health check at the local health center. Anna happily accepts the invitation, and one day during the spring she walks to meet the nurse. When walking towards the health center Anna thought: "It's not nice to hear all those things that are continually going to be worse in my performance, but it's really nice if somebody could help me with the issues that are going to become real obstacles in my everyday life". After many questions and handling of all kinds of papers, the nurse asked how Anna felt when she was making her trips around the city, traveling by bus and if there were any problems. Anna expected the nurse to provide physiotherapy or some physical exercises for her, but she made a totally different offer. She explained that they were inviting Anna and other seniors to an event next Thursday where it would be possible to try all the new technological solutions invented by companies.

Anna bought the Companion app for herself and her daughter is supporting her traveling. The role of Anna's daughter is changing a bit when she returns to work again after her youngest son has started his school. This causes some worries in Anna's mind but she has heard stories how the support is available from one of the local care companies.

2. Preventive intervention: e-companionship; effects after one year



Mary, the Determined

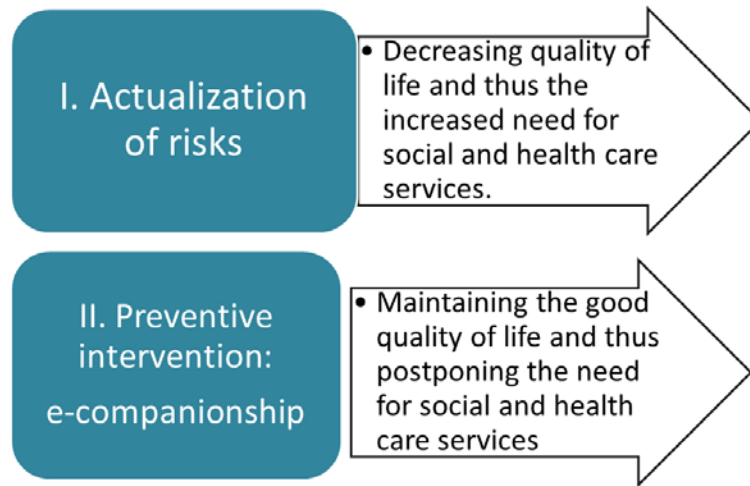
Mary's resources

- **Connectedness:** widow, her son's family living half an hour's drive away, two sisters, a few good friends. It is easy for her to make contact with others; especially she likes to talk to young people. Her son is worried when Mary travels alone.
- **Self-efficacy:** active and decisive, creative hobbies, desire for enjoyment and travelling, high acceptance of technology
- **Physical performance:** severe problems with both heart (pacemaker) and back. The walker is her true companion, also when using public transportation.
- **Environment:** metropolitan area, easy access to parks, cafes, lots of happenings in the streets or open areas

Risks for the quality of life

- Quite a small and vulnerable network
- Declining capabilities, fatigue and black outs
- Frailty with aches, heart and back, dizziness and mobility problems. Has to sit down and rest quite often when walking outdoors.
- Financial challenges

Two scenarios for Mary



10

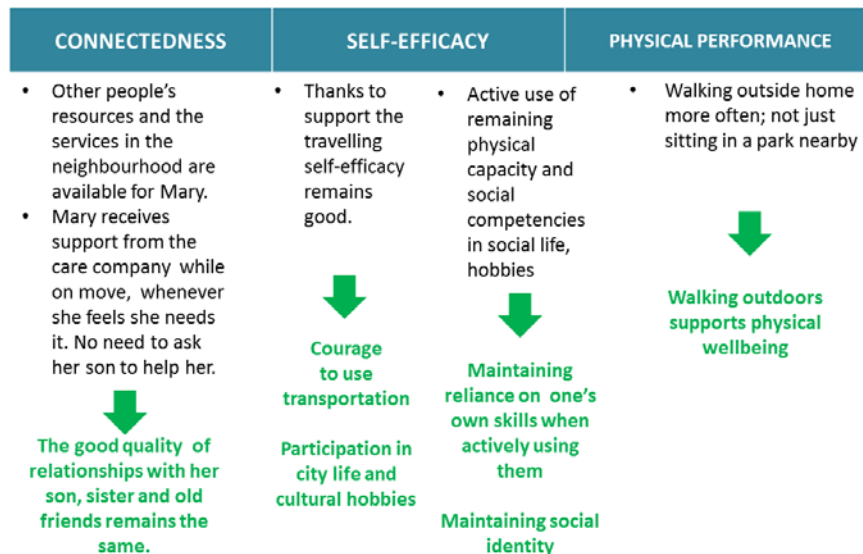
1. Actualization of the risks and fading of resources within one year

CONNECTEDNESS	SELF-EFFICACY	PHYSICAL PERFORMANCE
<ul style="list-style-type: none"> • Her closest sister has moved to an elderly home • Difficult to meet friends: no chances to cook for a group of people, and have a meal together • Mary's son is even more worried how his mother is coping at home, and especially outdoors. He has advised Mary not to go out alone. 	<ul style="list-style-type: none"> • Her energy level has gone down, but she is willing to do some household chores like prepare a meal for herself once a day • Is still missing her dog 	<ul style="list-style-type: none"> • Worsening pains and more moving disabilities • Has scarcely moved outside home • More time in chair and incipient need of wheel chair • Obesity
↓	↓	↓
<p>Home care visit once a week, doing shopping / Domestic care 1200 - 4400 € / year / customer¹</p>	<p>Self-esteem and gumption has dropped Feelings of helplessness</p> <p>Depression / Treatment of mental problems 2500-6200 €³</p>	<p>Two hospital stays 2600 x 2 = 5200 €</p> <p>Four visits in health centre 245 € x 4 = 980 €⁵</p>

It's not difficult for Mary to use the walker in the streets or in buses and trams. Mary laughs and says how she sometimes feels that her walker is like a battle wagon when she struggles through crowds, but often people quite easily turn to help her and give a seat when they see her labored walking. Mary confesses that the walker has been the only backup in moving and she feels that she should have checked the other moving aids earlier. She has heard many stories about bad transportation services aimed specially for the older adults, therefore she has decided not to rely on them, and tries to continue moving on her own.

One day Mary sits in a peaceful park near her home and gets a feeling that she would like to enjoy some musicals and theater productions in the new music hall few miles from her home. The problem is that the music hall is in the center of town and she is not comfortable traveling there alone, especially in the evening when performances mainly are presented. She calls a familiar nurse office and asks how the transportation services for the elderly are arranged nowadays. Unexpectedly the nurse tells Mary about a new solution and how the nurse can offer support during the trip with a technological system and the user only needs a mobile phone. Luckily Mary doesn't need to handle the phone throughout the whole trip, because she needs her hands for holding onto support inside the bus too. The nurse recommends her to buy a backpack because she needs her hands for other things. They are charging the new service like the security services for the elderly – a fixed sum every month. Mary decides to invite the nurse as her companion every time she leaves home.

2. Preventive intervention: e-companionship; effects after one year



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