

## Older adults' hedonic and eudaimonic well-being in information and communication technology activities

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*J. Zhang, H. Umemuro. Older adults' hedonic and eudaimonic well-being in information and communication technology activities. Gerontechnology 2012; 10(4):231-243; doi:10.4017/ger.2012.10.4.004.00* **Purpose** of the study This research examined whether older adults' hedonic and eudaimonic well-being during information and communication technology (ICT) activities are associated with their experiences in daily life activities, and investigated whether perceived usefulness, daily life well-being and computer attitudes can be used to predict hedonic and eudaimonic well-being in ICT usage. **Methods** The sample comprised 84 older adults aged 61 to 86 years living in Japan. A battery of questionnaires was used to assess hedonic and eudaimonic well-being, perceived usefulness and computer attitudes in a range of daily life activities and their ICT counterparts. **Results** The results indicated that in online news reading and online chatting, older adults' well-being associated with ICT activities was significantly correlated with that in corresponding daily life activities. In online shopping and writing email, the relation between older adults' well-being in ICT activities and their well-being in corresponding daily activities was moderated by perceived usefulness. Perceived usefulness and daily life well-being are important predictors of both hedonic and eudaimonic well-being in ICT usage, whereas self-efficacy is a unique predictor of eudaimonic well-being in ICT usage. **Discussion** Hedonic and eudaimonic well-being in ICT usage were two important and different perspectives when investigating user experiences in ICT. In addition, older adults' hedonic and eudaimonic well-being in ICT usage were associated with that in corresponding daily life. These findings are discussed in terms of the design of ICT systems to improve well-being of older adults in ICT usage.

**Keywords:** hedonic well-being, eudaimonic well-being, ICT, older adults

New information and communication technology (ICT) has been rapidly introduced in the daily lives of the general population. Children and young adults can enjoy the fun and convenience introduced by the Internet, social networking services and 3G telecommunication networks. However, older adults may not be as comfortable with technology as young people<sup>1</sup>. Some social researchers have highlighted the fact that the information society is also an aging society<sup>2</sup>. To

promote ICT to older adults and help them be comfortable with new technologies, it is important for us to understand older adults' well-being in the ICT context.

Although there is substantial literature on Internet use and older adults' well-being, ambiguous definitions of well-being and various methodologies have been employed<sup>3</sup>. Well-being has been represented by psychological constructs such as life satisfac-

tion, depression, psychological well-being, locus of control and self-efficacy<sup>4-8</sup>. Also, a wide variety of well-being measurements has been used. These inconsistencies have caused researchers confusion regarding this topic, and it is difficult to draw general conclusions across the studies. It is reasonable to speculate that not all these psychological constructs are appropriate for ICT research purposes, and certain measurements of well-being may be more suitable than others in measuring ICT use. Therefore, it is important to review the definition of well-being and clarify corresponding measurements in this research context.

The research on well-being has emerged as an important area of study, focusing on positive psychological functioning and positive subjective experience in the new millennium<sup>9</sup>. However, theorists have found the issue of well-being to be complex and controversial. There are various types of well-being, such as emotional, mental, psychological and social<sup>10-13</sup>, but they have not necessarily been properly defined or specified in terms of a measurement methodology. Ryan and Deci<sup>14</sup> distinguished theories of well-being into two basic types: hedonic and eudaimonic views.

Hedonism, as a view of well-being, has been expressed in many forms, varying from pleasures of the body to pleasures of the mind. Aristippus, a Greek philosopher from the fourth century BC, taught that the goal of life is to experience the maximum amount of pleasure, and that happiness is the totality of one's hedonic moments. In the 1970s, Kraut<sup>15</sup> suggested that hedonic enjoyment refers to the positive affect that accompanies acquiring material objects one wishes to possess or engaging in activities one wants to experience. Among the many ways to evaluate this concept, subjective well-being<sup>16</sup> (SWB) is most widely used in hedonic psychology research.

From the eudaimonic perspective, Aristotle's theories of well-being emphasize perfection or virtue. However, some ancient eudae-

monists, for example the Epicureans, denied that eudaimonia consists of perfection. They arguably agreed with Aristotle that well-being involves the fulfillment of our natures as human beings, but they believed that we fulfill our natures by achieving pleasure<sup>17</sup>.

In contemporary research, the term eudaimonia has many different interpretations. Waterman<sup>18,19</sup> suggested that eudaimonia occurs when people's life activities are most congruent with deeply held values, and they are fully engaged. Under such circumstances, people feel intensely alive and authentic. Eudaimonic experience of an activity occurs when there is an unusually intense involvement in an undertaking, such as a feeling of intensely being alive, a feeling of being complete or fulfilled while engaged in an activity, an impression that this is what the person was meant to do and a feeling that this is who one really is. Self-determination theory (SDT)<sup>20</sup> is another perspective that has embraced the concept of eudaimonia, or self-realization, as a central definitional aspect of well-being. SDT posits three psychological needs—autonomy, competence and relatedness—and theorizes that fulfillment of these needs is essential for psychological growth. In addition, Ryff and colleagues' six-dimension psychological well-being model (PWB)<sup>21,22</sup> is widely adopted in this research area. They have explored the question of well-being in the context of developing a lifespan theory of human flourishing. Although the research on well-being and hedonic experience is rather complicated, Ryan and Deci<sup>14</sup> argued that because of the theoretical and practical importance, well-being research is probably best conceived as a multidimensional phenomenon that includes aspects of both the hedonic and eudaimonic conceptions of well-being.

Some researchers have conducted trials to investigate the positive side of product using feelings, such as pleasure and enjoyment, in usability engineering<sup>23,24</sup>. However, the existing models of user experience in human-computer interaction that incorporate hedonic aspects such as pleasure are rare and

often overly simplistic<sup>25</sup>. To complement the traditional usability concepts, Hassenzahl<sup>26</sup> proposed the hedonic attributes of interactive products, which can be subdivided into identification and stimulation. Despite using the word 'hedonic', Hassenzahl considered hedonic attributes to emphasize individuals' psychological well-being, and fulfill the needs of competence and personal growth and relatedness with self-expression, which were intensively discussed by the eudaimonic theorists above. Slegers, van Boxtel and Jolles<sup>27</sup> argued that anticipated psychological benefits of the Internet, such as competence and connectivity with family members, are hard to quantify and measure with currently available well-being instruments. Therefore, it is necessary to consider both hedonic and eudaimonic aspects of well-being when studying older adults' ICT usage.

Well-being can be considered at four interrelated levels of analyses: the instance or event, the activity, the individual and groups<sup>18</sup>. Although measurements such as life satisfaction scales, PWB scales and SWB scales have been widely acknowledged as valid and used in previous studies on the relationship between well-being and ICT usage, it is noteworthy that those scales are generally viewed as assessments of well-being at an individual level. For example, DeNeve<sup>28</sup> suggested that SWB is determined to a substantial degree by genetic factors and is relatively stable across the lifespan. Thus, it is reasonable to infer that these measurements at an individual level are not capable of detecting well-being related to using ICT products. Evidence from a number of researchers have supported this inference. For example, Slegers, van Boxtel and Jolles<sup>27</sup> carried out an intervention study that examined the causal relationship between computer use and measures of various aspects of well-being. No effects of computer and Internet usage on life satisfaction and other well-being were found among older adults in a 1-year period. To empirically measure older adults' well-being in ICT usage, appropriate measurements at the activity level should be employed.

At the activity level, well-being can be measured by aggregate diary data using the experience sampling method (ESM)<sup>29</sup> across activities, or by the Personally Expressive Activities Questionnaire (PEAQ). The PEAQ was developed by Waterman<sup>19</sup> as a global evaluation of well-being related to specific activities and has been used in several studies<sup>19,30</sup>.

Many studies on the relationship between ICT use and older adults' well-being have been conducted. Bit-Cohen and Litwin<sup>31</sup>, using open-ended interviews, found that using the Internet enables older adults to maintain a social network and social contact in their homes. Chen and Persson<sup>5</sup> compared well-being between older Internet users and non-users, and suggested that ICT can affect the well-being of the elderly significantly and positively. Other researchers substantiated that computer usage improves the well-being of older adults using intervention studies, such as introducing computer training<sup>4,6,8</sup>. Although the benefits of ICT use seem obvious to older adults, most of these studies were hampered by methodological problems such as small sample sizes, lack of control groups and compound results with training or support effect. Therefore, Dickson and Gregor<sup>32</sup> stated that there is no empirical evidence to support the assertion that computer use alone has a positive effect on well-being among older adults.

ICT has many unique features and its own characteristics that our daily life does not have. Nevertheless, most ICT applications are developed to facilitate our daily life activities. For example, online shopping lets people do their shopping without going outside. Email is a substitute for postal mail that helps people keep in touch with their friends easily and economically. As discussed by Dickson and Gregor<sup>32</sup>, it is important to compare computer use with a similar activity that requires a comparable level of training or no training. Connectivity between ICT use experience and daily life experience is important, but there are few studies that have addressed this. Therefore,

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it is essential to examine the relationship of well-being in ICT usage and that in daily life.

Among many variables that may influence ICT usage, perceived usefulness and ease of use are two especially important determinants, with usefulness having a significantly greater correlation with ICT usage behavior than ease of use<sup>33</sup>. When people believe that using a particular ICT application will enhance their efficiency and make their lives more convenient, they may experience greater well-being by using ICT. Therefore, perceived usefulness should be considered when studying the connection between well-being in daily life and that in ICT usage.

To explore more about well-being in ICT usage, predictors of two kinds of well-being are also proposed. It is a widely shared assumption that individuals' attitudes are useful in understanding and predicting their behavior. For example, a person with positive attitudes towards computers may be more likely to choose to use computers and enjoy it more than those with very negative attitudes. A few studies have been conducted on the relationship between computer attitudes and well-being. In Karavidas, Lim and Katsikas's research<sup>7</sup>, self-efficacy helped to increase participants' overall life satisfaction. Beas and Salanova<sup>34</sup> reported that computer attitudes have a negative relationship with psychological well-being indicators (for instance, job-related anxiety and depression). Thus, computer attitudes, as a multidimensional scale, can be used as predictors of well-being in the ICT context.

The purpose of this study was to investigate the relationship between older adults' well-being in daily life activities and their corresponding ICT activities. This relationship was investigated across activities to find whether perceived usefulness influences the relationship in different ways. To further understand the two types of well-being in ICT, perceived usefulness in ICT, daily life well-being and computer attitudes were used to predict hedonic and eudaimonic well-being in ICT usage.

The first hypothesis was that older adults' well-being in ICT usage is correlated with their well-being in daily life. This correlation was expected to be moderated by their perceived usefulness of the activity. That is, if older adults consider an ICT activity useful, then their well-being in the daily life activity influences their well-being in the ICT parallel activity. If they consider an ICT activity useless, then their well-being in daily life should have no relation with their well-being in the ICT activity.

The second hypothesis was that perceived usefulness of ICT, daily life well-being and computer attitudes are predictors of both hedonic and eudaimonic well-being in ICT usage. However, the two kinds of ICT well-being are expected to be predicted by different dimensions of computer attitudes. Self-efficacy can significantly predict eudaimonic well-being in the ICT context, whereas dimensions related to affect (for instance, interest and anxiety) are predictors of hedonic well-being in ICT activities.

## METHOD

### Participants

The survey was carried out in July and August 2010. Older adults over age 60 volunteered to participate in this research in response to advertisements in regional newspapers. They were all Japanese residents living in the Tokyo metropolitan and suburban areas. We distributed 166 questionnaires and received 84 valid responses (51% valid response rate). 84 participants were aged between 61 and 86 years ( $M=73.0$ ,  $SD=5.3$ ). Of the 84 participants, 45 were males (age:  $M=73.8$ ,  $SD=5.0$ ) and 39 were females (age:  $M=72.0$ ,  $SD=5.5$ ).

### Procedure

Five daily activities and corresponding ICT activities were selected. The criterion for selection was that the older adults knew all the activities and their ICT counterparts. These five pairs of activities were shopping and online shopping, newspaper reading and online news reading, chatting and online chatting, playing games and playing

online games, and writing postal mail and writing email. A questionnaire investigating hedonic and eudaimonic well-being, perceived usefulness and computer attitudes was mailed to participants. They were asked to complete the questionnaire at their own pace and send it back to the investigators.

## Measurements

The questionnaire consisted of three parts. The first part was the PEAQ, used to investigate hedonic well-being and eudaimonic well-being of participants in provided activities. The original questionnaire<sup>19</sup> comprised two scales with six question items in each to probe the degree of hedonic well-being and eudaimonic well-being when participants were doing their personally salient activities.

Because the original statements in the PEAQ do not evoke appropriate responses from Japanese older adults, the degree of statements was changed from intensively positive to positive. For example, in the original questionnaire, the statement "This activity gives me my greatest pleasure" was changed to "This activity gives me great pleasure". To validate this modification, an additional questionnaire-based study was conducted with a different set of participants from this study. To evaluate the correlation between responses to the original PEAQ and the modified edition, 26 Japanese adults (21–76 years old,  $M=33.8$ ,  $SD=18.6$ , females 23%) were asked to evaluate four activities: two ICT activities and two daily activities, using both the original PEAQ and the modified edition. The correlations between the original and modified editions were 0.92 ( $p<0.001$ ) for hedonic well-being and 0.88 ( $p<0.001$ ) for eudaimonic well-being, suggesting that the two editions were measuring the same dimensions.

Furthermore, 1-week test-retest reliabilities were also analyzed for the modified edition. Among the 26 participants, 23 returned the questionnaire 1 week after the first test. The correlations between the first and second tests were 0.82 ( $p<0.001$ ) for hedonic well-being and 0.89 ( $p<0.001$ ) for eudaimonic well-being. These results suggested

that the modified edition had sufficient test-retest reliability when compared with 0.80 ( $p<0.0001$ ) for hedonic well-being and 0.78 ( $p<0.0001$ ) for eudaimonic well-being reported in the original study<sup>19</sup>.

Participants responded to each question item of the modified PEAQ on a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). Cronbach's alphas for hedonic well-being in five pairs of activities ranged from 0.94 to 0.98. Cronbach's alphas for eudaimonic well-being were 0.95 to 0.98.

The second part was the Perceived Usefulness Scale taken from Davis's two six-item scales for assessing user-perceived usefulness and perceived ease of computer usage<sup>33</sup>. For the present study, only the perceived usefulness section was adopted, and the descriptions of some items were modified to adapt to non-computer usage activities. For example, the original statement "Using \_\_\_\_ would make it easier to do my job" was changed to "Doing \_\_\_\_ would make it easier to live my life". Participants responded to each item on a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). In this study, Cronbach's alphas of perceived usefulness for the five pairs of activities ranged from 0.91 to 0.97.

To probe participants' computer attitudes, the last part of the questionnaire included the Attitudes Toward Computers Questionnaire (ATCQ)<sup>35</sup> and Computer Anxiety Scale (CAS)<sup>36</sup>. The ATCQ is a 35-item multidimensional scale for assessing seven dimensions of attitudes toward computers: comfort, self-efficacy, gender equality, control, dehumanization, interest and utility. Participants responded to items on a five-point Likert scale from 1 (strongly agree) to 5 (strongly disagree). Cronbach's alphas for the ATCQ were comfort (0.70), self-efficacy (0.74), gender quality (0.86), control (0.57), dehumanization (0.76), interest (0.81) and utility (0.61). The CAS is part of a 30-item, three dimensional computer attitudes scale that represents the dimension of feelings of anxiety or fear related to computers. Participants were asked to re-



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spond to each item on a four-point Likert scale from 1 (strongly agree) to 4 (strongly disagree). Cronbach's alpha for the CAS was 0.84.

## RESULTS

Table 1 summarizes the number of participants who reported their well-being in each activity. To calculate the correlations between daily life activities and their ICT counterparts, the numbers of participants doing both activities are also shown. Because there were only 11 respondents who played both traditional games and online games, this pair of activities was eliminated from the following analysis. The software used for data processing in this study was PASW Statistics 18.

## Well-being

Paired sample t-tests were conducted to examine the differences in hedonic well-being and eudaimonic well-being across all activities.

Table 1. Number of participants who reported on well-being for each activity and pairs of activity

Activity	n
Shopping	80
Online shopping	39
Shopping and online shopping	38
Newspaper reading	83
Online news reading	37
Newspaper and online news reading	37
Chatting	82
Online chatting	69
Chatting and online chatting	69
Playing games	48
Playing online games	14
Playing games and online games	11
Writing postal mail	76
Writing email	61
Writing postal mail and email	55

Table 2. Hedonic and eudaimonic well-being differences across daily life activities and corresponding ICT activities; HWB = hedonic well-being; EWB = eudaimonic well-being; \*= $p < 0.025$  (0.05/2); \*\*= $p < 0.005$  (0.01/2); \*\*\*= $p < 0.0005$  (0.001/2)

Scale	HWB		EWB		t	Cohen d
	M	SD	M	SD		
Shopping	5.16	1.14	4.44	1.06	8.47***	0.65
Online shopping	3.82	1.26	3.44	1.17	3.43**	0.31
Newspaper reading	4.84	0.92	4.34	1.08	6.48***	0.50
Online news reading	4.15	1.20	3.82	1.16	2.94*	0.28
Chatting	5.26	1.19	4.82	1.18	7.88***	0.37
Online chatting	4.53	1.29	4.16	1.40	5.31***	0.28
Writing postal mail	5.17	1.30	4.95	1.19	3.03**	0.18
Writing email	4.64	1.31	4.36	1.27	3.94***	0.22

ties. To control the type I error rate in multiple comparisons, alpha adjustments were conducted by the Bonferroni correction. In each pair, two activities were compared separately. Thus, the multiple correlations significance level was 0.025 (0.05/2).

Significant differences between hedonic and eudaimonic well-being were found in all eight activities (Table 2). The effect sizes of the differences in shopping and in newspaper reading were moderate, while all other effect sizes were small.

Next, paired sample t-tests were conducted to examine the differences in well-being between daily life activities and ICT activities in pairs: shopping and online shopping (n=38); newspaper reading and online news reading (n=37); chatting and online chatting (n=69); and paper mail and email (n=55). Alpha adjustments were also conducted by the Bonferroni correction. In each pair of activities, hedonic and eudaimonic well-being were compared separately, and thus the multiple correlations significance level was 0.025 (0.05/2). Significant differences in hedonic well-being and eudaimonic well-being were found between the daily life activity and its corresponding ICT activity in the shopping pair, news-reading pair and chatting pair. A

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Table 3. Differences in hedonic and eudaimonic well-being between pairs of daily life and ICT activities; HWB = hedonic well-being; EWB = eudaimonic well-being; \*= $p < 0.025$  (0.05/2); \*\*= $p < 0.005$  (0.01/2); \*\*\*= $p < 0.0005$  (0.001/2)

Scale		HWB		EWB		t	Cohen d
		M	SD	M	SD		
Shopping	HWB	5.06	1.07	3.80	1.27	4.93***	1.07
	EWB	4.32	1.05	3.42	1.18	3.97***	0.80
News reading	HWB	4.79	1.02	4.15	1.20	4.53***	0.57
	EWB	4.27	1.17	3.82	1.16	3.11**	0.38
Chatting	HWB	5.37	1.17	4.53	1.29	5.89***	0.68
	EWB	4.92	1.17	4.16	1.40	5.67***	0.59
Writing postal mail	HWB	5.07	1.40	4.59	1.31	2.04	0.35
	EWB	4.90	1.30	4.31	1.23	2.85*	0.46

significant difference was also found in eudaimonic well-being in the writing postal mail-email pair, while there was no significant difference in hedonic well-being (Table 3). Overall, older adults felt greater hedonic and eudaimonic well-being in daily life activities compared with the ICT counterparts. There were rather large differences in means for the two types of well-being between shopping and online shopping, while the difference was moderate in the news-reading pair and chatting pair. The difference in eudaimonic well-being for the writing postal mail-email pair was also moderate.

## Well-being in correlated activities

A series of correlation analyses on well-being scores were conducted between daily life activities and their ICT counterparts. To control the type I error rate in multiple correlations,

Table 4. Pearson's correlation coefficients of hedonic (HWB) and eudaimonic (EWB) well-being for news reading activities that showed a significant correlation between the daily life activity and its ICT counterpart;  $n=37$ ; \*\*= $p < 0.002$  (0.01/6)

		Newspaper reading		Online news reading	
		HWB	EWB	HWB	EWB
News-paper reading	HWB	1.00			
	EWB	0.79**	1.00		
Online news reading	HWB	0.72**	0.58**	1.00	
	EWB	0.68**	0.72**	0.83**	1.00

alpha adjustments were conducted by the Bonferroni correction. There were six correlation calculations for each pair of activities. Thus, the multiple correlations significance level chosen was 0.008 (0.05/6).

As a result of correlation analyses, two different types of activities appeared. One group was pairs of activities that showed a significant correlation

between the daily life activity and its counterpart. They were newspaper reading and online news reading, and chatting and online chatting. The other group was two pairs of activities for which no correlation was found in well-being scores between the daily life activity and corresponding ICT activity. They were shopping and online shopping, and writing postal mail and email. For all activities, hedonic well-being and eudaimonic well-being for the same activity were significantly correlated.

In the news-reading pair, hedonic well-being in newspaper reading was correlated with that in online news reading, and eudaimonic well-being in this pair was also correlated. Hedonic well-being in newspaper reading was correlated with eudaimonic well-being in online news reading, and hedonic well-being in online news reading was correlated with eudaimonic well-being in newspaper reading (Table 4). In the chatting pair, hedonic well-being in chatting face to face was significantly correlated with that in online chatting, and eudaimonic well-being in this pair of activities was also correlated. Hedonic well-being in chatting face to face was significantly correlated with eudaimonic well-being in online chatting, and hedonic well-being in online chatting was significantly correlated with eudaimonic well-being in chatting as well (Table 5).

On the other hand, there were no correlations between hedonic well-being scores and eu-

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Table 5. Pearson's correlation coefficients of hedonic (HWB) and eudaimonic (EWB) well-being for chatting activities that showed a significant correlation between the daily life activity and its ICT counterpart;  $n=69$ ;  $**=p<0.002$  (0.01/6)

		Chatting		Online chatting	
		HWB	EWB	HWB	EWB
Chatting	HWB	1.00			
	EWB	0.90**	1.00		
Online chatting	HWB	0.54**	0.60**	1.00	
	EWB	0.48**	0.64*	0.91**	1.00

daimonic well-being scores for the daily life activity and ICT corresponding activity in the shopping pair and writing mail pair for the entire sample. Therefore, the sample was divided into two subgroups for further analysis. Perceived usefulness was used as the criterion for grouping. The first group was defined as the participants whose perceived usefulness scores were greater than four (the center value of the score), and will be referred to as the High Perceived Usefulness (HPU) group. They considered ICT activity useful. The other group was defined as participants whose perceived usefulness scores were equal or less than four and will be referred to as the Low Perceived Usefulness (LPU) group. They perceived that ICT activity is less useful.

Table 6. Pearson's correlation coefficients of hedonic (HWB) and eudaimonic (EWB) well-being for shopping activities that overall showed no significant correlation between the daily life activity and its ICT counterpart, but are now divided between perceived high and low usefulness;  $*=p < 0.008$  (0.05/6),  $**=p<0.002$  (0.01/6)

		Shopping		Online shopping	
		HWB	EWB	HWB	EWB
Perceived high usefulness (n=25)					
Shopping	HWB	1.00			
	EWB	0.76**	1.00		
Online shopping	HWB	0.37	0.57*	1.00	
	EWB	0.24	0.46	0.80**	1.00
Perceived low usefulness (n=13)					
Shopping	HWB	1.00			
	EWB	0.80**	1.00		
Online shopping	HWB	-0.72*	-0.54	1.00	
	EWB	-0.58	-0.26	0.81**	1.00

In the online shopping HPU group, hedonic well-being in online shopping was significantly correlated with eudaimonic well-being in shopping. No significant correlations in hedonic well-being or eudaimonic well-being scores between shopping and online shopping were found. On the other hand, in the online shopping LPU group, hedonic well-being in online shopping was negatively related to that in shopping. No significant correlation in eudaimonic well-being scores between online shopping and shopping was found (Table 6).

In the email 'Useful' group, eudaimonic well-being was significantly correlated between writing postal mail and writing email activities. No significant correlation was found in hedonic well-being between writing postal mail and writing email. In the email 'Less useful' group, no significant correlation was found in well-being scores between writing postal mail and writing email (Table 7).

## Predictors of ICT well-being

Older adults' daily life well-being, perceived usefulness of ICT and computer attitudes were examined as predictors of ICT well-being. In this study, well-being scores of

Table 7. Pearson's correlation coefficients of hedonic (HWB) and eudaimonic (EWB) well-being for mailing activities that overall showed no significant correlation between the daily life activity and its ICT counterpart, but are now divided between perceived high and low usefulness;  $**=p<0.002$  (0.01/6)

		Postal mail		Email	
		HWB	EWB	HWB	EWB
Perceived high usefulness (n=41)					
Postal mail	HWB	1.00			
	EWB	0.94**	1.00		
Email	HWB	0.31	0.38	1.00	
	EWB	0.41	0.49**	0.92**	1.00
Perceived low usefulness (n=14)					
Postal mail	HWB	1.00			
	EWB	0.94**	1.00		
Email	HWB	0.10	0.29	1.00	
	EWB	-0.22	-0.08	0.81**	1.00



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participants were measured in four pairs of daily life and their corresponding ICT activities. The scores for ICT hedonic well-being (IHWB), ICT eudaimonic well-being (IEWB), ICT perceived usefulness (IPU), daily life hedonic well-being (DHWB), and daily life eudaimonic well-being (DEWB), representing all activities, were calculated. IHWB, IEWB and IPU were the sum of hedonic well-being scores, the sum of eudaimonic well-being scores and the sum of perceived usefulness in the four ICT activities, respectively. DHWB was the sum of hedonic well-being scores, and DEWB was the sum of eudaimonic well-being scores in four corresponding daily activities.

Given that the content of the ATCQ and CAS are overlapping, four composite variables were employed based on the results of factor analysis on the ATCQ and CAS by Czaja and colleagues<sup>37</sup>. The four composite variables were general computer attitudes, anxiety, self-efficacy and interest. The general

computer attitudes score was the average of the dehumanization (reversely scored), utility and control scales. The anxiety scale was the average of scores of the CAS and reversed comfort scale. Self-efficacy and interest were left as separate variables. Because the Likert scales for items of the ATCQ and CAS were different, the z score was computed for each item.

Daily life well-being (DHWB and DEWB), four composite computer attitude variables and IPU were employed as independent variables to predict IEWB by stepwise regression. Because of the high correlation between DHWB and DEWB ( $r=0.90$ ,  $n=77$ ,  $p<0.001$ ), two models, one with DHWB and the other with DEWB as the independent variable, were built. Beside the daily life well-being variables, both final models included IPU and self-efficacy (Table 8). IPU, DEWB and self-efficacy significantly predicted IEWB. IPU resulted in a significant increment in  $R^2$  of 0.901, while DEWB resulted in a significant increment in  $R^2$  of 0.012. Self-efficacy also resulted in a significant increment in  $R^2$  of 0.005.

In a similar way, IPU, DHWB and self-efficacy also significantly predicted IEWB. IPU resulted in a significant increment in  $R^2$  of 0.901, while DHWB resulted in a significant increment in  $R^2$  of 0.005. Self-efficacy also resulted in a significant increment in  $R^2$  of 0.003.

Next, IHWB was predicted with daily life well-being (DHWB and DEWB), four composite computer attitude variables and IPU as independent variables by stepwise regression. Because of the high correlation between DHWB and DEWB, again two models were examined, one with DHWB and the other with DEWB. Beside the daily life well-being variables, both final models included IPU (Table 8). IPU and DHWB significantly predicted IHWB. IPU resulted in a significant increment in  $R^2$  of 0.910; DHWB resulted in a significant increment in  $R^2$  of 0.006. In a similar way, IPU and DEWB significantly predicted IHWB. IPU resulted in a

Table 8 Final multiple regression models of ICT eudaimonic (IEWB) and hedonic well-being (IHWB); IPU = ICT perceived usefulness; DEWB = daily life eudaimonic well-being; DHWB = daily life hedonic well-being;  $n=77$ ; \* =  $p<0.05$ ; \*\*= $p<0.01$ ; \*\*\*= $p<0.001$

Variable	B	SE B	$\beta$
<b>IEWB: <math>R^2=0.92</math>; <math>F(3,73)=280.03</math>, <math>p&lt;0.001</math></b>			
IPU	0.83	0.03	0.93***
DEWB	0.16	0.05	0.12**
Self-efficacy	0.43	0.20	0.08*
Constant	-2.02	0.88	
<b>IEWB: <math>R^2=0.91</math>; <math>F(3,73)=255.46</math>, <math>p&lt;0.001</math></b>			
IPU	0.84	0.03	0.93***
DHWB	0.11	0.05	0.08*
Self-efficacy	0.41	0.21	0.07*
Constant	-1.37	0.99	
<b>IHWB: <math>R^2=0.92</math>; <math>F(2,74)=412.74</math>, <math>p&lt;0.001</math></b>			
IPU	0.90	0.03	0.95***
DHWB	0.11	0.05	0.08*
Constant	-1.34	1.00	
<b>IHWB: <math>R^2=0.91</math>; <math>F(2,74)=404.63</math>, <math>p&lt;0.001</math></b>			
IPU	0.90	0.03	0.95***
DEWB	0.10	0.05	0.07*
Constant	-0.90	0.94	

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significant increment in  $R^2$  of 0.910; DEWB resulted in a significant increment in  $R^2$  of 0.004.

These results of regression analysis suggest that hedonic and eudaimonic well-being, along with perceived usefulness of ICT, can predict hedonic and eudaimonic well-being when older adults use ICT. For eudaimonic well-being, computer self-efficacy might also predict older adults' ICT well-being.

## DISCUSSION

Oron-Gilad and Hancock<sup>38</sup> posited that the trend in human factor development is from ergonomics to hedonomics. Umemuro<sup>39</sup> suggested that technology should be designed considering affective experiences it might provide its users. Therefore it is important to understand positive experiences in ICT usage from a more comprehensive view, including both hedonic and eudaimonic aspects of well-being. In addition, to improve older adults' well-being, it is necessary to connect well-being in their daily lives with well-being in the ICT context. The objectives of this research were to investigate whether hedonic and eudaimonic well-being in daily life activities correlates with those in ICT corresponding activities, and investigate whether perceived usefulness, daily life well-being and computer attitudes can predict both types of well-being in ICT.

The results indicated that in all activities, older adults' hedonic well-being was greater than their eudaimonic well-being. Furthermore, in all pairs of daily and ICT activities, older adults' well-being in daily life activities was greater than their well-being in the ICT counterparts. Though many studies have shown that by using ICT older adults' well-being can be improved, it is nevertheless true that older adults still consider the Internet as second place to the real world in accomplishing daily tasks<sup>40</sup>.

One of the major findings of this study was the correlation of well-being between ICT activities and daily life counterparts. In online news reading and online chatting, well-

being in the ICT context was significantly correlated with that in the daily life counterpart. On the other hand, in online shopping and email, the relation between older adults' well-being in ICT activities and that in daily activities was moderated by their perceived usefulness of the ICT activities. In either case, older adults' hedonic and eudaimonic well-being in ICT usage were correlated with their daily life activities. These findings may help researchers review the relationship between computer usage and older adults' well-being from a new perspective. To improve the well-being of older adults in ICT usage, it is necessary to make use of their daily life experiences, for example, by appropriately designing systems that can better simulate and connect with their daily life experiences.

An unexpected finding was the different correlation patterns across various activities. One possible explanation is that complexity of ICT activities and participants' perceived usefulness might influence the relationship of well-being between ICT usage and daily life. Therefore, in ICT activities that are less complicated, such as online news reading and online chatting, older adults might be able to connect their well-being in daily life directly with that in ICT usage, whatever their perceived usefulness. Meanwhile, in more complicated ICT activities, such as online shopping and writing email, only older adults who perceive ICT activity as useful might be able to connect their well-being in ICT with that of daily life.

The other unexpected result of this study was related to online shopping. For older adults who perceived that online shopping is not useful, there was a negative correlation between hedonic well-being in online shopping and that in daily life shopping. A possible explanation for this is that those who perceive online shopping as useful can enjoy not only the fun but also the convenience of such shopping. Those who perceive online shopping as useless, on the other hand, could be very concerned about the risks involved. The more they experience well-being from shopping, the more

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concerned they are about online shopping. As one participant explained, "It is risky to shop online by just checking catalogs".

To further analyze the property of well-being in ICT usage, multiple stepwise regressions were calculated with IPU, computer attitudes and daily life well-being as independent variables. The results showed that IHWB could be predicted by IPU and daily life well-being. In addition, IEWB was predicted by IPU, daily life well-being and self-efficacy. This finding suggests that older adults' daily life well-being can be used to predict their well-being in ICT usage, though perceived usefulness of ICT activities was the dominant predictor of ICT well-being.

Another finding is that beside ICT usefulness and daily life well-being, self-efficacy predicted IEWB, but did not predict hedonic well-being. A possible explanation is that older adults with higher self-efficacy can use ICT without obstacles or frustrations, facilitating increased competence in ICT use. Competence, considered one factor of IEWB, leads to an increase in IEWB. Because eudaimonic well-being is closely related to achievement, competence in using ICT for a longer term might have a significant influence on such well-being. Because IHWB focuses only on the affect aspect of well-being in the short term, self-efficacy might have a smaller influence on the short term periods. This suggests that hedonic and eudaimonic well-being in the ICT context are two different aspects of well-being. In our study, interest and anxiety were hypothesized as predictors of IHWB. The reason they did not remain in the final regression model could be the multicollinearity between IPU and these two dimensions of computer attitudes.

This study represents a preliminary effort to examine the correlation of well-being in daily life activities and ICT activities. The following issues are limitations that should be addressed in future research.

First, only results from older adults who were engaged in both daily life activity and ICT

activity were used in the analyses. It is likely that the sample was representative of only a part of older adults who are familiar with ICT, that is, those who are well-functioning volunteers with positive attitudes towards research. Thus, it may not be appropriate to generalize the results to the older population in general, especially to those who have less experience with new ICT activities. In addition, because young people may be different from older adults in terms of ICT usage, it would be of value to conduct a comparative study to examine whether such relationships also exist for younger generations, and whether they are related to age differences between older adults and young people.

Second, hedonic well-being and eudaimonic well-being were highly correlated. Instead of asking participants to recall their experiences, it might be more appropriate to study real time experiences with methods such as ESM. If ratings of well-being had been made when participants were actually engaged in the different activities, the correlation between hedonic and eudaimonic well-being might have been different. In addition, prior studies have indicated that the two types of well-being can be distinguished in terms of their associations with a substantial number of measures. In this research, although some predictors of well-being in ICT usage were proposed, other variables should be examined in future studies. Some researchers<sup>7</sup> have reported that self-realization values and activity importance are more useful variables in predicting eudaimonic well-being compared with hedonic well-being, and should be employed in future research.

Third, although this research demonstrated that older adults' well-being in ICT activities is connected with their well-being in daily activities, a causal relationship between them was not clear. Further research should be done to determine the causal relationship of well-being between daily life activities and ICT activities.

Finally, perceived usefulness was revealed as a predictor of ICT well-being in this study.

However, there still remains the issue of perceived usefulness of non-functional ICT activities such as games. Although the activity pair of games and online games was excluded from the analysis in this study, whether perceived usefulness would still determine well-being related to online games is questionable. Nowadays computer games can be an effective way to enhance older adults' well-being. Telecare systems are frequently

used for game playing by older people. In addition, advanced play devices are heavily promoted for older people as a way to get physical exercise. These 'fun' technologies may be considered different in nature from more practical ICT uses such as those investigated in this study. Whether the same predictors still hold for games and play or if new variables should be proposed should be studied in future research.

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## References

1. O'Hara K. Curb cuts on the information highway: Older adults and the Internet. *Technical Communication Quarterly* 2004;13(4):423-445; doi:10.1207/s15427625tcq1304\_4
2. Bernard M, Phillips J. The challenge of ageing in tomorrow's Britain. *Ageing and Society* 2000;20(1),33-54
3. Joshanloo M, Ghaedi G. Value priorities as predictors of hedonic and eudaimonic aspects of well-being. *Personality and Individual Differences* 2009;47:294-298; doi:10.1016/j.paid.2009.03.016
4. Shapira N, Barak A, Gal I. Promoting older adults' well-being through internet training and use. *Ageing & Mental Health* 2007;11(5):477-484; doi:10.1080/13607860601086546
5. Chen Y, Persson A. Internet use among young and older adults: Relation to psychological well-being. *Educational Gerontology* 2002;28(9):731-744; doi:10.1080/03601270290099921
6. Straka SM, Clark F. Connections: Internet access for frail older seniors to improve their psychological well-being; [www.aging.mcgill.ca/pdf/conn\\_proj\\_e.pdf](http://www.aging.mcgill.ca/pdf/conn_proj_e.pdf); retrieved June 2011
7. Karavidas M, Lim NK, Katsikas SL. The effects of computers on older adult users. *Computers in Human Behavior* 2005;21(5):697-711; doi:10.1016/j.chb.2004.03.012
8. White H, McConnell E, Clipp E, Branch LG, Sloane R, Pieper C, Box T. A randomized controlled trial of the psychosocial impact of providing Internet training and access to older adults. *Ageing & Mental Health* 2002;6(3):213-221; doi:10.1080/13607860220142422
9. Seligman MEP, Csikszentmihalyi M. Positive psychology: An introduction. *American Psychologist* 2000;55(1):5-14; doi:10.1037/0003-066X.55.1.5
10. Wyller TB, Thommessen B, Sødving KM, Sveen U, Pettersen AM, Bautz-Holter E, Laake K. Emotional well-being of close relatives to stroke survivors. *Clinical Rehabilitation* 2003; 17(4):410-417; doi:10.1191/0269215503cr627oa
11. McDaid D, Curran C, Knapp M. Promoting mental well-being in the workplace: A European policy perspective. *International Review of Psychiatry* 2005;17(5):365-373; doi:10.1080/09540260500238397
12. Diener E, Suh EM, Lucas RE, Smith HL. Subjective well-being: Three decades of progress. *Psychological Bulletin* 1999;125(2):276-302; doi:10.1037/0033-2909.125.2.276
13. Keyes CLM. Social well-being. *Social Psychology Quarterly* 1998;61(2):121-140; doi:10.2307/2787065
14. Ryan RM, Deci EL. On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology* 2001;52:141-166; doi:10.1146/annurev.psych.52.1.141
15. Kraut R. Two conceptions of happiness. *The Philosophical Review* 1979;88(2):167-197
16. Diener E. Subjective well-being. *Psychological Bulletin* 1984;95(3):542-575; doi:10.1037/0033-2909.95.3.542
17. Haybron DM. Philosophy and the science of subjective well-being. In: Eid M, Larsen RJ, editors. *The science of subjective well-being*. New York: The Guilford Press; 2008; pp 17-43
18. Waterman AS, Schwartz SJ, Conti R. The implications of two conceptions of happiness (hedonic enjoyment and eudaimonia) for the understanding of intrinsic motivation. *Journal of Happiness Studies* 2008;9(1):41-79; doi:10.1007/s10902-006-9020-7



# Older adults' well-being and ICT

19. Waterman AS. Two conceptions of happiness: Contrasts of personal expressiveness (eudaimonia) and hedonic enjoyment. *Journal of Personality and Social Psychology* 1993;64(4):678-691; doi:10.1037/0022-3514.64.4.678
20. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist* 2000;55(1):68-78; doi:10.1037/0003-066X.55.1.68
21. Ryff CD. Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology* 1989;57(6):1069-1081; doi:10.1037/0022-3514.57.6.1069
22. Ryff CD, Keyes CLM. The structure of psychological well-being revisited. *Journal of Personality and Social Psychology* 1995;69(4):719-727; doi:10.1037/0022-3514.69.4.719
23. Jordan P. *Designing pleasurable products: An introduction to the new human factors*. London: Taylor & Francis; 2000
24. Brandtzæg P, Følstad A, Heim J. Enjoyment: Lessons from Karasek. In: Blythe MA, Monk AF, Overbeeke K, Wright PC, editors. *Funology: From Usability to Enjoyment*; New York: Springer; 2005; pp 55-65; doi:10.1007/1-4020-2967-5\_6
25. Hassenzahl M. The thing and I: Understanding the relationships between user and product. In: Blythe MA, Monk AF, Overbeeke K, Wright PC, editors. *Funology: From Usability to Enjoyment*. New York: Springer; 2005; pp 31-42; doi:10.1007/1-4020-2967-5\_4
26. Hassenzahl M. The interplay of beauty, goodness, and usability in interactive products. *Human-Computer Interaction* 2004;19(4):319-349; doi:10.1207/s15327051hci1904\_2
27. Slegers K, Bostel MPJ, van, Jolles J. Effects of computer training and Internet usage on the well-being and quality of life of older adults: a randomized, controlled study. *Journal of Gerontology: Psychological Sciences and Social Sciences* 2008;63(3):176-184
28. DeNeve KM. Happy as an extraverted clam? The role of personality for subjective well-being. *Current Directions in Psychological Science* 1999;8(5):141-144; doi:10.1111/1467-8721.00033
29. Csikszentmihalyi M, Larson R, Prescott S. The ecology of adolescent activity and experience. *Journal of Youth and Adolescence* 1977;6(3):281-294; doi:10.1007/BF02138940
30. Waterman AS. Finding someone to be: Studies on the role of intrinsic motivation in identity formation. *Identity: An International Journal of Theory and Research* 2004;4(3):209-228; doi:10.1207/s1532706x-id0403\_1
31. Blit-Cohen E, Litwin H. Elder participation in cyberspace: A qualitative analysis of Israeli retirees. *Journal of Aging Studies* 2004;18(4):385-398; doi:10.1016/j.jaging.2004.06.007
32. Dickinson A, Gregor P. Computer use has no demonstrated impact on the well-being of older adults. *International Journal of Human-Computer Studies* 2006;64(8):744-753; doi:10.1016/j.ijhcs.2006.03.001
33. Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly* 1989;13(3):319-340
34. Beas MI, Salanova M. Self-efficacy beliefs, computer training and psychological well-being among information and communication technology workers. *Computers in Human Behavior* 2006;22(6):1043-1058; doi:10.1016/j.chb.2004.03.027
35. Jay GM, Willis SL. Influence of direct computer experience on older adults' attitudes toward computers. *Journal of Gerontology* 1992;47(4):250-257
36. Loyd BH, Gressard C. Reliability and factorial validity of computer attitude scales. *Educational and Psychological Measurement* 1984;44(2):501-505; doi:10.1177/00131644844442033
37. Czaja SJ, Charness N, Fisk AD, Hertzog C, Nair SN, Rogers WA, Sharit J. Factors predicting the use of technology: Findings from the center for research and education on aging and technology enhancement (CREATE). *Psychology and Aging* 2006;21(2):333-352; doi:10.1037/0882-7974.21.2.333
38. Oron-Gilad T, Hancock PA. From ergonomics to hedonomics: trends in human factors and technology. In: Amichai-Hamburger Y, editor. *Technology and psychological well-being*. New York: Cambridge University Press; 2009; pp 131-147
39. Umemuro H. Affective technology, affective management, towards affective society. *LNCS* 2009;5612:683-692; doi:10.1007/978-3-642-02580-8\_75
40. Fallows D. *The Internet and daily life*. Washington; www.pewinternet.org/~/media/Files/Reports/2004/PIP\_Internet\_and\_Daily\_Life.pdf; retrieved June 2011