

Issues of Devices and Applications for Supporting Walking in Older People

- Focus on the Information Provision

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Abstract

Japan has become a super-aging society, with the number of older people (over the age of 65) at a historical high both in absolute numbers (33 million) and as a proportion of the total population (26.0%). Walking is known to be associated with positive psychological improvements such as in subjective sense of wellbeing, life satisfaction, and a sense of purpose in life, as well as improvements in physical and mental function, such as arm/leg muscle strength and standing balance. In this study, we focus on information about functions for assisting walking, comparing and contrasting the information provided by existing products that support walking with the goal of clarifying issues from an information-provision viewpoint. We conducted interviews with eight older people who go for walks on a daily basis, asking about their thoughts before, during, and after walking. From 110 total comments, we obtained 30 comments relating to the action of walking. Furthermore, we investigated the functions of 11 devices and 20 applications that support walking, and from 24 functions, we focused on 20 functions relating to the action of walking. By comparing and contrasting the twin perspectives of “information items” and “information content” with visualization levels identified in the field of management, we clarified issues relating to devices and applications for supporting walking among older users, from the viewpoint of information provision.

Keywords: Walking, Older people, Healthcare, Device, Application, Information provision

Japan has become a super-aging society, with the number of older people (over the age of 65) at a historical high both in absolute number (33 million) and as a proportion of the total population (26.0%), where one in four individuals is elderly (Director General for Policy on the Aging Society, Japan Cabinet Office. 2015). As part of the aging process in people, a certain degree of deterioration in physical performance is inevitable. However, it is essential to minimize the degree of functional decline and maintain the ability to engage in daily activities without hindrance, and these are urgent topics in the era of the super-aging society (Kawakami, et al., 2004). For older people, exercise is essential to maintaining good health. According to a Ministry of Education, Culture, Sports, Science and Technology survey (Ministry of Education, Culture, Sports, Science and Technology. 2013), the majority of people over the age of 60 replied “walking” in response to questions about the kinds of exercise they had performed in the previous twelve months, and the kinds of exercise that they would like to perform in future. Moreover, walking is known to be associated with positive psychological improvements, such as a subjective sense of wellbeing, life satisfaction

and a sense of purpose in life, as well as improvements to physical and mental functioning, such as arm and leg muscle strength and standing balance (Murata, et al., 2009).

A wide range of products to assist walking have come onto the market in recent years, but relatively few have been targeted at older people. Accordingly, in this study we focus on information (Jouhou, n.d.) about the functions for assisting walking, comparing and contrasting the information provided for existing products that support walking with the goal of clarifying issues from an information-provision viewpoint.

1. Viewpoint of this study

In this study, we take “walking” to be an activity directed at a certain goal or ideal, focusing on the number of steps taken or the distance walked, for example. Thus, we carried out the research described below with reference to the visualization levels that have been identified in previous work in the management field (Miyazaki, et al., 2006).

These visualization levels are as follows (Figure 1). (1) Making the current situation visible, (2) making their goal visible, (3) the gap (or deviation) between the goal and the current situation, (4) establishing a specific action to reach the goal, and (5) making the progress toward the goal in the process of the activity visible. These levels are abbreviated below as (1) “current state,” (2) “goal,” (3) “gap,” (4) “action” and (5) “progress.”

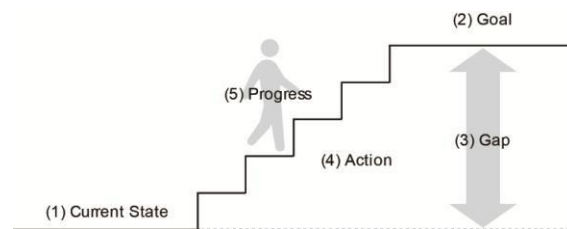


Figure 1: Visualization levels

2. Information required by older people

2.1 Investigation

Between October 2015 and January 2016, we conducted interviews with eight older people (Table 1) who go for walks on a daily basis, asking about their thoughts before, during and after walking.

Table 1: List of subjects

Subject No.	Gender	Age	Walking course	Place	Date and time
A	Female	67	Park near her house	Fukutsu city	October 31, 2015, 4 pm–5 pm
B	Male	70	Around his house	Iizuka city	October 11, 2015, noon–1 pm
C	Male	87	Around his house	Kitakyushu city	November 3, 2015, 2 pm–3 pm
D	Male	73	Around his house	Koga city	November 23, 2015, 10 am–11 am
E	Male	67	Park near his house	Koga city	November 23, 2015, noon–1 pm
F	Male	68	Park near his house	Fukuoka city	November 23, 2015, 1 pm–2 pm
G	Male	66	Park near his house	Fukuoka city	January 8, 2016, 6 am–7 am
H	Female	60	Around her house	Fukuoka city	January 9, 2016, 2 pm–4 pm

2.2 Results

From these interviews, we obtained a total of 110 comments from the eight survey participants (Table 2). We classified comments into three categories according to content: 1) 30 comments relating to the action of walking, such as “I wonder how far I’ve walked so far (A17)”, “I’m very thirsty (C7)”, “I walked well today, as usual (D11)”, “I should weigh myself and check the result of today’s walking (F17)” and “When I’s cold, my heart and lungs get tired (H8)” ; 2) 35 comments relating to the circumstances surrounding the walk, such as “Tomorrow I might walk when it’s a bit cooler (B13)” ; and 3) 45 comments not directly related to walking, such as “I’m all sweaty. I’m going to have a shower (E15)” and “Let’s buy breakfast and go home (G5)”.

Accordingly, we decided to focus our subsequent considerations on the 30 comments related to the action of walking, as comments in alignment with the viewpoint of the study: walking as “an action directed at a certain goal or ideal.”

Table 2: Number and examples of the comment

Subject	Number of comments	Example comment
A	18	I wonder how far I've walked so far (No.17).
B	16	Tomorrow I might walk when it's a bit cooler (No.13).
C	13	I'm very thirsty (No.7).
D	12	I walked well today, as usual (No.11).
E	15	I'm all sweaty. I'm going to have a shower (No.12).
F	19	I should weigh myself and check result of the walking (No.17).
G	8	Let's buy breakfast and go home (No.5).
H	9	When it's cold, my heart and lungs get tired (No.8).
Total	110	

2.3 Required information items and information content

Within the 30 comments selected, we first examine which information items were required by the survey participants. Considering comment A17 (“I wonder how far I’ve walked so far”),

for example, three possible information items are “number of steps,” “walking distance,” and “walking time.” We considered each of the other 29 comments using the same approach. Doing this allowed us to extract seven types of information item, which we broadly divided into items related to walking and items related to the body (the left-hand side of Table 3). Next, we examined the information content required by the survey participants. Considering the three information items (number of steps, walking distance and walking time) listed above for comment A17 (“I wonder how far I’ve walked so far”), for example, the information content is likely to be “the situation up until that point in time.” We considered each of the other 29 comments using the same approach. We were able to extract six types of information content (the right-hand side of Table 3).

Table 3: Required information items and information contents

Information itmes		Information contents				
Walking	Number of steps	Current status	Target figure	Difference from target	Arrival	
	Distance walked	Current status	Target figure	Difference from target	Arrival	
	Time walked	Current status				
Body	Calories burned	Current status	Target figure	Difference from target	Efficient	
	Heart rate	Current status	Target figure	Difference from target	Efficient	Safe condition
	Hydration	Current status				
	Blood pressure	Current status				

3. Information provided by existing products

3.1 Investigation

Products that support walking can be classified into two types: dedicated devices and smartphone apps. The sample products for this investigation were chosen by conducting a web search with the keywords “walking & device” and “walking & app” and selecting the 11 devices listed in Table 4 and the 20 apps listed in Table 5. We then investigated the functions of these devices and applications.

Table 4: List of devices

PULSESENSE PS-500B	FuelBand SE	MOVEBAND® 2	UP2
SmartBand Talk	miCoach Fit Smart	Flex	vivofit
MIO Alpha	SmartBand SWR10	WistableGPS	

Table 5: List of applications

Pedometer for M7 Steps	Runmeter GPS Pedometer	Walker	RunKeeper
Pedometer +	The Walking Collector	Walkr	Hosukei
Pedometer Pro Runner	Pedometer POPOPO	WalkPlanner	My Tracks
Manpokei-Sanpohosukeisoku	Sanpokei GPS	OHFUKU	Sanpo no Tomo
Application for Calories burned calculation	Moves	Kyorisoku	Sanpo

3.2. Results

As a result of this investigation, we were able to identify 22 device functions and 23 app functions. Grouping similar functions, we classified functions into 24 different categories, including functions that measure how many steps have been taken so far (step counters) and functions that measure how far one has walked (distance trackers). See Table 6 for these. Looking at these results, it appears that functions can be classified into (A) functions relating to the action of walking (20 functions, such as step counters) and (B) functions relating to the circumstances surrounding walking (4 functions, such as setting up courses).

Accordingly, we decided to focus on the 20 functions in the (A) category (functions relating to the action of walking), which agrees with the viewpoint of this study as outlined earlier, namely, walking as “an activity directed at a certain goal or ideal.”

Table 6: 24 functions

Count steps	Set step goals	Manage step goals	Notification of milestones for step count
Distance measurement	Set distance goals	Manage distance goals	Notification of milestones for distance
Time measurement	Set time goals	Manage time goals	Setting up courses
Calorie measurement	Set calorie goals	Manage calorie goals	Notification of milestones for calories burned
Heart rate measurement	Set heart rate goals	Calorie-burning zone	Pace measurement
Set pace	Ranking	Notes	Post to social media

3.3. Available information items and information content

We started by considering what information items are provided by each of these functions. For functions such as “count steps,” “set step goal,” “manage step goals” and “notify of milestones in step count,” for example, we regard the information item as “number of steps.” We considered each of the other 16 functions using the same approach. As a result, we were able to extract 5 types of information items, broadly divided into items related to walking and items related to the body (the left-hand side of Table 7).

Next, we examined the information content provided by each function. Considering the “number of steps” item for the “count steps” function, for example, we regard the information content to be “the situation up until this point in time.” We considered each of the other 19 functions using the same approach. We were able to extract 5 types of information content (the right hand side of Table 7).

Table 7: Available information items and information contents

Information Items		Information contents				
Walking	Number of steps	Current status	Target	Difference from target	Arrival	
	Distance walked	Current status	Target	Difference from target	Arrival	
	Time walked	Current status	Target	Difference from target	Arrival	
Body	Calories burned	Current status	Target	Difference from target	Arrival	Efficient
	Heart rate	Current status	Target	Difference from target		Efficient

4. Analysis based on visualization levels

4.1 Connection between the information required by elderly users and visualization levels From the results of section 2, we organized the connections between information items and information content by assigning them to visualization levels.

The results are summarized in Table 8. We found that under the category of information items related to walking, the “number of steps” and “distance walked” items correspond to all levels other than (4) “action,” whereas “walking time” only corresponds to (1) “current state.”

Similarly, under the category of information items related to the body, “pulse rate” corresponds to all five levels and “calories burned” corresponds to all levels other than (5) “progress,” whereas “blood pressure” and “hydration” only correspond to level (1) “current state.” Thus, we found that the visualization levels for the information required by older users varies considerably depending on the information item.

Table 8: Connection between the information required by elderly users and visualization levels

Information itmes		Visualization levels				
		(1) Current status	(2) Goal	(3) Gap	(4) Action	(5) Progress
Walking	Number of steps	Current status	Target	Difference from target		Arrival
	Distance walked	Current status	Target	Difference from target		Arrival
	Time walked	Current status				
Body	Calories burned	Current status	Target	Difference from target	Efficient	
	Heart rate	Current status	Target	Difference from target	Efficient	Safe condition
	Hydration	Current status				
	Blood pressure	Current status				

4.2 Connection between the information provided by existing products and visualization levels

Based on the results of section 3, we organized the connections between information items and information content by assigning them to visualization levels.

The results are summarized in Table 9. We found that under the category of information items related to walking, the “number of steps,” “distance walked” and “walking time” items correspond to all levels other than (4) “action.” Similarly, under the category of information items related to the body, “calories burned” corresponds to all five levels and “pulse rate” corresponds to all levels other than (5) “progress.” Thus, we found apparent differences in the visualization levels for the information provided by existing products depending on the information item, but we also found that information for most visualization levels is already available.

Table 9: Connection between the information provided and visualization levels

Information items		Visualization levels				
		(1) Current state	(2) Goal	(3) Gap	(4) Action	(5) Progress
Walking	Number of steps	Current status	Target	Difference from target		Arrival
	Distance walked	Current status	Target	Difference from target		Arrival
	Time walked	Current status	Target	Difference from target		Arrival
Body	Calories burned	Current status	Target	Difference from target	Efficient	Arrival
	Heart rate	Current status	Target	Difference from target	Efficient	

4.3. Discrepancies between the information required by older users and the information provided by existing products

We compared and contrasted the information required by older users and the information provided by existing products on the basis of visualization level (Table 10).

Table 10: Discrepancies between the information required by older users and the information provided by existing products

● : Information required by older users ● : Information provided by existing products

Information items		Visualization levels				
		(1) Current state	(2) Goal	(3) Gap	(4) Action	(5) Progress
Walking	Number of steps	●	●	●	—	●
		●	●	●	—	●
	Distance walked	●	●	●	—	●
		●	●	●	—	●
	Time walked	●	—	—	—	—
		●	●	●	—	●
Body	Calories burned	●	●	●	●	—
		●	●	●	●	●
	Heart rate	●	●	●	●	●
		●	●	●	●	—
	Blood pressure	●	—	—	—	—
		—	—	—	—	—
	Hydration	●	—	—	—	—
		—	—	—	—	—

Under the category of information items related to walking, for the “number of steps” and “distance walked” items we found that functions satisfying the visualization levels for information required are already available. In contrast, for walking time the functions available have information visualization levels that exceed the needs of those we interviewed, and so instructions on how to use these functions may be needed.

Under the category of information items related to the body, we found that for the “calories burned” item, the functions already available have information visualization levels beyond the needs of our interviewees. In contrast, for the “heart rate,” “blood pressure” and “hydration”

items, functions providing the information visualization levels required by older users are not yet available and such functions should be added. In particular, the functions for “blood pressure” and “hydration” do not meet the very basic visualization level of (1) current state, and we believe that such functions should be added as a matter of urgency.

5. Conclusion

This study focused on walking by older people, using the twin perspectives of “information items” and “information content” to organize the information required by older people and the information provided by existing products. By comparing and contrasting these perspectives with visualization levels, we have been able to clarify issues relating to products for supporting walking by older people from the viewpoint of information provision. Future challenges may include the need to increase the number of survey participants and conduct additional surveys in different seasons. This work was supported by JSPS KAKENHI Grant Number JP15H01761.

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In this study, we define information as “something that notifies the content or state of a certain thing”. Moreover, in this manuscript we describe a “certain thing” as an “information item” and the “content or state” as the “information content”.
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Author Biography

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Ryoichi Tamura is an Associate Professor at the Department of Design Strategy, Faculty of Design, Kyushu University, Japan. He is also a member of the board of directors at JSSD since 2006. He holds an ME and a PhD in Engineering (Chiba University, Japan). Recently, his research scope has expanded not only product design but also service design. He has several publications in international conferences such as IASDR, KEER, ICED, ISIDC and ICServ. Now he is working on a project entitled “Study of service design to improve the quality of life of healthy elderly utilizing their daily life information”, which is supported by Japan Society for the Promotion of Science.

Yohei Ariyoshi

Yohei Ariyoshi studied service design at the School of Design, Kyushu University, and studied the needs and desirable services for older people in the graduation study on the theme of older people and walking. After graduation in 2016, he became a national civil servant, was employed as a court secretary in the accounts section in Nagasaki Domestic Relations Court, and is working to support the administration of the trials.