

G. TERLOUW (Convener). **Exergaming in gerontechnology: Moving forward.** *Gerontechnology* 2014;13(2):144; doi:10.4017/gt.2014.13.02.140.00 **Participants** H. Matsuguma (Japan), G. Terlouw (Netherlands), H.W. van Dijk (Netherlands), Y. Schikhof (Netherlands) **Issue** Exergames combine physical exercises with computer simulated environments to increase the appeal of exercise. Designing exergames for older people with and without dementia is a challenge for gerontechnology, and several variables must be taken into account. For example, exergames should be attractive to the target group, the business case has to be steady, and evidence of the intended results should be obtained. **Content** Exergames have already been introduced successfully into rehabilitation and healthcare centers for older people across different cultures, like in Japan and the Netherlands. One of the main goals of developing and using new interventions like exergaming<sup>1</sup> is trying to stimulate clients to exercise more so that they can reduce their risk of falling and improve their wellbeing. Designing and implementing exergames, suited for older people with and without dementia, is an up-and-coming issue in gerontechnology. In this paper we aim to help people understand different aspects of exergaming in gerontechnology. (i) Designing and publishing an exergame: The Rehabilium is a Japanese game that contains a stand-up exercise called a squad<sup>2</sup>. It is strongly recommended to be done in a stroke treatment guideline. The commercial version, 'Rehabilium Kiritsu-kun', was published last year and started selling for use in long-term healthcare facilities and hospitals this March. This session will give insight into how the game went from a prototype to the commercial version and presents results from a clinical trial. (ii) Designing an exergame: The design principles for a generic (situational) game will be presented. This generic game is designed for home use. In addition to the regular exercises and exercising with the Rehabilium or BITgame, this game also supports a broad range of friction resistance exercises. (iii) Testing and redesigning an exergame: The Japanese Rehabilium was introduced in healthcare for older people in the Netherlands, and was used as a prevention therapy to reduce fall risk and help its users stay physically fit. Based on prior research, a Dutch version of the Rehabilium was built: the BITgame. In the BITgame, a dashboard function with database feature was added. This dashboard function gives more insight into the amount and quality of the therapy and the performed exercises. (iv) Research on effects of exergaming: A research design to obtain evidence in dementia care and the first pilot outcomes will be presented in this session. **Structure** There will be 4 chaired oral sessions followed by Q&A and a general discussion. **Conclusion** We expect to give the audience a thorough understanding of our visions for exergaming, from design to implementation, across different cultures. We hope that this approach inspires other people to bring exergaming in gerontechnology to the next level.

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**Address:** NHL University of Applied Sciences, Leeuwarden, Netherlands

**E:** g.terlouw@nhl.nl

H. MATSUGUMA, F. HATTORI, J. KAJIWARA. **Development of a rehabilitation game to support stand-up exercise and its usability in care facilities.** *Gerontechnology* 2014;13(2):144-145; doi:10.4017/gt.2014.13.02.142.00 **Purpose** Japan has been facing an aging society with a declining birthrate and it is urgently necessary to reduce the cost for medical and nursing care. Rehabilitation training is one of the keys to resolving the situation, but it is always difficult to motivate the elderly to spontaneously engage in exercise every day. We developed the game 'Rehabilium' to help stand-up exercise, which is strongly recommended in Japanese Guidelines for the Management of Stroke<sup>1</sup>. This paper presents usability data obtained through empirical studies in care facilities. **Method** 'Rehabilium' is a game that displays a picture of a tree on the monitor. The tree grows in response to user's actual stand-up motion, which is sensed by Microsoft kinect with a variety of animations, beat voices, and cheerful music. While viewing a

monitor, users repeat standing up and sitting down on a chair until they feel fatigued. A wide range of elderly people can use this game since stand-up exercise itself is simple and effective. The exercise is applicable in all stages of stroke recovery. Using this game, we compared the maximum number of times subjects could stand up under three

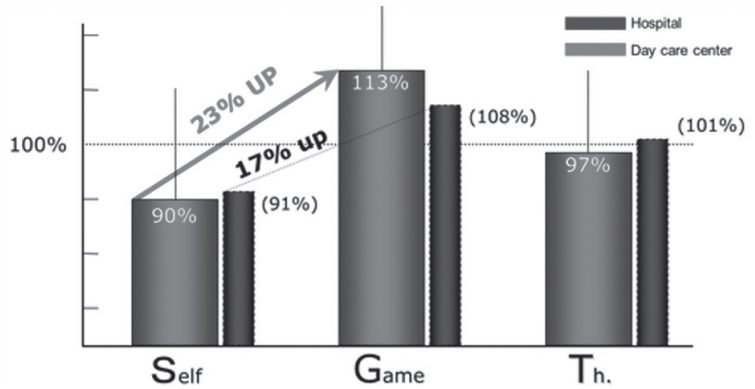


Figure 1. The comparison of average number of stand up times in the 3 conditions; Th.=Regular therapy

conditions: exercise alone, exercise using the game 'Rehabiliium', and exercise with a rehabilitation staff. We carried out this empirical study both in the hospital (n=48, Male/Female: 19/29, Age: 75.5±11.1) and the day care center (n=34, Male/Female: 8/26, Age: 80.5±10.3). **Results & Discussion** As shown in Figure 1, there was a statistically significant increase in the maximum number of stand-up times when the subjects used the game during the exercise compared to those when they did it by themselves alone. No incidents of stumbling or falling down were reported through all the process during the study. From these results, we conclude 'Rehabiliium' is a useful and safe game that helps the elderly voluntarily exercise and fulfilled nearly every role that a rehabilitation staff would perform in an equivalent manner. That shows also a possibility that it would be used effectively in elderly care facilities that are short of rehabilitation staff. This game is intended to be used only in the facilities under the assistance of care staff who advise the user's gesture properly, but more considerations need to be taken when it is used at home.

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Address: Faculty of Design, Kyushu University, Fukuoka, Japan

E: kuma@design.kyushu-u.ac.jp

G. TERLOUW, B.H. DIJKSTRA, N. ERNSTEN, A. DIJKSTRA, H. MATSUGUMA. **The bit-game, a serious exergame designed to support exercise and assess the 30-second chair stand test automatically.** *Gerontechnology* 2014;13(2):145-146; doi:10.4017/gt.2014.13.02.141.00 **Purpose**

Exercising and staying physically active are important factors that can contribute to healthy aging and reduce the chance of falling, a major problem for older people around the world. Exergames have already been introduced successfully to improve the appeal of exercise, but assessing fall risk is difficult and intensive to do on a regular base. This paper introduces a way to combine the physical exercises that are used in an exergame with an assessment for fall-risk. The 'Rehabiliium tree blooming game' is an exergame that has been introduced successfully in rehabilitation and healthcare centers for older people in Japan. The 'Rehabiliium' is a useful game that helps voluntary exercise of older people. The Rehabiliium is developed by the Kyushu University (Fukuoka, Japan) and is built around the stand-up exercise called a squat with chair<sup>1</sup>. This movement is nearly identical to the movement used in the chair stand test<sup>2</sup>. The chair stand test is a valid and reliable test to evaluate lower extremity muscle strength, a critical factor in evaluating functional performance and fall risk<sup>3</sup> of older people. In a 30 second trial, 'The 30-second chair

Table 1. Average scores in the '30 seconds chair stand test' in relation to age and gender<sup>4</sup>

Age, yrs	Men	Women
60-64	14	12
65-69	12	11
70-74	12	10
75-79	11	10
80-84	10	9
85-89	8	8
90-94	7	4

stand test', the client will rise from a chair and then sit back again as many times as possible, with his or her hands on the opposite shoulder, crossed at the wrists. A below average score<sup>4</sup> (Table 1), based on gender and age, indicates a higher risk for falls. The objective of this study is to determine if the 30-second chair stand test can be assessed automatically while playing a modified version of the Rehabilium, so assessing can be done remotely, on a more frequent base and is easier to do. **Method** The chair stand test was implemented in a Dutch translated version of the Rehabilium: the 'BIT-game'. In the BIT-game a database function was added, which can record data during play sessions. In a web-based dashboard, therapists can easily access and analyze the data (Figure 2). The application automatically compares the first thirty seconds of play, the first thirty seconds of rising from a chair, and when the participant sits down again, with the average scores of the 'The 30-second chair stand test'. For reliable results the instructions of the chair stand test should be followed carefully. **Results & Discussion** The chair stand test was implemented in a playable version of the BIT-game. In user tests the records of the first thirty seconds of play are comparable with scores for the chair stand test. In the user tests, the instructions were provided by an instructor. In the future these instructions should be implemented in the game, so the game is compatible for use at home. Future research with the target group is needed to study if the output of the game on the first 30 seconds of play is comparable with the results of 'The 30-Second chair stand test' on larger groups and if this output can be used as a predictor for fall risk.

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**Address:** NHL University of Applied Sciences, Leeuwarden, Netherlands

**E:** g.terlouw@nhl.nl



Figure 2. Dashboard BIT-game

**H.W. VAN DIJK, B.O. WARTENA, G. WIERSMA, J. BOTGER. Chasing the sinusoid: Extrinsic motivation and monitoring of friction loaded squat exercise training** *Gerontechnology* 2014; 13(2):146-147; doi:10.4017/gt.2014.13.02.183.00 **Purpose** Ageing societies are seeking exercise training that efficaciously combats frailty and imbalance in societies with increasing populations of older adults. However, proper execution of such exercise is labour intensive, for reasons such as the repetitive character of exercise training and its general tendency to be perceived as boring, amongst others. This so-called lack of companionship<sup>1</sup> barrier limits adherence to an exercise regimen and thereby makes exercise regimens less suitable for unsupervised training. Here we present the design of a friction loaded squat training support tool that uses gaming technology to create extrinsic motivation for the sustained execution of squats. Recent studies show that the combination<sup>2</sup> of resistance training and core strength is an effective means of improving the power and strength of limbs<sup>3</sup>, as well as improving the overall balance performance of older adults. **Method** We employed an iterative design approach with palpable artifacts referred to as design science. The three principal stakeholders in a game-based training tool are: the physiotherapist, the game designer, and the client. The subsequent prototypes gradually include various dimensions of training and motivation. Initial training aspects include a clear trail of the proper execution of a squat. Feedback on the correct execution will be included in future versions. Motivational aspects start with player engage-

ment, i.e., by exploiting the novelty and including game-play elements such as a scoring system that provides feedback of in and out-game actions. **Results & Discussion** A friction loaded squat movement plotted in the time domain can be considered a sinusoid movement. This target trail of the exercise is fitted to the individual needs of the client by varying its amplitude and frequency. Feedback on the correct execution has been deferred to future versions of the tool. The graphical theme, look, feel, and implementation of the interactive sinusoid movement have been established through paper-prototype experiments with a small group of potential clients. In addition, we built on the experience of testing a tool that supports frictionless sit-to-stand exercise, in which the actual event is important rather than the precise of movement in time. The current prototype adheres to the design for an acceptance<sup>4</sup> principle. It is a 'trivial game', which implements a readily recognisable exercise trail (a sinusoid movement), an engaging setting, a scoring system, and to some extent curiosity and free roaming. The obvious trail is an important aspect for therapists. The game-play elements adhere to the extrinsic motivation of clients, whereas the integration into a true game is an accepted basis for game designers. Experience sampling with the multiple stakeholders indicates the game demonstrates adherence and acceptance were improved through use of them gaming technique. More importantly, this prototype and series of tests induced innovations in design and activities as well as confirmed the positive intent of the users to use the tool for unsupervised training.

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**Address:** NHL University of Applied Sciences, Leeuwarden, Netherlands

**E:** h.w.vandijk@nhl.nl

Y. SCHIKHOF, C.S. STERKE. **The effects of exercise interventions with and without technology for people with dementia.** *Gerontechnology* 2014;13(2):147-148; doi:10.4017/gt.2014.13.02.107.00

**Purpose** The physical inactivity of nursing home residents with dementia, agitation and falling are challenges in daily practice. For a long time there has been insufficient evidence to conclude whether or not physical activity programs are beneficial for people with dementia<sup>1</sup>. However, more recent reviews found that physical activity was beneficial in all stages of dementia, looking at physical outcome measures<sup>2</sup>. Concerning exergaming, there are limited published data, and controlled research on effects is needed<sup>3</sup>. This study will compare exercise interventions with and without technology and look at the ability of these interventions to reduce the risks of falling for nursing home residents with dementia. The pilot study also serves to evaluate the feasibility and practicality of new technology and of simple standardized physical performance tests, preparing us for a large-scale controlled research project. **Method** A literature review was conducted to find feasible measurements for predicting fall risk in people with dementia. This was followed by a literature review of fall prevention and exercise. Feasible measurements and experience with exercise programs for people with dementia shall be integrated in new research. SilverFit is a virtual rehabilitation program and is adapted and used for people with dementia. In a pilot study SilverFit will be compared with supervised individual walking in nursing homes. Thirty-two residents will be chosen by physical therapists and will be included after giving written informed consent. In a quasi-experimental design, trained students will execute the exercise interventions with the residents twice a week over 16 weeks. They will measure gait speed every week and will also keep a journal about participant activity. **Results & Discussion** The literature review showed that gait velocity is a feasible and valid measure to predict fall risk in nursing home residents with dementia<sup>4</sup>. The standardized 6-m and 10-m walk tests<sup>5</sup> will be used to measure gait speed.

Some recent studies have found that physical rehabilitation for long-term care residents may be effective, but there is still insufficient evidence<sup>6</sup>. Specifically, the benefits of physical activity for people with dementia needs to be further researched<sup>7</sup>. The results of this pilot study will be presented at the conference. Simple and reliable tests should be widely used in practice to describe effects of new interventions as exergaming within gerontechnology.

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**Address:** Rotterdam University of Applied Sciences, Rotterdam, Netherlands

**E:** y.schikhof@hr.nl