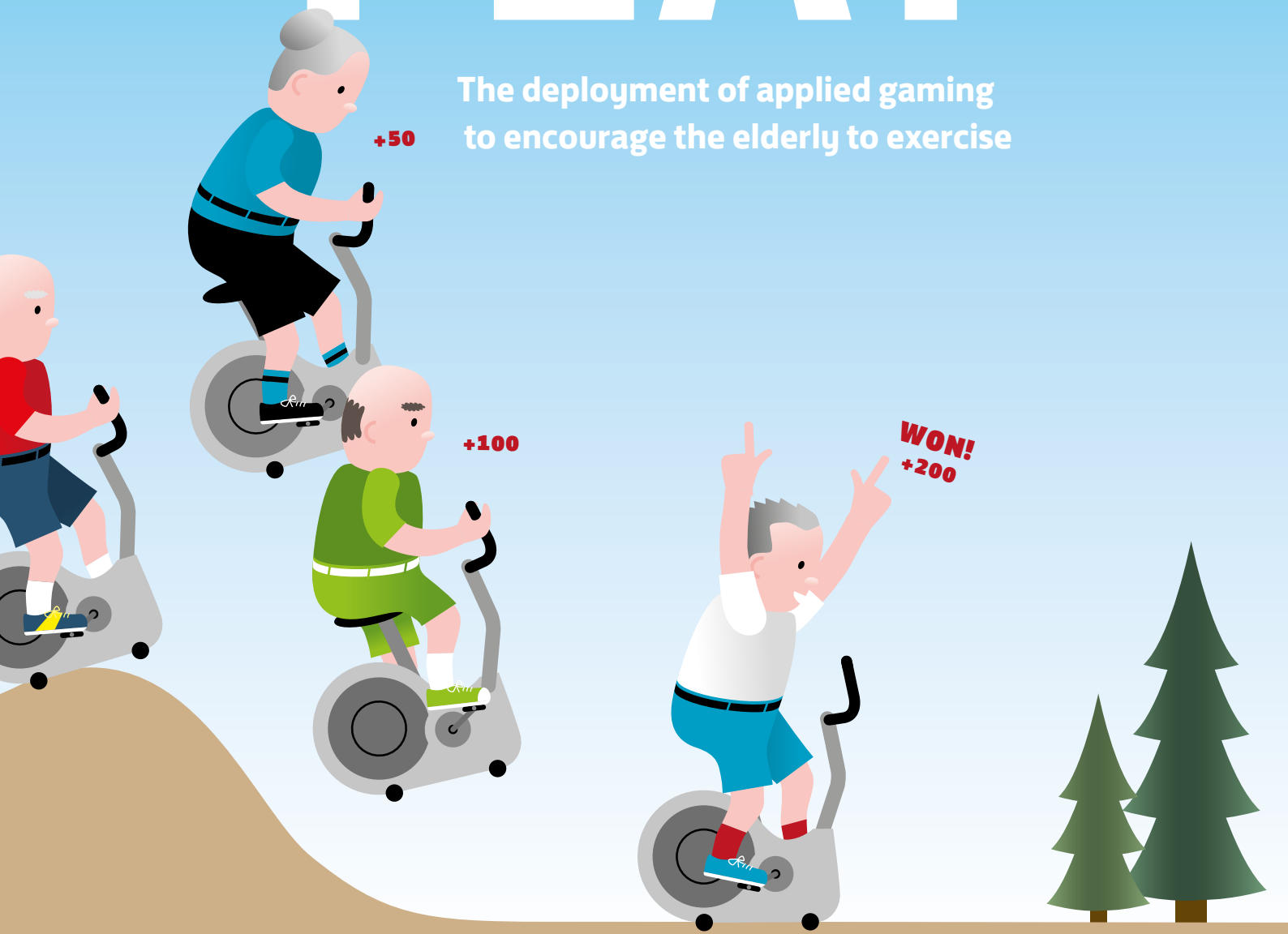
LET'S PLAY

The deployment of applied gaming to encourage the elderly to exercise



TNO • VitaValley

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ABOUT THIS PUBLICATION

This white paper is an initiative of the Applied Gaming for Healthy Aging Coalition. The coalition consists of various participating partners who play an important role in the implementation, scaling-up and (further) development of applied games for the elderly. These are parties from the health care sector, the gaming sector, knowledge organizations and a senior citizens' association.

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Members of the coalition: Actiz, ANBO, Carintreggeland, Embedded Fitness, Ellis in Wonderland, Hilverzorg, Lentis, Menzis, QLVR, Qwiek, Rijksuniversiteit Groningen, TNO, Universitair Medisch Centrum Groningen, Vital Innovators, VitaValley, VU medisch centrum, Warande, and ZuidOostZorg.

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MANAGEMENT SUMMARY

At the end of 2012, TNO and VitaValley launched an initiative to form the Applied Gaming for Healthy Aging Coalition. Its goal: the implementation, scaling-up and, if so required, the (further) development of applied gaming for the elderly. The coalition's first activity was the formulation of this white paper with the objective of sharing knowledge and giving shape to the (further) development and implementation of applied gaming. The focus of this white paper is on applied games that encourage elderly people to exercise, so-called 'exercise games' or 'exergames'. This white paper is based on current scientific insights, available evaluations and practical experience offered by the coalition partners.

Current developments have a favorable impact on exergaming

- Both the number of elderly people and the average age of the elderly population are increasing.
- A large proportion of the over-75s has one or more chronic conditions.
- Regular exercise increases life expectancy, continued increased performance and a greater chance of maintaining one's vitality while growing older. The least active people run the highest risk of negative health effects.
- The elderly do not exercise enough. The percentage of elderly people getting sufficient exercise decreases as they get older. The percentage of elderly people in institutions getting sufficient exercise is even lower.
- Since 2015 a compulsory exercise policy has been in place in nursing and care institutions: exercise must form an integral part of the care provided.
- The availability and affordability of health care are under pressure. Ever more money and effort is being spent on preventing functional limitations and loss of self-sufficiency. This is in line with the trend that older people wish to continue to live at home ever longer.
- The elderly are rapidly developing digital skills. More and more elderly people are using the internet, social media, and devices such as computers, smartphones and tablets.
- Technological advances are accelerating at lightning speed. Computers, telephones and sensors are getting smaller, cheaper and more readily available, in addition to which ever more new features are being introduced. The accessibility and capabilities offer new opportunities where the range of exercise options for the elderly is concerned.
- The acceptance of technology in care and welfare has improved in recent years. E-health and home automation in health care are gradually becoming more widely accepted and applied. The introduction of exercise games can capitalize on this development.

An effective exercise game has motivational value

- Exercise games should address the needs and motivational requirements of the target group.
- Effective games inspire users to discover new things, are intuitive, geared to the interests of the players, and provide the right level of challenge.
- Exercise games can address one or more motivational aspects, such as performance, teamwork, competition or connectedness.
- In order to appeal to a diverse audience of elderly people, a wide range of exercise games is required.
- An exercise game that triggers intrinsic motivation ensures that players will continue to play.

The effects of exercise games show great promise

- While only limited research has been done regarding exercise games for the elderly, initial studies show positive short-term effects: playing exercise games can have a beneficial effect on physical fitness and balance. Various studies also show positive effects on cognitive and social functioning.
- Playing (and even watching) exercise games can have a positive effect on people's attitudes as regards exercise and the intention to exercise more.
- Care providers indicate that elderly people

playing exercise games often exercise longer and more intensively than when using traditional forms of exercise.

Exercise games potentially have advantages compared to regular exercise

- Exercise games are more fun than standard exercise.
- Exercise games can be played in all weather conditions.
- A number of activities in exercise games stimulate fall prevention.
- Exercise games can be played solo or as a group activity.
- Exercise games can cover a more varied range of activities.
- Exercise games offer a combination of physical and cognitive activities. This makes them perfect for the elderly to practice their coping skills in dealing with the dynamic outside world, and help them prevent falls.
- Exercise games make it easier to track exercise behavior. They also allow for automatic feedback on this behavior. Exercise games furthermore offer standard testing options, as well as the ability to track changes over time.

The available range of exercise games is still (too) limited

The available range of exercise games that are geared to the wishes of the elderly Dutch population is limited. There are few affordable games that are also suitable for home use. The main point of improvement is therefore to increase variety. A point of concern is that many (often subsidized) exercise games that are developed for the Dutch elderly, do not move beyond the pilot phase.

The acceptance of applied games among the elderly merits particular attention

Research shows that the elderly play games because they find them useful and fun. Even though the elderly recognize the usefulness of exercise games, they do not use these games very much. The reasons for this are varied. The look and feel of the games do not appeal to the elderly; the elderly are not familiar with the games; they find that they already exercise enough, or that the games are too expensive. The majority of these issues seems to be surmountable. After all, once the elderly get involved in exergaming, they tend to enjoy it and indicate that they want to continue playing.

The implementation of exercise games often depends on enthusiastic leaders

- The progress of implementation depends on a number of different factors, such as:
  - whether the initiative for the purchase is driven by management or the shop floor;
  - the particular exercise game purchased;
  - the location within the institution in which the exercise game can be played;
  - the target group for which the exercise game is used.
- Exercise games within institutions are rarely embedded in the range of activities on offer. Their use mainly depends on the enthusiasm and skills of the people involved.

The (growth) market of exercise games is still in its infancy

- Further scale-up will require development of the market.
- So far, game developers have shown a somewhat reticent attitude due to their unfamiliarity with the elderly (health care) market, as well as its complexity.
- The market should be stimulated through marketing and communication. By doing so the elderly, their environment, and the care and welfare organizations involved, will become (more) familiar with the added value of exergames. Within this context it is important for all parties concerned to familiarize themselves with exercise games as much as possible, and to ensure the availability of reliable information. To this end more research should be conducted into the effectiveness of exercise games. Another important factor is to bring practical experience to the forefront.

The focus of this white paper is on applied games that encourage elderly people to exercise, so-called 'exercise games' or 'exergames'. This white paper is based on current scientific insights, available evaluations, and practical experience offered by the coalition partners.

Exercise games can already be deployed in a variety of situations

- Several Wii and Kinect games are good candidates to be used as an addition to the general (organized) range of activities being offered. Proper introduction and supervision do, however, require the presence of an enthusiastic coach.
- A number of exercise games geared to fitness and physical therapy have been specifically developed for the elderly. Cycling games in particular seem highly promising.
- There are certain exercise games that elderly users can play at a time that best suits them. This involves games in communal or central rooms that invite people to try them out.

There is a need for different types of new exercise games

- There is a need for games for tablets and smartphones: this concerns both games for preventive, independent use, and games for use within a care or treatment setting.
- The addition of a game layer to existing fitness equipment has proven successful. There is room for more of these types of games in the lower price segment.
- It is also advisable to develop exercise games as part of the living space which encourage people to exercise in a surprising and inviting way.
- There is a need for more exercise games for the Wii and Kinect. These exercise games do, however, need to be geared to the specific requirements and characteristics of elderly users.

The implementation of an exercise game calls for a structured approach

This white paper contains a guideline for the implementation of exercise games. In the appendices you will find a number of tools: an overview of potential stakeholders, a step-by-step plan/checklist, and a template for an overview of investments and returns.

The implementation guideline is focused on four components of the implementation:

1. Strategy: why, how, what, who, where and when. Make sure you have a clear picture of the goal you want to achieve and how you should go about this. The more specific the better!
2. Technology: this component deals with the selection of an exercise game. This white paper contains a list with possible selection criteria. When selecting a game, bear in mind that the available variety is limited and that the games currently available may possibly not meet all the criteria.
3. Organization: this component concerns the activities involved in installation and preparation, introduction, stimulation of use, and accurate parameters. This white paper contains a number of do's and don'ts based on practical experience.
4. Business case: this component deals with potential funding sources. Many of these sources are only suitable for one-time investments. Long-term investments should be funded from regular resources or realized savings.

The Applied Gaming for Healthy Aging Coalition is making an appeal

- We (the Applied Gaming for Healthy Aging Coalition) see a great many opportunities and possibilities for the use of exercise games that will benefit the fitness and vitality of the elderly. To achieve true social impact this use will need to be scaled up.
- We call on (organizations for) the elderly, municipal authorities and care and welfare organizations to start using the exercise games already available.
- We challenge the gaming industry to broaden the range of exercise games to cater for the needs of different groups of elderly people.
- We call on investors to contribute to the development and scale-up of exercise games for the elderly.

Ten recommendations for the development of suitable and successful exercise games

1. Allow for sensory, cognitive and motor impairments.
2. Ensure the gameplay is tailored to the target group.
3. Offer the right level of challenge.
4. Adapt the game complexity to suit the context.
5. Imitate the dynamics of real life.
6. Provide access to relevant game data.
7. Involve elderly users during the early stages of the development process.
8. Invest in sales and marketing.
9. Provide support for installation and use
10. Develop new business models.

CONTENTS


RIJWIEL STALLING
75 P. MAAND
KIEST
VR 3D

DEVELOPMENTS CONCERNING **THE ELDERLY**

What developments are taking place concerning the elderly? Are there developments that affect the urgency and opportunities of exercise games where (care for) the elderly age group is concerned?

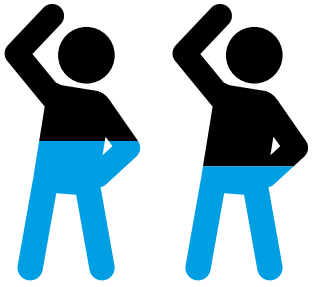
The challenges in terms of availability and affordability of care are causing a shift in health care. The emphasis is increasingly on citizens' self-management, own strength and self-reliance.

Demography and clinical picture

The number of elderly people will increase in the years to come. People are furthermore expected to live ever longer, a phenomenon that is also referred to as 'double aging'. According to the 'Nationaal Kompas Volksgezondheid', the gateway to information about health and disease, risk factors, care and prevention in the Netherlands, the number of over-65s will increase from 2.7 million in 2012 to a staggering 4.7 million in 2041. Over the next few years, the main growth is expected in the 65 to 79 age category. As of 2025 the same will apply to the group of over-80s. By 2040 an estimated 26% of the population will be over 65 (2012: 16%), a third of whom will be older than 80 (2012: 25%).[1]

Chronic conditions
As the number of (elderly) people rises, so does the number of elderly people with an increased risk of functional decline who become dependent on (informal and professional) care. In 2013, 79% of the over-75s had a chronic condition, and half (580,000 people) had multiple chronic conditions at the same time (multimorbidity). The Dutch Health Council expects the number of elderly people with multimorbidity to increase by about 50% between 2008 and 2020.[2]

The risks of physical inactivity
Research[3] shows that the least active people run the highest risk of experiencing negative health effects. Approximately one in five new stroke cases are attributable to physical inactivity. Too little exercise is moreover responsible for almost 20% of acute myocardial infarction cases, and some 10% of diabetes mellitus cases.[4] Coronary heart disease is responsible for the greatest loss in quality of life for the over-65s. Diabetes mellitus, strokes and arthrosis also negatively affect the quality of life to a high degree.[5]



55% of the 65- to 75-year-olds exercise enough

45% of the over-75s exercise enough

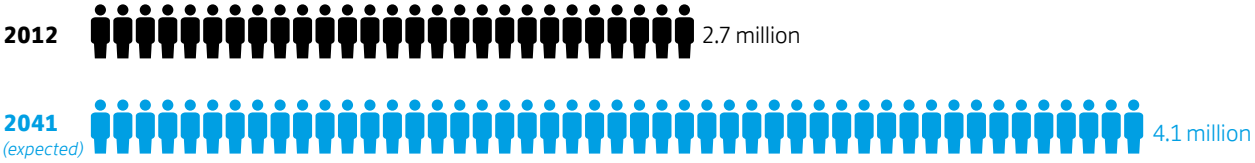
The importance of exercise
Sufficient exercise – the Dutch Standard for Healthy Exercise recommends half an hour a day of moderately intensive physical activity – can have a positive effect on chronic conditions such as coronary heart disease, diabetes mellitus type 2, osteoporosis, strokes (CVA) and depression.[6] Even in the over-75s life expectancy increases through exercise. Elderly people who go from 'no' to 'a little' exercise are likely to experience the most health gains.[7]

Health care

The challenges in terms of availability and affordability of care are causing a shift in health care. The emphasis is increasingly on citizens' self-management, own strength and self-reliance. In order to shorten the care period there is ever more focus on proper prevention and aftercare. In-patient care will only be available for people requiring long-term, highly intensive care. People with less permanent or less intensive care needs should be able to live independently for longer.

Funding
The shifts in health care are reflected in the shifts in funding flows and responsibilities. In 2015, all care duties involved in supervision and day care activities will be transferred from AWBZ care (care provided under the Dutch Extraordinary Medical Expenses Act) to Wmo care (care provided under the Dutch Social Support Act). As a result, the municipal authorities will be responsible for providing suitable support to people at home and in day care centers. Under the terms of the Wmo and the Dutch Public Health Act (Wpg), the municipalities will also be responsible for taking measures aimed at prevention and health promotion.

NUMBER OF OVER-65S



Citizens' prospects and support needs are becoming the focus of attention. Most organizations that are involved in the implementation of the Wmo and Dutch Public Health Act offer preventive measures in the form of information meetings and organized activities.[8]

Exercise behavior

55% of the Dutch 65- to 75-year-olds meet the Dutch Standard for Healthy Exercise (NNGB). This means that they have half an hour of moderately intensive exercise at least five days a week.[9] In the age group of over-75s some 45% meet this standard. As regards senior citizens residing in care institutions the percentages are even lower.

Obstacles
Of the people older than 65 who do not meet the NNGB standard, 67% indicate that they are (very much) in favor of getting more exercise. Some 55% would find this (very) enjoyable.[9] In other words, there is a desire to exercise, but elderly people often find themselves faced with various obstacles:

- lack of encouragement by partners or friends;
- a sense of feeling unsafe;
- fear of injuries and accidents;
- lack of a suitable exercise program;
- a negative view of the available range of exercise programs for the elderly.[10]

In the United Kingdom a study was conducted into the exercise patterns of dementia sufferers living at home. Of this group, 70% has given up certain activities due to lack of self-confidence. Some 39% only venture out of the house once a week. And 50% avoid contact because they feel hampered by their limitations.[11]

Responsibility of care institutions
Research shows that the majority of elderly people in care institutions suffering from somatic conditions is (completely) inactive.[12] No exact figures are available on the physical activity of elderly people in psychogeriatric homes. Given the clinical picture it seems likely, however, that this group gets even less exercise. In response to this study, the Netherlands Health Care Inspectorate (IGZ) has determined that nursing and care homes have a responsibility to promote physical exercise. From 2015 onward the Inspectorate will monitor these institutions to ensure the proper implementation of an exercise policy as an integral part of the care provided.

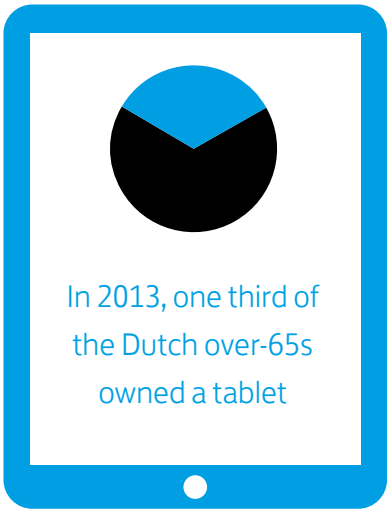
Digital skills

In recent years, the use of mobile phones, smartphones, computers and tablets by elderly people has increased significantly. The same applies to the use of the internet. In 2013, more than half (55%) of the 65- to 75-year-olds used the internet almost daily. Less than 20% had never used the internet. In 2005[13] the group of 'never used' was twice as big. In addition, the elderly are making ever more use of the social potential the internet has to offer. In 2013 nearly 30% of 65- to 75-year-olds were using social media. Some 15% use internet phone functionality, such as Skype. The elderly use various devices[14] for internet access:

Device	Number of 65- to 75-year-olds using the device for internet access
desktop	64%
laptop	51%
smartphone	24%
other devices	37%

It is not known what these 'other devices' are. Most likely these are mainly tablets. After all, in 2013 one third of the Dutch over-65s owned a tablet.[15]

Over-75s
In the over-75 age category internet use is significantly lower than among 65- to 75-year-olds. In 2013, 39% of the over-75s stated they had occasionally used the internet. Some 20% did so on a daily basis. This is more than in 2012, when the figures were 34% and 16% respectively. There is no additional historical data available as the Dutch Central Statistical Office (CBS) only started collecting the data for this oldest age group in 2012.[16] Within the group of over-75s, almost twice as many men as women use the internet. The most popular internet activities are email and searching for information. Only 10% of the over-75s use social media.



Smartphone and tablet demonstrations in BoodschappenPlusBus

BoodschappenPlusBus, an initiative of the Dutch Association for the Elderly, provides bus services for the elderly to take them on (shopping) trips and other outings. Since the spring of 2014, all seventy buses have a smartphone and tablet on board. This way the 30,000 elderly people using this bus service can get acquainted with these communication devices in a low-threshold setting. The goal is to show them during outings what they can do with these devices and that their use is not 'difficult' or 'complicated'.

More information: www.plusonline.nl/mensen-meningen/tablet-tegen-eenzaamheid

A plethora of opportunities
The number of elderly people owning and using modern technology has increased significantly in a relatively short time. This provides ample opportunities for technology to influence the behavior of these people resulting in greater self-reliance.

Technological availability

The rapid developments in the use of computers and the internet are linked to the dynamics surrounding the availability of different devices. Computers, telephones and sensors are not only getting smaller and cheaper, but also more readily available. The same applies to specific devices that can be used to incentivize seniors to exercise.

Game consoles
The Nintendo Wii launched in 2006 was the first game console requiring physical activity. Microsoft followed with Kinect for the Xbox 360, and Sony with the Move for Playstation 3. Thanks to these game consoles the possibilities of playing exercise games at home or in care institutions have increased tremendously.

Smartphones, tablets etc.
Ever more smartphones, tablets (such as the iPad), and other mobile devices are being used to promote physical exercise. In addition to high portability these devices offer a number of other functionalities. The devices can, for example, acquire and track a person's location, serve as a pedometer, and provide specific information based on the user's location. Such features create growing opportunities to integrate games that encourage physical activity into people's everyday lives.

Alignment with digital care

For the past few years these new technologies have also been implemented in health care for the benefit of both patients and care professionals (in their training and work duties, for instance). More and more services are available through e-health, online and remote applications. The Netherlands has a leading position in this area. A common form of e-health is so-called 'blended care'. Blended care is a combined service that covers regular appointments between health care professionals and patients, and online services such as video calling, ordering of repeat prescriptions, contact with other patients, access to one's own health records, and self-management. E-health opportunities can be found in six particular areas:

- self-management;
- efficiency/affordability;
- continuity of care;
- patient safety;
- quality of care;
- accessibility.[17]

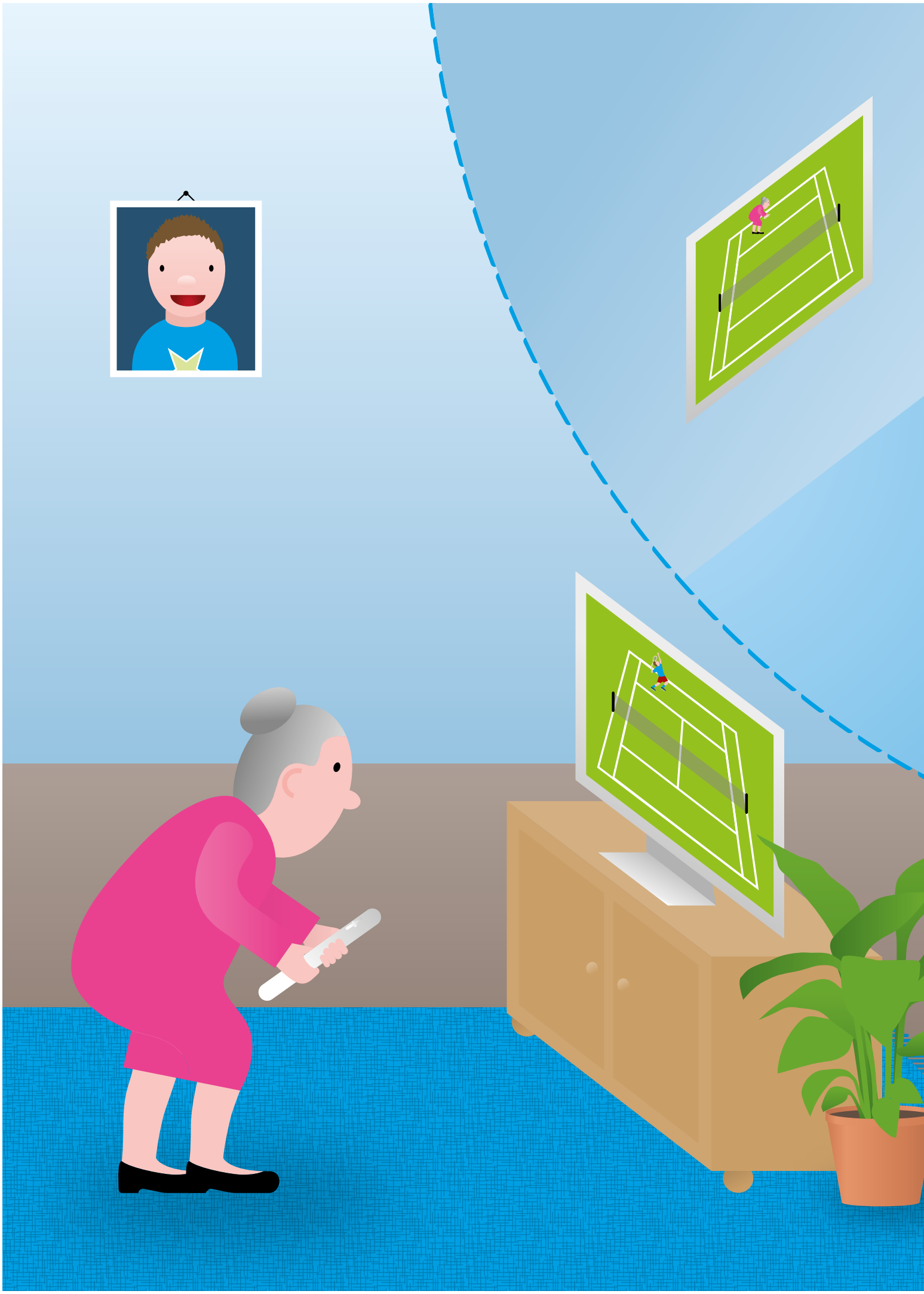
A related development is the emergence of home automation: smart technology to improve the quality of life at home. E-health and home automation offer many opportunities to promote the availability and affordability of care for the elderly. The Netherlands offers several professional e-health services for the elderly in the form of portals, apps and home automation.[18]

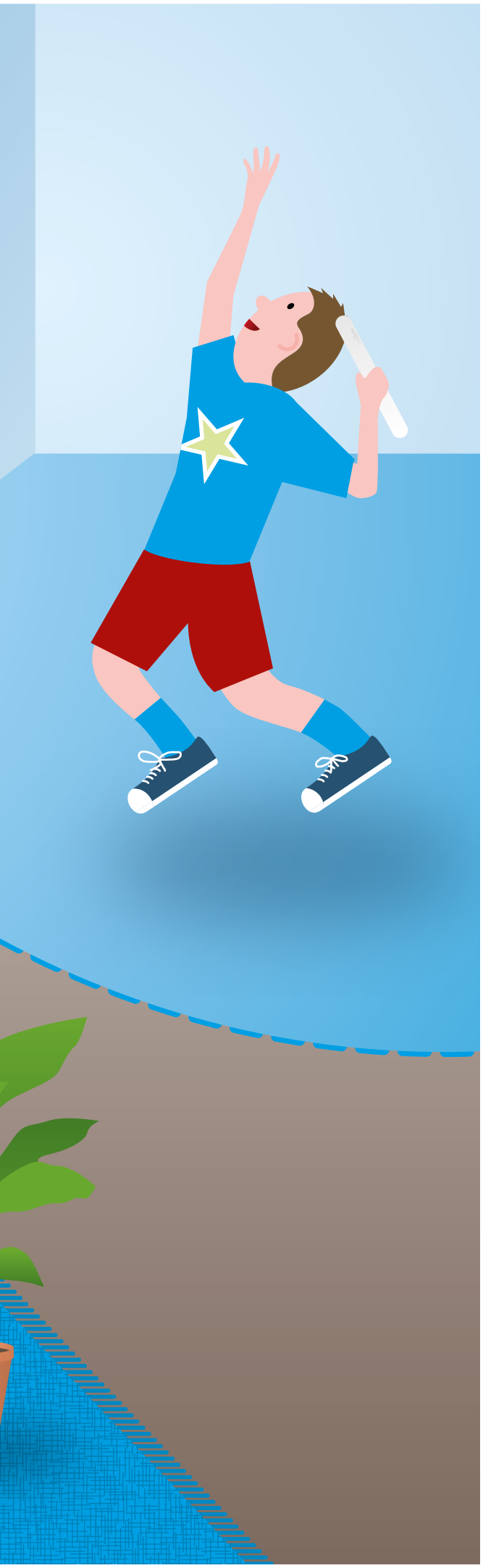
In many of these initiatives elderly people are given (free) use of a tablet. In addition, more and more consumer solutions are being introduced on the market that offer additional value to elderly people and informal caregivers, such as video calling and managing appointments and medications.[19]

Opportunities for applied games
The above developments offer opportunities for applied games as they can capitalize on the roll-out of new technologies for the elderly. A case in point is that some of the most popular health portal applications are games (mostly without any health goals).[20]

PHOTO: SILVERFIT/ROBERT VAN DEN BERGE

The SilverFit Mile in use at Brabantzorg in Veghel





THE **VALUE** OF EXERCISE GAMES

What value do exercise games actually have to offer the elderly? And what do they have to offer in addition to existing regular exercise programs?

Well-designed games are ideal to (intrinsically) motivate people: they will want to make people play the game time and time again.

Motivation and experience

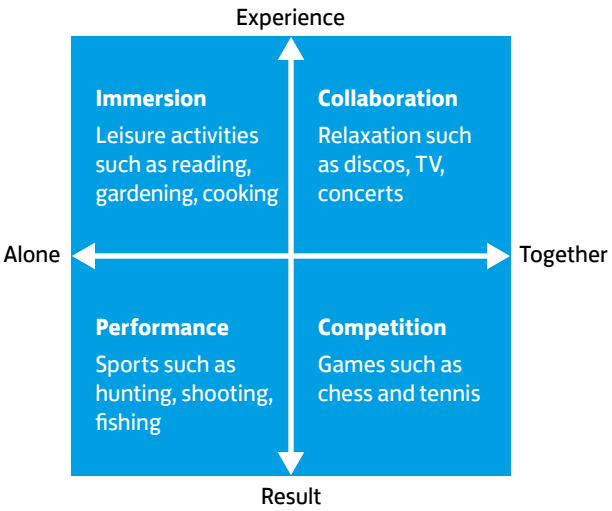
One of the best-known theories in the field of intrinsic motivation states that people have three basic needs: autonomy, relatedness and competence.[21] The more an activity fulfills these basic needs, the more people are motivated to undertake that activity. Good games capitalize on this by:

- stimulating the curiosity for discovery;
- providing the player with the intuitive ability to perform the desired actions;
- satisfying the interests of the player;
- enabling interaction with others;
- offering the right level of challenge so that the player does not get bored or frustrated.

Flow experience
A relevant psychological concept as regards the value of applied games is that of 'flow'.[22] Flow is a mental state in which a person is completely immersed in his or her activities. A few factors that are required to achieve flow state and the desire to repeat the experience:

- a clear goal;
- immediate feedback;
- a balance between one's own skills and the activity in question;
- a sense of personal control;
- an internally rewarding experience.

Gaming motivation



Once again, it is exactly these features that make for a good game.

Gaming motivation
The theories on the motivation to play games generally mention two overarching motivational dimensions: alone/together and experience/results'.[23] These two dimensions can be subdivided into four main motives:

1. immersion: a sense of being part of the world of the game, for instance by means of stories, role play, exploration and imagination;
2. cooperation: being involved in activities in which players help each other, in the form of creativity or shared adversity for example;
3. competition: being involved in activities in which players compete for scarce resources for example, or through the ability to compare skills or win/lose situations;
4. achievement: a sense of advancement, mastery of skills and knowledge.

Most people typically have more than one gaming motivation, although they generally do have a set of preferred motives. As a result, they will be more or less motivated depending on whether the game supports their preferred gaming experience.

Gaming requirements
Well-designed games are ideal to (intrinsically) motivate people: they will want to make people play the game time and time again. The implementation of the right motivational drivers in games that stimulate exercise, helps in achieving exercise goals through play. Because of the wide range of motivational drivers and preferences, it is not possible to develop one single game that appeals to all elderly people. In other words, in order to ensure that exercise games appeal to a large audience of elderly people, a large variety of games is needed.

Physical fitness, cognition and well-being

The research into the effects of exercise games is still in its infancy. Several studies have nevertheless shown that games can have positive effects – at least in the short term – on physical activity, cognitive fitness and social contacts. It has been proved, for instance, that exercise games on the Wii and Xbox Kinect get people to exercise in an easily accessible and playful way. The playing of exercise games is considered to be a light to moderately intensive activity[24,25] that can produce positive

Wii bowling competitions

Bowling is the most well-known example of exergaming popular among the elderly. In the United States in particular there are many nursing homes, care institutions and homes for the elderly that organize virtual bowling competitions. In these competitions elderly players try to qualify for local or national competitions. 118 locations across 34 states have signed up for the National Senior League. Over 1,500 Wii bowlers participate, spread over 311 teams.

More information: www.nslgames.com

physical effects within a relatively short space of time (twelve weeks), such as improved balance.[26,27,28] Research also shows that the playing of exercise games (and even watching others play) has effects in terms of:

- a more positive attitude to exercise;
- a stronger sense of control over one's own movement skills;
- a greater determination to exercise more.[29]

Care counselors, too, frequently indicate that elderly people playing games subconsciously exercise longer and more intensively than they do without games. While doing so they are actually capable of movements that they no longer thought were possible.

In addition to positive physical effects, both exercise games and other games can have a positive effect in terms of cognition[30,31], an aspect that contributes to self-reliance. Lastly, exercise games also seem to have beneficial social and emotional effects. These effects are both noticeable in elderly people living independently[32], as in those living in nursing homes.[33,34] This positive social and emotional impact is owed to the fun people experience while playing. Another important factor is the social contact generated by playing with other people. Applied gaming turns out to be a fun way to make contact, not only between elderly people, but also between elderly people and their (informal) caregivers and (grand)children.[35]

Advantages compared to 'regular' exercise

Several barriers to regular physical activity are less present in exercise games.

- The ability to play exergames is not dependent on the weather.
- The fear of falling can be largely eliminated by using a proper setup, especially in cycling games.
- Games can often be played solo or with someone else. Because of the ability to play alone, the elderly person is not dependent on an organized activity or the availability of other players. And if users like playing with other users, they can often choose between a competitive or cooperative game.
- Due to the wide range of games, it is easier – at least in theory – to find a game that suits a person's interests and capabilities than is the case with regular physical exercise activities within the community.
- The game element makes certain movements more fun, causing people to be more motivated to exercise. Exercise games are generally considered to be more fun than regular treadmill exercises, for example.[36] A striking detail is that health care professionals notice that dementia sufferers will often stop pedaling on their exercise bikes as soon as the supervisor leaves the room. In cycling games, however, they tend to continue to play much longer while unsupervised.[37]
- Practice shows that playing applied games can decrease behavioral problems displayed by people with dementia.[38]
- Exercise games offer a combination of locomotor movements and cognitive activity: the processing and responding to on-screen information. As such, exercise games could be suitable as an exercise technique for frail elderly people who are prone to falling in circumstances requiring cognitive attention.[39]

Imitation of real life

Coaching the elderly so that they can function better in everyday life, is best achieved by imitating the dynamics of real life.[40] On account of the combination of physical and cognitive elements, exercise games are ideally suited for this purpose. In order to achieve maximum effect, in addition to offering concurrent tasks it is important to offer sufficient 'chaos', through rapid and unexpected transitions for instance.

Feedback and assessments

As far as 'prescribed' exercise is concerned, it is generally more challenging to motivate people to not only exercise under supervision, but to keep this up when at home. Exercise games are the perfect solution for this purpose. The software, for example, can keep track of a person's movements, in addition to which games can give immediate positive or corrective feedback on these movements. This data is also useful for standard assessments, such as measuring running speed, or so-called Time Up and Go Tests.

Data use

The software can effectively track behavior, as well as any changes in this behavior. The feedback is generated from within the game itself, or through a therapist who can then modify the treatment based on the data provided. Tracking these changes can furthermore benefit early signaling mechanisms. Thanks to applications of this kind, the work of therapists using exergames becomes easier, more effective and more fun. For an efficient use of the data for treatment purposes and care, adding the data to the Electronic Client/Patient Record should be a straightforward process.

THE AVAILABLE **RANGE** OF OF EXERCISE GAMES

What kind of exercise games are there? What do users need? Is there a wide range of exergames for the elderly target group, and what is the trend in terms of the range being offered?

Since 2006 the Wii has made it possible to play games through the movements of a controller. Wii games offer both a physical activity and an intuitive gaming experience.

Generic exercise games

Wii game console
Since 2006 the Wii has made it possible to play games through the movements of a controller. This is possible because of the fact that the position of the controller (remote control) can be tracked using a motion sensor to enable actions to be rendered identically on the screen. Wii games offer both a physical activity and an intuitive gaming experience.

Wii Sports
Wii Sports (or the newer Wii Sports Resort) is an easy to play game that appeals to a wide audience. The basic version covers bowling, tennis, baseball, golf and boxing. Wii Sports is probably the exercise game that the elderly play the most. Bowling in particular is a huge favorite thanks to the fact that it is an easy and well-known activity. The bowling game is moreover suitable for one to four players so that players can challenge and cheer each other on. The promotion of social contact means that Wii Bowling can contribute to a sense of well-being.[41] However, the physical effort (it can be played sitting down) and cognitive effort required are so minimal that the question arises to what extent this game can contribute to the health and long-term self-reliance of relatively fit elderly people. On the other hand, Wii Bowling can encourage elderly people with a sedentary lifestyle and those involved in a rehabilitation program to get out of their chairs and take a few steps.

Evaluations of Wii use among the elderly show that control of the game can be somewhat tricky at first. Often a button has to be pressed at the same time as performing a physical movement.[42] It is therefore advisable to initially coach elderly people to guide them through the game. An additional reason is that there is no Dutch language version of Wii Sports. Having said that, it has emerged that in time many elderly people are quite able to play the game on their own.

Wii Fit (Plus)
Wii Fit is a game using a balance board. The board is similar to a pair of scales that accurately measure where and how someone is standing on the board. This information is used to control the games. Players can, for example, ski and head soccer balls by shifting their weight. There are also fitness and yoga exercises, as well as games in which the player has to steer a ball around a labyrinth with holes. A number of pilot studies have shown that even in a short space of time (20/30 minutes at a time, three times a week for four weeks/three months), elderly people playing a Wii Fit game can experience enhanced physical fitness, in particular in the form of increased balance.[43,44,45] Many elderly people are well able to play Wii Fit games, both in a home setting and when using a rollator or walking frame. Wii Fit is not suited for players who want to play against or with each other.

Xbox Kinect console
The introduction of the Kinect in 2010 saw the second major revolution in exercise games. The Kinect is a smart camera that recognizes movements and uses these as input for playing games. The software can be used on Xbox consoles and Windows. One of the differences with the Wii is that no controller is used. For bowling on the Kinect, for instance, players only need to move their arms. This makes playing the game not only more intuitive, but also more intensive.[46] Kinect games are played while standing. The Kinect is not suitable for people using a rollator or cane. The games are also quite movement-intensive. On the one hand this means that Kinect games are more likely to promote exercise among elderly people than the Wii; on the other it means that Kinect games are less suitable to be played by this age group. In general, however, the console itself (whether Wii or Kinect) is not a decisive factor in terms of movement intensity. The main deciding factor is the choice of game. Bowling and Tai Chi are 'light' games; boxing and tennis 'challenging'.[47]

PHOTO: SILVERFIT/ROBERT VAN DEN BERGE

The SilverFit Alois for dementia sufferers in use in residential care facility Wenckebach in The Hague.

Kinect Adventures game
Kinect Adventures consists of five family games for one or two people. The most fun game is probably RiverRush, in which the players stand on a raft going down a river. They control the raft by moving back and forth while dodging objects like trunks by jumping. To play this game the elderly player does need to be fairly fit. The relatively hectic game environment makes the game especially suitable for elderly people who are already accustomed to computer games.

Kinect Sports
Kinect Sports is very similar to Wii Sports. Kinect Sports, too, consists of various sports, including bowling. Thanks to the relatively simple interface Kinect Sports is very suitable for elderly people, provided they are able to stand unsupported.

Your Shape: Fitness Evolved
'Your Shape: Fitness Evolved' offers a wide variety of single-player games and movement exercises. The package includes fitness, yoga and dance exercises, supported by a virtual coach. In addition there are a number of games that offer exercise in a fun and engaging way. Thanks to the clear interface and instructions these games are relatively easy to play. Experience nevertheless shows that many elderly people have difficulty simultaneously performing the movements and taking in the additional on-screen information (in English). It will therefore often be necessary to assist these people.

Exercise games for the elderly

Cycling games
Cycling games are highly suitable for elderly Dutch people. The movements are recognizable and therefore extremely accessible. Moreover, cycling is a good exercise activity that can be safely performed with the right setup. An additional advantage is that elderly people with cognitive and physical impairments are often still able to perform cycling motions.

The Netherlands produces a great many cycling games, such

DanceTown

In 2008, the US company Touchdown launched Dancetown, a variation on the popular Dance Dance Revolution (DDR). Dancetown was especially developed for (English-speaking) elderly people. DDR requires a dance pad that can be connected to a game console or PC. The players have to put their feet on the arrow(s) on the pad at the exact moment the steps are shown on screen.

Compared to regular DDR applications, Dancetown has a simpler interface. It also offers music that is suitable for elderly people, as well as various levels of difficulty. The game allows players to track performance and use.

For reasons unknown, Dance Town unfortunately is no longer available.

More information:
www.ddrgame.com
www.gamasutra.com/view/news/109549/Analysis_Making_DDR_For_Seniors_With_Touchtowns_Dancetown.php
www.stepmania.com

as *BuitenKomtVoorbij, DiFiets, Fietslabyrint, Praxtour* and *SilverFit Mile*. In all these games the players cycle around in a virtual environment, and come to a standstill when they stop pedaling. Curiosity and recognition are motivators for the elderly users to keep pedaling. The images on screen make it easier to keep up the exercise. In principle cycling games are solo games. Some games, however, can be linked locally so that people can cycle with or against each other.

Cycling games vary in terms of:
- practical matters, such as ease of mounting and easy of use;
- the type of activity; cycling together or alone; in a fictitious world or one's own (virtual) environment;
- the ability to set the level of intensity or difficulty: only in terms of speed or distance, or also the track, gradient, etc.;
- required operations: pedaling only, or also steering and/or changing gears.

Cycling games are expensive. As a result their use is more or less reserved exclusively for care institutions. When using existing exercise bikes and screens already available, the investment in cycling games will obviously be much lower. Examples are DiFiets, Fietslabyrint and SilverFit Mile, all games using virtual on-screen environments that can be custom-created if desired. This way, elderly people can cycle around an outdoor environment that they are familiar with. The use of on-screen footage does, however, only allow for limited interaction. This interaction is limited to speed and sometimes route selection.

Cycling games that take place in a virtual world are mostly developed for gyms. Cycling games such as Praxtour, ExpressoBike and GameBike offer more interactive features. Users can select gradients and tracks, steer, change gears and race against other players. The players are given feedback on distance, speed, heart rate and calorie consumption. All these additional features are not equally motivating to all elderly people. They can also create problems, for instance when users accidentally steer too far to one side and 'get stuck' but do not understand what is happening.

An interesting development is the recent emergence of cheap products in the US that make it possible to play games on any exercise machine (exercise bikes, treadmills or rowing machines) using a smartphone or tablet. Goji Play[49] ($100), a sensor-based app for the iPad and iPhone, is a well-known example of such a game. Another app is BitGym.[51] BitGym uses the camera on an iPhone, iPad or Android to determine the player's speed, while he or she is moving through the most stunning environments imaginable. The monthly BitGym subscription fee is $7.99. While both products were not designed for (Dutch) elderly people, they are nevertheless suitable for the elderly, especially when used under supervision.

SilverFit & SilverFit Alois

SilverFit is one of the oldest and largest providers of exercise games for the elderly on the Dutch market. The SilverFit (one to four players) is suitable for exercises that are based on the KNGF (Royal Dutch Association for Physical Therapy) physical therapy guidelines. The players' movements are tracked by a smart camera, without the players needing to operate or hold a controller. The game can be played while sitting down or standing. The level of the exercises is adjustable. The SilverFit also provides support in choosing the right exercises and automatically stores the player's exercise behavior. The fact that the exercises are offered in the form of a game makes them more fun to perform. The SilverFit was designed for physical therapy clinics. A new product with a functionality similar to the SilverFit is *Doctor Kinetic*.[51] This product is based on the Kinect camera.

Based on studies into the deployment of games within day care centers and living areas of psychogeriatric wards52, the SilverFit was customized

for use outside of physical therapy clinics. This was done by adapting the games themselves, by introducing new games, by simplifying the manual and game instructions, and by introducing a separate menu with which relatives, volunteers and others can start up new games more easily. A different version of the SilverFit was developed for people in moderate to advanced stages of dementia: the *SilverFit Alois*. By using personal photos and music and film preferences, the Alois games can be adapted to suit the needs of the individual player. In addition, thanks to the touchscreen and extra large buttons, the Alois is far more user friendly.

Other examples

Qwiek

The Dutch firm of Qwiek[53] has introduced a number of products that capitalize on the increasing need to offer the elderly exercise activities that require no or minimal supervision. The *Qwiek.play* is an exercise game that includes puzzles and darts and makes use of the Kinect camera. It is an intuitive game that is controlled using body movements, and can be played alone or with someone else, both while sitting down and standing. For added enjoyment and recognition players can use their own photos. Another Qwiek product is Qwiek.melody. This is an interactive system that plays music as soon as it detects a person moving within the range of the sensor. Players can also use their own music.

Yalp

Yalp produces a totally different kind of exercise game based on the *Sona*[54], an interactive system in the shape of a large arch. The Sona was designed for outdoor use. The Sona floor pad has colors, numbers and shapes that are also used in the games themselves, which include a dance contest, an arithmetic competition and musical chairs. Even though the Sona was originally developed for young people, it was recently introduced in ten care institutions to stimulate residents to exercise.[55] As part of this project and in cooperation with the target group, games are now being developed that better suit the requirements of the elderly. Another aspect that is being assessed is whether the Sona sound arch does actually incentivize elderly people (with and without dementia) to exercise more.

The Sona by Yalp

SensaMove

SensaMove produces various versions of SensBalance.[56] The SensBalance consists of a balance board and 28 balance training computer games. In some ways the SensBalance resembles the Wii Fit balance board. One of the main differences is that the SensBalance requires more balance control, and therefore always comes with a safety rack. Compared to the Wii Fit the interface and desired

The Sona floor pad has colors, numbers and shapes that are also used in the games themselves, which include a dance contest, an arithmetic competition and musical chairs.

interaction are simpler, making them more suitable for elderly players. For safety reasons supervision is highly recommended, especially for beginners.

Exercise games on smartphones and tablets

There are two types of game apps that are used for promoting physical exercise behavior among the elderly:

- apps that *gamify* walking, running or other exercise activities (making them more fun by providing extra motivation);
- apps that stimulate physical exercise (the desired input requires body movement).

In addition to these apps there are a lot of effective fitness apps that can be used by elderly people.[57] This white paper will, however, not address these apps and (comprehensive) pedometers.

Tablet apps
The aforementioned Goji Play and BitGym are examples of tablet apps that gamify movement. The availability of tablet exercise apps is very limited. The reason for this is that a tablet is not able to measure a player's movements as well as a smartphone. People are, after all, less likely to carry their tablets around with them. The emergence of hardware that can measure movement and link this to smart devices will undoubtedly lead to more tablet apps being introduced into the market. An example that is already available is i-Stapps, produced by the Dutch company Nyoyn.[58]

The i-Stapps consists of small, colored pads that are linked to a smart device. The game is activated by putting pressure on one of the pads or by standing on it. Another interesting development is the smart camera software produced by the Israeli firm Extreme Reality. Based on a phone or tablet camera image, this software allows for interaction with the Kinect.

Smartphone apps that gamify physical exercise
Prime examples of exercise games for the smartphone are *Zombies, Run!* and *The Walk* by Six to Start.[60] Zombies, Run! places players in a post-apocalyptic world in which they have to run to survive. The audio narrative is interspersed with music. Based on the success of Zombies, Run! the British government has given instructions to develop a similar app with the aim of encouraging walking behavior. In The Walk players are given daily exercise targets. By achieving certain targets they are able to unlock different parts of a thrilling story. The walking aspect makes The Walk highly suitable for elderly people, on condition that they have no difficulty walking. The fact, however, that the game is in English and requires the use of a smartphone, will be an obstacle for many Dutch seniors.

Another type of gamified exercise apps are those in which players collect points through exercise, after which they can win (virtual or real) prizes. Some examples of such games are *Fitocracy, Nexercise* and *Pact*. Pact is a type of gambling game. Players win money when they achieve their exercise targets, and lose money when they fail to do so.

The *FigureRunning* app is another example of gamification. Using this app players can draw a picture on a map

Stranded in the prototype stage

Commissioned by 'Omroep Max', a Dutch TV channel aimed at senior citizens, students of the Utrecht School of the Arts have developed a game called 'De moestuin', Dutch for 'kitchen garden'. In this game elderly people can plant seeds, water their plants, and in due course harvest their own carrots and apples. The game uses the Kinect camera and was tested at Hilverzorg, a care organization specialized in care for the elderly.
More information: https://prezi.com/zgqe3bo6lzdp/copy-of-gamedoc-moestuinnederland-in-beweging/

The SIA RAAK Healthy Aging through Serious Gaming (HaSeGa) research project has produced a dance game with a focus on Ta Chi and ballroom dancing.
Trailers: youtu.be/wPcz21dliOg en youtu.be/9dvKeBtYTrU

through body movement (running, cycling, walking).

All of these apps can fairly easily be played by elderly people as long as they are sufficiently physically fit and have the skills to use a smartphone.

Smartphone apps that incentivize physical exercise

More and more successful console exercise games are becoming available for smartphones. At the end of 2013, for instance, the developer of DDR introduced a version for the iPhone. This version does not require a dance pad, and can be played on the Apple TV.[61]

An excellent example of an app that encourages exercise as a 'side-effect' is *Roamler*.[62] This Dutch app lets users take photos in different stores, for which the 'players' can earn money. The photo tasks are assigned by suppliers who want insight into the availability, promotional activities, placement, and price of their products in different stores.

Another original example is *Bounden*[63], a Dutch app for the iPhone. This game gets two people to 'dance' together, more or less without them realizing it. As soon as the players place their thumbs on the same screen, a piece of classical music starts to play. The players then use body movements to steer a spaceship toward a planet. The required movements have the players make all kinds of twists and turns. Although Bounden is a nice example of how an app is able to stimulate exercise, it is not suitable for elderly people who lack a certain level of physical agility.

Improvement potential

Tacking stock it is clear that there is a wide variety of exercise games. At the same time, the number of games suitable for (Dutch) elderly people is disappointing.

- The content or themes are often not geared towards elderly people, for instance as regards the music or the clothes worn by the characters in the game.
- The interface and game mechanisms often do not sufficiently take into account potential sensory, cognitive and motor impairments experienced by elderly people, for instance as regards font size, response times and movements.
- The entry level is often so complicated that seniors with little game or computer experience do not understand how the game works.
- Many games are not available in the Dutch language.

The increasing availability of affordable game technology – in particular the smart Kinect camera – has resulted in increased availability of games for the elderly. A number of successful products have been developed, such as Qwiek.play and Dr. Kinetic. Unfortunately, many games do not move past the prototype phase due to the fact that they are often developed as part of a graduation or doctoral project. Once the students have obtained their degree or doctorate, there is often no more money or know-know for further development.

The main area for improvement involves the range of available exercise games that properly meets the characteristics, capabilities and limitations of elderly people. It is also important to develop new games that are affordable. After all, in spite of the positive evaluations, exercise games designed especially for the elderly have as yet not been implemented on a large scale. In addition to the challenges in terms of (un)familiarity and implementation, the main bottleneck appears to be price-related. Price also plays a key role in the use of these games by elderly people living at home.

In spite of the positive evaluations, exercise games designed especially for the elderly have as yet not been implemented on a large scale. In addition to the challenges in terms of (un) familiarity and implementation, the main bottleneck appears to be price-related.

Current research programs

Two major research programs are currently being conducted in the Netherlands that are focused on the development and market introduction of an applied game for the elderly.

The SPRINT program is funded by the northern Dutch provinces. Its goal is to develop new technologies that can help people to continue to live and work independently as long as possible. One of the projects within SPRINT is focused on exergaming for balance training of elderly people. This involves a skating exercise game to be played at home. The game recognizes and encourages movements that play a role in fall prevention.
More information: www.imdi-sprint.nl/huidige-projecten/ exergaming-project/

The G Motiv project is part of the Creative Industry Scientific Programme funded by the Dutch government. The G-Motiv team, an initiative of the Delft University of Technology, has developed a product called Active Cues. Active Cues is an interactive system that incentivizes people in the advanced stages of dementia to exercise. This is done by images projected on a table that stimulate people to move their hands and arms.
More information: www.activecues.com.


THE BUS
IS COMING!
RUN 300 METRES AS FAST AS YOU CAN
AND YOU'LL CATCH IT!

INVESTING IN EXERCISE GAMES

What investments are needed for exercise games and corresponding equipment? How much is the initial investment (purchase), and what investments are needed subsequently?

What investments are needed for exercise games and corresponding equipment?

Initial investment

Based on the initial investment (purchase) the above games can be divided into four categories:

1. **High-end games**
   (> €5,000)
   This category includes games such as the SilverFit, BuitenKomtVoorbij, Qwiek.play and ExpressoBike. These games have often been especially designed for elderly people and a specific (care) environment. The games all include a complete setup: hardware, software and a screen.

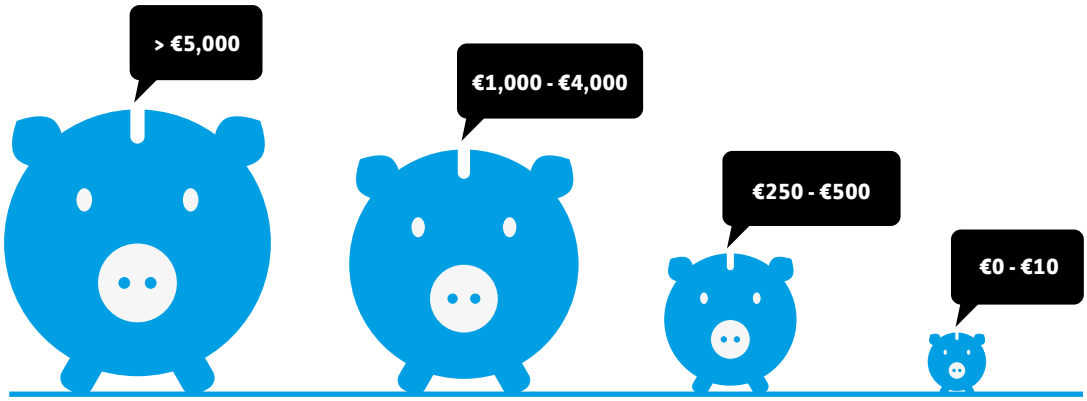
2. **Mid-range games**
   (€1,000 - €4,000 + hardware investment, if applicable)
   Examples of mid-range games are Qwiek.melody, SensaMove, DiFiets and Active Cues. These games, too, have been especially designed for elderly people and a specific (care) environment. The range of available games, however, is more limited than in the high-end category. Some mid-range games require the use of a computer, screen or exercise machine.

3. **Low-end games**
   (€250 - €500 + purchase of a screen)
   The low-end games category includes games for the Wii, Xbox Kinect and Playstation Move. These games have often not been specifically designed with the elderly in mind, but can nevertheless be used for this group (under supervision, if needed). The games cost several dozen euros each; the one-off purchase cost of a game console is approximately €300.

4. **Free games**
   (free - €10 + investment in a smartphone or tablet and additional hardware, if required)
   Free games, such as apps, have often not been specifically designed for elderly people, but can nevertheless be used for this age category (possibly after having received instructions). These games sometimes require a sensor, pedometer or heart rate monitor.

Implementation

The effective use of an exercise game requires careful implementation. The implementation, whether at home or in a care facility, also requires an investment.



- SilverFit
- BuitenKomtVoorbij
- Qwiek.play
- ExpressoBike

- Qwiek.melody
- SensaMove
- Difiets
- Active Cues

- Spellen voor de Wii
- Spellen voor de Xbox Kinect
- Spellen voor de Playstation Move

- Free games, such as apps

DiFiets in use at St. HilverZorg, Flat Kerkelanden

Home use may require the following investments:
- internet/WiFi;
- help with installation, instructions for first use and (on-call) user help.

When used, for example, in a community center or health institution, the following investments may be required:
- infrastructure (appropriate space);
- installation;
- supervision (training and remuneration);
- communication;
- administration (registration of use for invoicing purposes).[64]

Maintenance and management

The continued proper performance of games requires proper maintenance. This includes investments in:

- **Support and bug fixing**
  For high-end and mid-range games this is often part of the service contract.

- **Extended functionality**
  In order to keep exercise games fun, they need to be renewed on occasion. Service contracts typically include regular updates to new games or content, such as new levels, music or cycling routes. For low-end and free games users can take out extended functionality for a service fee of 1 - 10 euros a months. This fee covers updates as well as the option to play remotely against other players.

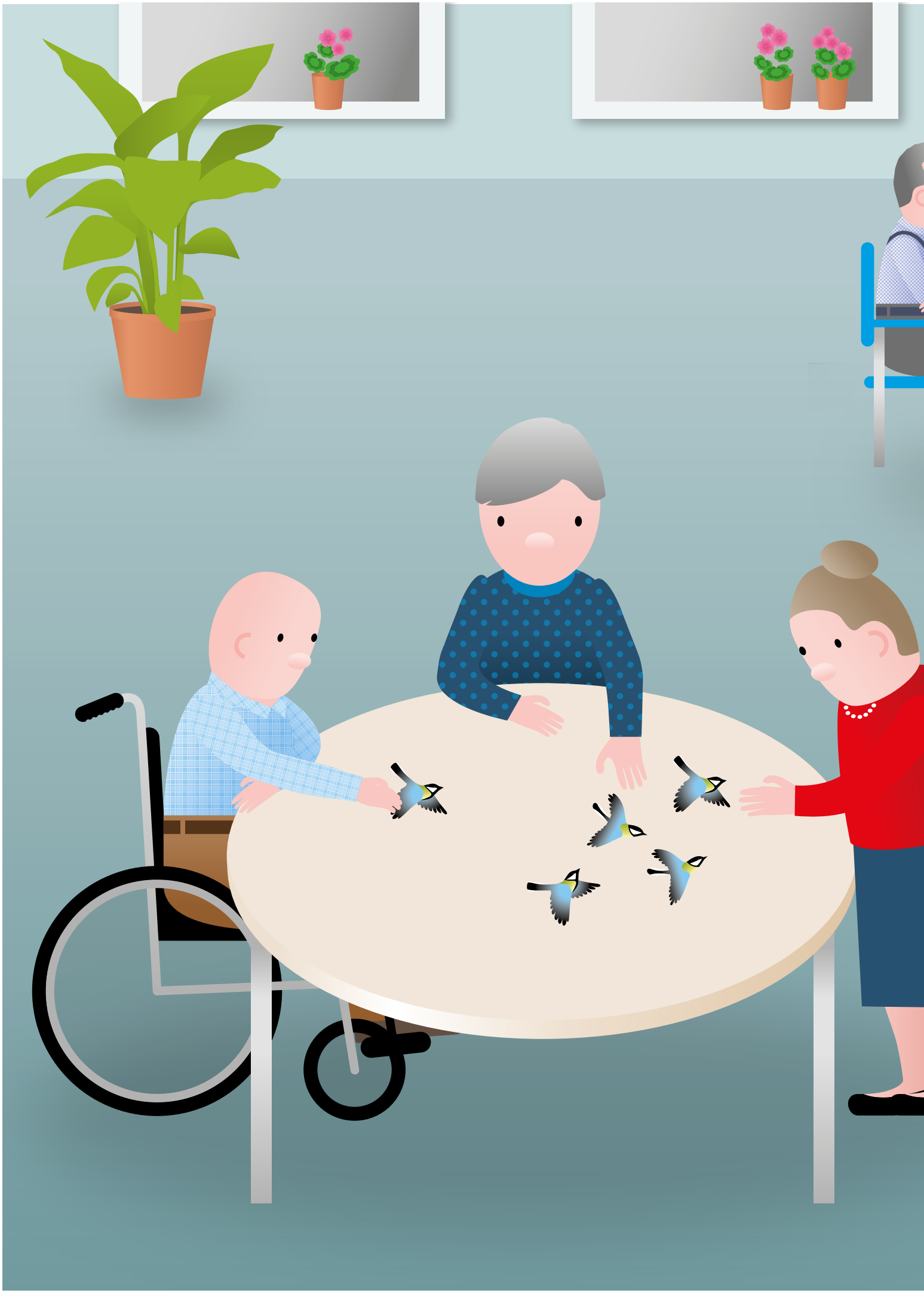
- **Repairs**
  The repair costs depend on the type of game and the malfunction involved.

Alternative funding models

Sometimes other types of funding are available:

- **Lease**
  Fietslabyrint, for instance, already offers this option. Active Cues is considering doing so. The advantage for the user is that it makes investments predictable. The benefit for the provider is customer loyalty.

- **Exchanges**
  By exchanging exercise games the investments (purchase and maintenance) can be split between multiple locations and parties. The implementation costs remain the same. For a continuous supply, more systems are needed, however. The question arises whether this arrangement is as financially advantageous as it may seem. In terms of variety this is certainly an interesting model.



THE **ACCEPTANCE** OF EXERCISE GAMES

Playing exercise games can be beneficial to elderly people. But how do seniors feel about these games themselves? Are they familiar with the games? If so, are they motivated enough to actually try out a game and continue to play it?

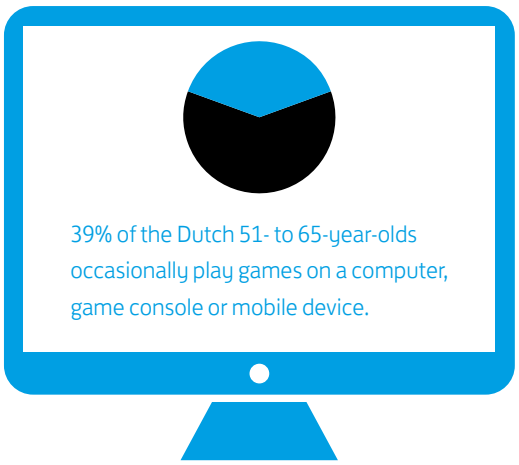
It appears that elderly people play games for two different reasons: for fun and because they find them useful. The study also shows that it is not only the games themselves that motivate seniors: the context of their situation also plays a part.

The elderly and games

Little is known about the use of games by elderly people. An overview of what we do know:

- Every year global games market research firm Newzoo examines the gaming behavior of the Dutch population. The oldest age group being researched is the category 51-65 years. 39% of this group occasionally play games on a computer, console or mobile device.

- A survey by TNO65, the Netherlands Organization for Applied Scientific Research, shows that 43% of the over-65s who use the computer at least five days a week, never play computer games. Some 29% indicated they play computer games at least five days a week. Solo games are particularly popular among elderly people: puzzle and card games, 'fast' casual games, such as Minesweeper, Freecell, solitaire, and Angry Birds. A questionnaire survey of 124 people in the age category 45-85 who play games[66], shows that the majority seems to prefer to play casual PC games. The main motivation for playing games is the challenge. The time spent playing strongly depends on the degree of social interaction.



- A qualitative (focus group) study showed that the significance elderly people attach to playing games, as well as the corresponding motivation, depend on the extent to which games contribute to:
  - social contact;
  - people's own development and that of others;
  - the community[67]

- A similar survey identified fun and relaxation as the main motivational factors. The underlying motivations involved were:
  - an escape from reality;
  - to stay in touch with the community;
  - a sense of purpose to one's day-to-day life;
  - an enjoyable pastime;
  - challenging cognitive skills and reflexes.[68]

In other words, elderly people seem to play games for two reasons: for fun and because they find them useful. The study also shows that it is not only the games themselves that motivate seniors: the context of their situation also plays a part. Some seniors state, for instance, that they play games to avoid, replace or support other activities, or to bridge the time between different activities.[69]

The elderly and exercise games

Little is also known about the view of Dutch elderly people where exercise games are concerned. The available data originate from two questionnaire studies and a number of qualitative studies on this topic.

'Omroep Max' questionnaire study
Between 2008 and 2012 a research project called 'Healthy Aging through Serious Gaming' (HaSeGa) was conducted in the north of the Netherlands. Within this context 'Omroep Max' provided its panel members with a questionnaire on 'interactive and serious gaming/games'. The questions were answered by 734 people in the age group 50-64, and by 986 people in the age group of 65 and older.

The elderly participating in this study do agree with the potential benefits of exercise games, but are reluctant to use them themselves.

Questions submitted to the 'Omroep Max' panel members	Agree
Interactive games increase the chances of elderly people exercising/practicing a sport more often	46%
I would be (very) eager to start using interactive games, on condition I receive proper instructions	35%
I am not (at all) eager to start using interactive games	39%
I prefer the 'old-fashioned' way of exercising/practicing a sport	39%
I prefer exercising/practicing a sport using interactive games	12%
Exercise should be taken outdoors, not in front of a TV or using a Wii	68%
It is much better for elderly people to engage with other elderly people when exercising under the supervision of a personal coach, than individually before a TV, or behind a PC or console.	67%
The elderly should be given free lessons to improve their physical condition using interactive games	50%
If young people can learn to do sports using interactive games, then so can elderly people	54%

Interviews among the category of frail elderly people
Within the framework of the above HaSeGa project, 15 frail elderly people (with an average age of 77) were interviewed. These were elderly people who still lived on their own, and were receiving up to four hours of domestic or personal care.[70] Even though none of the people interviewed were familiar with exercise games, they had a positive attitude towards the use of such games. They considered the versatile scope of application (satisfying everyone's wishes) as a distinct advantage. They also saw exercise games as a new opportunity to exercise more. To achieve this, in their opinion the games should be adapted to their individual capabilities, in addition to which they would need help to (learn how to) use the game. The reason they stated is that they would be afraid to fall, in addition to which they foresaw problems due to their increasing forgetfulness. Most of the respondents furthermore do not have a proper command of the English language, and expect to need help with installation.

Interviews among the category of fit elderly people
In another study 15 healthy and fit elderly people between the ages of 55 and 78 were interviewed about their experiences. The study results are similar to those from the study conducted among the group of frail elderly people. As part of the study the respondents were asked to play the game Fitness Evolved on the Xbox Kinect.[71] The subsequent interview about the players' experiences showed that all participants had felt motivated to play this exercise game. Specific benefits mentioned, were:

- the ease with which the game allowed for physical exercise indoors;
- the choice of games and levels;
- the feedback provided by the game to coach the players;
- the fun in performing sports (movements) that the users are familiar with from when they were younger.

A disadvantage mentioned by the respondents was the fact that they viewed traditional exercise activities as more appealing. As far as they were concerned, exercise in front of a screen is nowhere near as good as outdoor activities or team sports. A second disadvantage mentioned is that the look and feel of the game were not in keeping with Dutch culture.

Internet panel questionnaire for people over 65
A questionnaire for an internet panel of Dutch people over the age of 65 set up by TNO shows that exercise games are not all that well-known as yet. 482 people participated in this survey, with an average age of 72.

- 29% of the participants had never heard of exercise games.
- Of the group that had heard of these games, 18% stated to have played the games at one time or another. Some 15% stated to have access to exercise games, for example through family, a community center or residential complex.
- Of the group that had never heard of exercise games, 98% stated they had no intention of playing such a game within the next six months. Of the people who had played an exercise game before and (really) enjoyed it, 51% stated they did intend to do so. The people who had previously played exercise games moreover turned out to be significantly more fond of (computer) games and working with computers, and apparently do so quite frequently.
- Of the elderly people that play exercise games on occasion, 72% stated they enjoy doing so (very much). Only 9% do not enjoy it.
- The most frequently cited reasons for intending to play or for playing exercise games were to be physically active and have fun. The group that had not previously tried playing exercise games, cited 'trying out something new' as a third reason.

The most frequently cited reasons for intending to play or for playing exercise games were to be physically active and have fun.

- People who had not previously played exercise games had no intention of doing so for the following reasons:
  - no interest;
  - no added value;
  - not willing to spend that much money;
  - enough exercise as it is;
  - too busy.
- The people who had previously played exercise games but had no intention of doing so again, stated that they are not willing to spend that much money on them and are also not willing to go elsewhere to play the game.

All in all, a large part of the elderly respondents recognizes the opportunities applied gaming has to offer with respect to growing old in a healthier way. They are, however, not all interested in playing these games themselves. The main obstacles seem to be lack of interest, costs, and the belief that traditional (outdoor) exercise is more useful.

Current use

It is virtually impossible to provide concrete data on the use of exercise games by the Dutch elderly population. The only information available about home use, is the information presented above. A cautious conclusion is that the use of low-end exercise games is not widespread. Even less is known about the use of free exercise games (apps). Considering the limited range being offered, however, their use is also not expected to be extensive. On account of the growing use of smartphones, the chance that elderly people will start using fitness apps is increasing.

Not much research has been conducted into the use of exercise games in care and welfare institutions, and even less information has been published on this subject. The overview below mainly consists of anecdotal practical experiences that were shared within the coalition and laid down in reports.

Word-of-mouth advertising seems to be an important factor where the sale of exercise games is concerned. This type of advertising generates sales as a result of the snowball effect.

Games already installed
It appears that health and welfare organizations have acquired more exercise games in recent years. The Wii and SilverFit are particularly popular. Virtually all health providers within the coalition offer the Wii and/or SilverFit.

- **250 SilverFit systems**
  Joris Wiersinga of SilverFit, a system introduced in 2009, states that some 250 SilverFit systems have been installed in the Netherlands, and another 1,000 systems in the rest of the world. Ten Alois systems have been installed since the introduction of the SilverFit Alois in the summer of 2014. New orders are coming in on a weekly basis.

- **40 DiFiets systems**
  Ron Otten of the BOZ foundation has sold forty DiFiets systems since their introduction to the market in 2011. Many (new) providers of cycling games have adopted the concept of users cycling and walking through their own surroundings.

- **35 Qwiek systems**
  Tom Frissen of Qwiek states that since the market introduction at the end of 2013, 10 Qwiek.play systems and 25 Qwiek. melody systems have been installed.

Word-of-mouth advertising
Word-of-mouth advertising seems to be an important factor where the sale of exercise games is concerned. This type of advertising generates sales as a result of the snowball effect. Almost all installed Qwiek products can for instance be found in Limburg. DiFiets systems, on the other hand, can mostly be found in and around Utrecht. And SilverFit, whose development began in collaboration with Avans university of applied sciences in North Brabant, was initially especially popular in the province of North Brabant. Physical therapists who had been educated at Avans university of applied sciences and were excited about the product, introduced SilverFit in their own clinics and shared their experiences with local colleagues. Following the dissemination of the system across North Brabant, SilverFit conducted a study in collaboration with The Hague University of Applied Sciences and HU University of Applied Sciences. In those regions, too, sales increased, in particular in the form of purchases by physical therapists.

Innovation funds
There are major differences in the way exercise games installed in the Netherlands have been financed. The SilverFit, for example, is often part of a physical therapist's budget. The purchase of DiFiets systems often involves local fund raising events, or use is made of money from innovation funds. The Wii, too, is often financed by means of innovation funds or grants. In 2011, for example, the National Foundation for the Elderly donated Wii systems to 24 Dutch institutions.[72]

Initiative and implementation
The implementation of applied games and their success depend on the type of game, the initiator, the objective and the target group. The purchase and implementation of high-end and mid-range exercise games are often a management decision. This definitely applies to the games used for exercise activities and well-being. For purchases by physical therapy clinics the main decision makers are the therapists themselves. The purchase of low-end games, too, is sometimes the result of management decisions. Saying that, the initiative for their actual use often originates on the shop floor.

Role of the project leader
Management often appoints a local project leader. In the hustle and bustle of everyday life, however, there is a risk that there is insufficient attention for matters such as the creation of support and training of supervisors. This in turn may lead to a level of resistance on the shop floor. The rate of success therefore stands or falls with the project leader. The most successful projects are those run by someone who believes in the initiative in question, and can inspire this belief in others. It is also important for this person to be given the time and resources needed to properly carry out his or her tasks. Initiatives that originate on the shop floor nearly always involve someone who is enthusiastic about the introduction of the game. Too little management support, however, will result in the introduction not proceeding smoothly, as the introduction will simply be viewed as an additional work task. The link to IT frequently also poses a problem, especially if the game requires an internet connection.

It appears that health and welfare organizations have acquired more exercise games in recent years. The Wii and SilverFit are particularly popular.

In addition, the game itself and the role of the supplier are decisive where implementation is concerned. Free and low-end games do not include any personal assistance in installing or learning to play the game. This is not necessarily a problem. Some supervisors, for instance, state they did not encounter any problems because they happened to have the same console at home.

Sometimes, however, people need to supervise others playing a game that they have yet to learn themselves. Some people prepare beforehand, others learn through experience.

Mid-range and high-end games often include a service contract that provides for installation and the introduction to employees. Such a personal introduction is explicitly focused on the game properties that are relevant to the target audience.

Some care and welfare institutions personally decide how, where and for what purpose the game is to be implemented. Others rely on the expertise of the suppliers. SilverFit, for example, offers advice on the design and setup of a geriatric training area, as well as a user plan. As an independent provider of a wide variety of games, Embedded Fitness[73], too, provides setup advice. The company furthermore gives advice on the purchase of equipment, and offers assistance regarding installation and introduction.

A permanent spot
Due to the sensitive settings in many game systems and the need to recalibrate the games after having been moved, most games are installed in a permanent spot. Health care facility Warande, for example, has a MOTOmed and cycling game right at the entrance. The receptionist has been

Of the elderly people that play exercise games on occasion, 72% stated they enjoy doing so (very much).

Only 9% do not enjoy it.

One Kinect, multiple users

In a home for the elderly in New York a welfare supervisor is playing an exercise game on the Xbox Kinect. The elderly people behind her are dancing along. This way the home is using one single game for multiple people. This solution also removes any difficulties people may have controlling the game. The fact that much is possible with sufficient guidance is also evident from the positive experiences of blind and visually-impaired elderly people when using Kinect Games (such as bowling and Zumba).

More information:
blogs.msdn.com/b/healthblog/archive/2013/02/03/10290757.aspx
blogs.msdn.com/b/accessibility/archive/2014/02/06/blind-and-low-vision-seniors-dance-and-bowl-with-microsoft-xbox-games.aspx

instructed on the use of the system, and helps all residents and visitors who are interested in making a virtual bicycle tour. Hilverzorg has chosen for a totally different form of implementation. Here Embedded Fitness has equipped a whole room with several types of exercise games. This room is centrally located and easily accessible for the various target groups involved. Other institutions have chosen to instal the games in their physical therapy wards, the general coffee lounge or sitting room to make sure they are easily accessible. Although most institutions tend to use lockable rooms because of the equipment being quite expensive, it is easily accessible and familiar rooms that offer the highest chance of success.

Continuity of use

The actual level of game use widely varies between different organizations. Some institutions have been using the Wii with great success for many years now. In other locations the Wii is left on the shelf. An assessment of the use of the SilverFit in 16 locations has also shown that the level of use of this system varies greatly. This level of use is mainly determined by the internal organization involved, as well as the level of affinity, knowledge and skill of the supervisors.[74] The use of the SilverFit by dementia sufferers is moreover greatly determined by the perception they have of their skills in handling the equipment.

In general the use of a game is determined by the game itself, the purpose of the purchase, and the location. It makes a difference, for example, whether a game is used for the purpose of physical therapy, or as part of outpatients' treatment or welfare services.

The importance of the space used

A highly visible and easily accessible room can strongly promote game use. The reverse is true as well. A room that is a good bit away or locked by default, will result in decreased use. It has been shown that highly visible 'open door' spaces motivate elderly people to play exercise games because they can see others do the same. Open spaces give people the opportunity to watch and cheer on other players. However, if the space is also used for other activities (in the case of a communal sitting room for instance), this may create problems. Hilverzorg seems to have introduced the perfect solution. It has a room specifically equipped for games, which can be used for multiple objectives and by multiple target groups and parties. The games in the exercise room at HilverZorg, Flat Kerkelanden are used by both its own physical therapist for prescribed physical therapy (for elderly patients in the nursing unit), and the

Qwiek.play in use at health care institution Sevagram

PHOTO: QWIEK

physical therapist at health center Fitwell (for elderly people in the surrounding community and care home). In addition, health welfare workers at Hilverzorg also use the games for residents of the care home. People in the surrounding community can also play the games by using a Fitwell subscription.

Supervisors' creativity
The use of the games furthermore depends on the level of creativity displayed by the supervisors. The DiFiets system can, for example, only be used by one elderly person to cycle around a virtual neighborhood. However, the smart placement of other exercise bikes and equipment around the DiFiets allows more elderly people to cycle together through this same neighborhood.

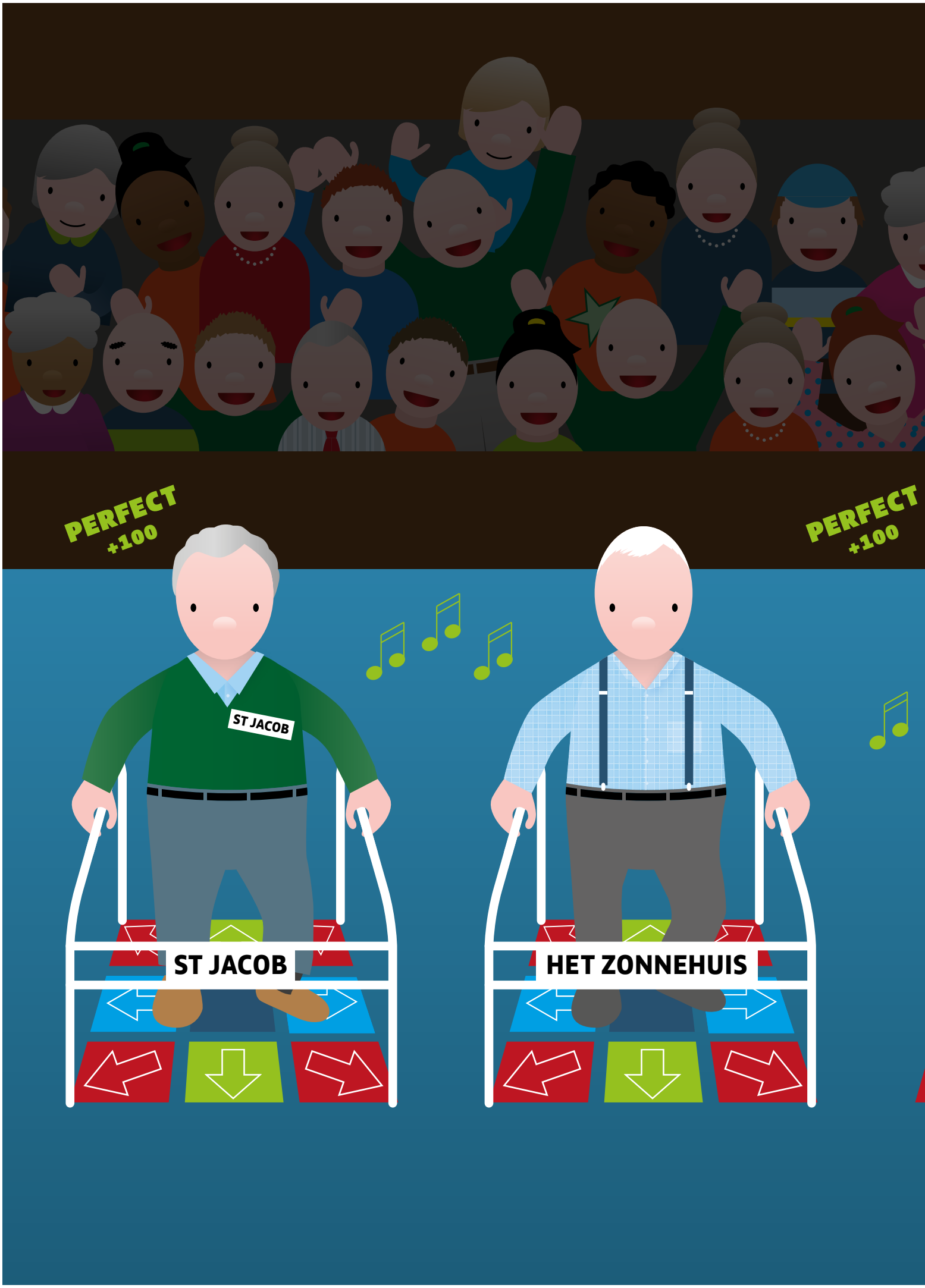
The playing of exercise games is moreover often combined with regular exercise activities. This is done to ensure a varied exercise program, as well as to encourage multiple elderly users to exercise at the same time. Practice shows that due to the cost involved one supervisor should ideally supervise multiple elderly users at the same time. The fact that some games require individual supervision or are only suitable for one or two players at a time, stands in the way of their use. Practical experience shows that games are generally used for groups of up to six people.

'Self-service'
Many care and health welfare organizations would like to be able to implement games without the need for supervision. This is usually not feasible for elderly people residing in institutions. Feasible options, however, are games that people more or less immediately feel comfortable with, such as BuitenKomtVoorbij and Qwiek.melody. But even Qwiek.play with its extremely simple interface is only used without supervision once the elderly users have been encouraged to do so.

After a proper introduction it appears that elderly people living independently can start using these games on their own. TNO, for example, studied[75] the voluntary use of the Xbox Kinect in a residential service flat. Following the introduction, 10 out of the 19 participants played the games at least once a week for a period of three months, by themselves and on a voluntary basis.

The actual level of game use widely varies between different organizations. Some institutions have been using the Wii with great success for many years now. In other locations the Wii is left on the shelf.

Fun as a crucial factor
The main factor to ensure continued game use seems to be that the elderly users have fun playing. According to FitWell, elderly people who come into contact with exercise games during physical therapy treatment sometimes take out a subscription afterwards. Using this subscription they can be continue to play the games under the supervision of their personal trainers. The fact that fun can be a deciding factor is also demonstrated by the TNO study. The elderly participants in the study who had the most fun playing, also played the most frequently and continued to do so once the study had concluded. The elements that make playing fun, vary. Many people enjoy being good and getter better at a game. Another major motivator is the ability to play with others. Institutions are capitalizing on that motivation by organizing group games at regular intervals, often supervised by welfare workers or volunteers.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SHORT-TERM **OPPORTUNITIES** AND **CHALLENGES**

Are there opportunities for providers of exercise games for the elderly? And if so, how can these be capitalized on? What kind of games are in demand? And in what way can institutions currently implement exercise games?

The Dutch games industry has experienced substantial growth in recent years. But despite the fact that the elderly population is growing and on average has the highest disposable income, the market for exercise games for the elderly is still in its infancy.

Market development

The Dutch games industry has experienced substantial growth in recent years. But despite the fact that the elderly population is growing and on average has the highest disposable income76, the market for exercise games for the elderly is still in its infancy. Game manufacturers often recognize the potential of the growing market, but rarely capitalize on this potential. At times this is a result of preconceptions, such as the notion that elderly people are not willing and able to embrace technology. At other times it is a result of a lack of knowledge, for example regarding the needs of the target group or the design requirements. The main bottleneck, however, seems to be the complexity of the market. The elderly people involved are often approached indirectly through care and health welfare organizations. This complicates the introduction of new games. After all, in addition to the end users (the elderly), game companies must also convince the intermediary providers (municipalities and care and health welfare organizations) of the added value of their games. All in all, the market for exercise games for the elderly is still in its infancy. We urge the different parties to further facilitate and stimulate this market.

Increase the awareness and understanding of added value

It is important for the added value of exercise games to be effectively communicated: this applies to both elderly people and the parties that have an influence on or work with the elderly. This means that more attention should be paid to these games in media aimed at the elderly, as well as in their immediate environment.

- Games should be presented as fun, interactive activities that bring pleasure and can contribute to a person's health. In addition, it is essential that products are not marketed as products 'for the elderly'.[77]
- In order to convince people of the value of exercise games the right people must be approached. Perspectives based on experience play a crucial role. It is particularly important for enthusiastic elderly people who actually play games to be given a platform. The benefits of games can be emphasized by experts such as general practitioners. Enthusiastic colleagues are perfect ambassadors to help persuade health and welfare professionals.
- Both local (free local papers) and national media (Dutch TV channel 'Omroep Max' or the TV program 'De Wereld Draait Door') are suitable channels for reaching a wide audience. Organizations that focus on the elderly, such as ANBO (General Dutch Association for the Elderly), also have a wide reach.
- Communication with care and health welfare professionals usually requires a more specific approach. Highly suitable channels for this purpose are publications in journals, such as 'Fysiopraxis'78, 'Fysiotherapie en Ouderenzorg', 'Zorgvisie', or the 'Helpdesk Ontmoetingscentra' newsletter.

Get people into gaming

Personal experience plays an important role in the acceptance of exercise games by both elderly people themselves, and care and health welfare professionals. Research shows that elderly people who have personally tried out applied games have a more positive attitude towards them. There is also anecdotal evidence to suggest that the same applies to physical therapists and welfare workers. Marketing and communication should be focused on getting people to become better acquainted with exercise games. In doing so it is advisable to use ambassadors: elderly people who already play these games and other enthusiastic people within this area of application (informal caregivers, health care professionals, etc.).

- Associations for the elderly and industry organizations can also play a role by organizing an exercise gaming experience. This is best achieved by coordinating such experiences with existing events, such as the '50 Plus Beurs' (Over-50s Fair) and 'Zorg & ICT Beurs' (Health Care & IT Fair).
- In a best-case scenario the potential and opportunities of exercise games are addressed as early as the training stage of health care and welfare study programs.

Ensure the availability of proper information

It has emerged that elderly people or health care and welfare organizations with an interest in taking up exercise games find it difficult to find suitable information.[79] It is a relatively new field in which availability changes constantly.

The suitability of a game depends on a great many factors, such as the interests and physical and mental limitations of the target group. Elderly people therefore have problems determining which games best suit their needs and capabilities. It can be equally difficult to find information on the use of the games.

- Associations for the elderly should be able to offer objective and tailored information in addition to the information that is already available via channels such as YouTube and internet forums.
- Ideally speaking, care and health welfare organizations should be able to find the knowledge required to successfully deploy games for the elderly through knowledge platforms such as Vilans and Nictiz, or through industry associations such as Actiz. Until this is the case we are hoping that the knowledge in this white paper will give the implementation activities a powerful boost. To this end this white paper covers an overview of the different types of games (page 18), an overview of implementation opportunities (page 47), and an implementation guideline for care and welfare organizations (page 44).
- Care and welfare organizations requiring more specific help with selection and implementation can turn to providers such as Embedded Fitness. They can furthermore join knowledge networks such as the the 'Applied Gaming for Healthy Aging Coalition', or the association for 'Innovation in games and welfare in geriatric care'.[80]
- We also recommend that people learn as much as possible about general facilitating and impeding factors that play a role in the implementation of care innovations.[81,82]

Demonstrate effectiveness

More and more research is being conducted into the added value of exercise games (see page 30). The majority of this research consists of pilot studies with a small number of participants. However, as regards the financing of exercise games as a therapy component it is important to generate more scientific evidence on the effectiveness of these games. This is also an important factor where the acceptance by care professionals and investor confidence in exercise games are concerned.

- All in all, there should be more focus on effectiveness research. Randomized Controlled Trials are considered the gold standard among research methods. A major disadvantage is that they are very time-consuming and expensive. Moreover, they are not suitable if there is no non-biased control group for comparison.
- On account of the amount of time to be invested, when researching effectiveness we recommend cooperation with researchers in universities (of applied sciences) and knowledge institutes. Research funds may be available through the EU (Horizon 2020) or the Dutch government (ZonMw, RAAK, etc.).

Increase the availability of suitable games

The number of exercise games for the elderly is (too) limited and requires (further) development. In order to encourage the gaming industry to develop exercise games for the elderly, the industry needs effective information about the target group, the requirements in terms of prevention, care and welfare, the relevant game elements, scientific insights, and potential funding sources.

- The aim of this white paper is to contribute to the dissemination of relevant knowledge and alert the Dutch gaming industry to the opportunities involved.
- Other more ad hoc opportunities to keep the gaming sector informed, are articles in trade journals such as Control[83], or presentations on relevant forums such as 'Games for Health Europe', and 'Dutch Game Garden'.
- Another approach is to organize easily accessible meetings and workshops where game developers come in contact with elderly senior citizens' associations, foundations for the elderly, professionals in the field of Wmo (Social Support Act) and AWBZ (Exceptional Medical Expenses Act), and health care professionals. This way they will have a better picture of what is going on. This is also the objective of the recently launched Growing Games.[84] This is an incentive program to promote the sustainable growth of the Dutch applied gaming sector, among other things in the field of health (both preventive care and health care itself).
- Another source of opportunity is offered by the programs of the Dutch top-tier sectors policy on Life Sciences and Health (LSH) and the Dutch Creative Industries knowledge and innovation network (also known as CLICKNL). CLICKNL includes a program called 'Create Health'. In this program, various subsectors (gaming, design, the built environment, heritage, fashion and media/IT) develop and validate solutions to overcome the challenges in the health (care) sector. In keeping with this program, TNO is in the process of developing a thematic e-health boost initiative in consultation with VH (Netherlands Association of Universities of Applied Sciences), NRPO (National Taskforce for Applied Research), the Ministry of Education, Culture and Science, innovation center Syntens/Chamber of Commerce, and employers' organization VNO-NCW. This e-health boost is a multi-year initiative to introduce validated e-health services into the community. The e-health services in question are mainly focused on the level of vitality and functioning of elderly people and people with (multi)morbidity.

The availability of investment resources

A major bottleneck in the development of exercise games for elderly people seems to be funding. Only a limited number of companies are able to finance their investments using their own resources. And as long as the demand remains small, investors will be reluctant to get involved.
An interesting development is the recently opened Center for Applied Games[85], an initiative that has designated care as one of its three pillars and is backed by an investment fund.

- The development of exercise games partly still depends on grants. The EU, for example, issues innovation grants to help promote self-reliance among elderly people. An example is the Ambient Assisted Living (AAL) program that seeks IT-based solutions as a key to prolonged healthy life, while at the same time giving a boost to small and medium-sized businesses.
- A particular point for consideration in processes of this kind is intellectual property. The rights are not vested in the game developers by default, but often in parties that have no interest or opportunity to actually introduce the game into the market.

Deployment options

In the prevention, care and welfare sector the number of locations where exercise games can be used for elderly people is growing. Their added value and success depend on the background against which they are used.

Make games part of the range of activities
Many associations for the elderly, municipal authorities, and care and welfare organizations offer a variety of activities for the elderly involving physical and mental fitness and well-being. The available range often contains cultural, creative, musical and sporting activities and games.

- Exercise games can serve as quite a suitable addition to this range. These games can, after all, have a positive impact on a physical, cognitive, and social-emotional level (see page 30). Under proper guidance, possibly by volunteers, elderly people can easily start playing games on game consoles such as the Wii or the Kinect. It is important that the games can be easily operated by the supervisor. The enthusiasm and creativity of the supervisor are determining factors for the measure of success.
- It is a good idea to offer different games and different levels. That way, there is an appropriate challenge for everyone. As the games start requiring higher levels of exercise intensity, the physical effect to be expected will be greater.
- Suitable games: Qwiek.play, SilverFit Alois, Wii, Xbox-Kinect, Yalp Sonaboog.

Both from a qualitative and quantitative standpoint the available range of exercise games on offer is not yet solid enough. There is a particular need for affordable exergames that can also be played at home.

Stimulate unaided use
Even without specifically organized activities it is possible to deploy games to get elderly people to exercise.

- The best places for games to be played without assistance turn out to be communal or public areas.
- It is important to draw the attention of the elderly and their environment (family, informal caregivers, professionals) to the game and to make its use as smooth and easy as possible. This means that the games are ready for play by default, or can be started very easily. The people in the user's daily environment should also know how to start the game. In addition, the elderly person should be able to play the game without assistance once it has started.
- In order to get the people in the user's immediate circle to encourage the use of the game, they have to be aware of the added value of the game and be able to (see and) believe that the elderly user enjoys playing it.
- In particular when users play the game on their own, safety is of crucial importance. The user should feel safe and the risk of falls must be reduced to a minimum. It is important, for example, to make sure there are no cables in the way and to remove all loose rugs.
- Suitable games: Active Cues, BuitenKomtVoorbij, DiFiets, Qwiek.melody, Qwiek.play, SilverFit Alois, SilverFit Mile.

Use games for increased fitness and physical therapy
Exercise games offer countless opportunities for increased fitness and physical therapy. Certain game elements can ensure that elderly people have more fun doing the exercises, and are more motivated to perform them. As a result they will be able to keep playing longer. Another advantage is that elderly people are partly able to play exercise games on their own. Trainers or physical therapists therefore find it easier to have two or more people do the exercises simultaneously.

- To effectively deploy exercise games for the purpose of increased fitness and physical therapy, people should be able to adjust the games in accordance with their own preferences.
- Costs are the main barrier in high-end games that are mostly developed especially for elderly people. It is therefore important to ensure optimal and/or the highest use possible. Investments can be shared by deploying games for multiple target groups and parties. Another possibility to limit investments is the deployment of cheap new products used to add a game layer to fitness equipment by means of a tablet.
- Suitable games: BitGym, DiFiets, Fietslabyrint, ExpressoBike, Goji Play, Praxtour, SensaMove, SilverFit, SilverFit Mile.

Development of games

Both from a qualitative and quantitative standpoint the available range of exercise games on offer is not yet solid enough. There is a particular need for exergames that can also be played at home.[86]
Develop Wii and Kinect exercise games for the elderly
Many care and welfare institutions (and some elderly people)


PHOTO: ACTIVE CUES

Active Cues

already own a Wii or Xbox Kinect. In case they do not yet have such a game console, the purchase cost is usually not much of a problem. Given the often successful deployment of games such as Kinect Sports and Wii Fit for the elderly, there is obviously a demand for fun, accessible, and useful games for elderly players. The games, however, do need to be completely 'finished' and not too expensive.

- The games to be developed should take into account potential sensory, cognitive and motor impairments of elderly users. Most games that are currently on the market do not meet that requirement. A great many elderly people should be able to play the game successfully at its lowest level.
- The theme and design of the games to be developed should also be geared to the elderly users' perception of the game.
- A disadvantage of producing a game for a console is that the coordinating efforts with the publisher take time, money and effort. On the other hand, the roll-out of a game for a game console is much easier and cheaper than a PC game that only uses the sensors of the game console (the Wii controller or Kinect camera).
- In order to make development financially feasible, it is advisable to look beyond the Dutch market.

Develop exercise games for tablets and smartphones

These days more and more elderly people own a tablet or smartphone. At the same time, more and more care institutions encourage the use of tablets for support and care purposes. These trends, coupled with the developments in hardware and software, result in tablets and smartphones gradually becoming ever more suitable for exercise games. The available range of such games, however, is very limited.

- A major advantage of games of this type is the low purchase price. The business model involved requires particular attention.
- For the development of games to be played by elderly people, on their own and for preventive purposes, we recommend adding a social component. It should, for example, be possible to play with others (in the same room or remotely).
- Playing games as part of a care and treatment program should be carefully discussed and monitored. What is important is that the caregiver is able to properly set up the game. A game has even more added value if it can gather meaningful information based on the player's exercise behavior, such as changes in physical performance and clinical measurements.

Increase the available range of exercise games for fitness equipment

Cycling games are among the most popular games in the range of exercise games for the elderly. They make exercise more fun, meaning that people are able to keep exercising for longer. The association with normal exercise (cycling) adds to the level of acceptance. In addition, many elderly people are familiar with the use of exercise machines, such as exercise bikes, cross trainers or treadmills. Some developers have therefore designed exercise games that can be linked to fitness equipment. There is, however, room for a wider range of games.

- The hard- and software should not be prohibitively expensive. This offers opportunities for use in both a health care setting and recreational use (at home).

Encourage people to make exercise part of their daily lives

People spend most of their time in their own living environment. This environment, too, can be used to encourage elderly people to exercise. Games that are an integral part of the living space can stimulate people in a surprising and inviting way. Using sensors, cameras and/or screens, a regular living room can be turned into an appealing exercise environment.

- For an optimal effect the interaction should be more or less spontaneous (for instance by the game starting as soon as a person walks past it). The system should also match the interests of the elderly person concerned (for example by making use of familiar images and music) and continue to surprise.

A GUIDELINE FOR THE **IMPLEMENTATION** OF EXERCISE GAMES WITHIN THE FRAMEWORK OF **PREVENTION, CARE** AND **WELL-BEING**

The guideline in this chapter provides recommendations and tips on how to implement an exercise game within the framework of prevention, care and well-being. In Annex 1 (page 58) you will find a summary in the form of a checklist. The implementation guideline, a representation of the current knowledge and experience, is intended for health care and welfare organizations, municipal authorities and other organizations that want to make exercise games available to the elderly.

The Applied Gaming for Healthy Aging Coalition wants to use this guideline in practice and hone and complement it on the basis of practical experiences. The implementation guideline consists of four parts: strategy, technology, organization and business case.

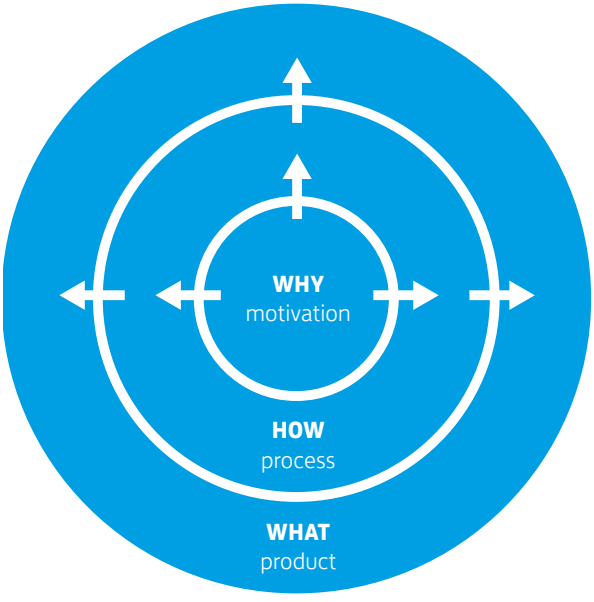
The Applied Gaming for Healthy Aging Coalition wants to use this guideline in practice and hone and complement it on the basis of practical experiences. General project management is not part of the guideline.

The implementation guideline consists of four parts:

1. strategy: why, how, what;
2. technology: selection of exercise games;
3. organization: implementation steps;
4. business case: provide funding.

Strategy

Make sure you have a clear picture of what you want to achieve with the deployment of an exercise game. A handy tool to map out this objective is Simon Sinek's 'Golden Circle'.[87]



Why

- Why do you want to introduce exercise games?
- What (social) problem do you want to solve?
- How do the games contribute to your organization's strategic goals?

List the results you want to achieve. Here are a few examples:

- improved physical fitness;
- retain or increase self-reliance;
- promote possibilities of living at home for longer;
- promote social contacts;
- promote contact with the community;
- offer a purposeful way of spending one's days;
- reduce the burden of supervising day care activities/physical therapy;
- prevent the need for additional care and support;
- define the intramural exercise policy;
- support the organization's innovative image.

How

- How can exercise games contribute to the 'why'?
- What makes exercise games more attractive than other solutions?

Consider what makes the exercise game solution unique compared with other options. Examples are:

- deployability for people with disabilities;
- the ability to adjust the level to suit the player;
- an incentive for exercise;
- the (relatively) safe way of offering exercise activities;
- the limited space required compared to 'real' sports activities;
- the ability to exercise without supervision or under the guidance of volunteers;
- the interaction with other people.

What

- What exactly do you want to do?
- Where do you want to deploy the exercise game?
- For what target group?
- Do you want to offer the game for solo or group use?
- Does the game require supervision?

Be as specific as possible about the project layout. The target group and setting are important variables.

When selecting a target group you can consider the size of the target group and the expected impact. Do you intend to deploy the exercise games for the majority of your clients, or would you rather focus on a small, specific audience that you expect to produce more results? It is easier to select an exercise game if you generate a specific description of your target group, as well as the manner in which you want to offer the game. You can obviously also choose a combination of target groups and/or settings. Examples of target groups are:

- fit elderly users who often participate in fitness programs;
- elderly people with (mild/temporary) somatic disorders, a target group that may be known to the physical therapist/rehabilitation service, home care, and fitness or lifestyle programs;
- elderly people with (mild) cognitive problems, a target group that may be known to home care and day care centers;
- elderly people with (complex, multi)morbidity, a target group that may be known to the physical therapist, day centers, home care and/or nursing or care institutions.88

Technology

Given the dynamics of the market we recommend not merely basing your decision on the range of exergames described in this white paper. It is advisable to obtain additional information on new products. The following is an overview of possible selection criteria. If so desired, you can add more criteria and apply a prioritization.

Criterion	Comments	Priority
Desired effect	Suitability for an elderly target audience Suitability for people with sensory, cognitive and motor impairments	
Alignment with target audience	Suitability for an elderly target audience Suitability for people with sensory, cognitive and motor impairments	
Complexity	Suitability for independent use Suitability for customized use (configurable settings)	
Validity	Based on factual and correct knowledge? Demonstrability of certain effects?	
Data availability	Data availability on player performance Suitability for feedback and (standard) tests Option of data inclusion in ECD	
Services	Availability of installation services Other services offered by the game provider Availability of user instructions Availability of assistance to train supervisors	
Price*	One-off purchase costs Recurrent costs	
Personal criteria	....	

** Annex 2 includes a tool to compare the costs against the available budget.*


PHOTO: YALP

Elderly users of the Sona by Yalp

Organization

The implementation activities are organized in four steps:

1. installation and preparation;
2. introduction and acceptance;
3. stimulation of use;
4. setup of the parameters.

Installation and preparation

- Proper installation of the exercise game is a prerequisite for use. You can install the game yourself or have it installed by the provider. The installation of a Wii or Kinect is fairly simple. The installation of specific game solutions (often high-end games) or a complete game room is more complicated. In those cases you could consider calling in the help of a third party.
- It is always important to involve the IT Department both before and during the installation process.
- When introducing the game to the target group you should always arrange for sufficient supervision. This simplifies the first use of the game. This supervision may consist of an explanation of the instructions of the game, how to start, how to play against another player, and how to 'cheer on' others. Sometimes permanent supervision is required.
- You have several supervision options: volunteers, informal carers, activities supervisors, care professionals, fitness instructors, experienced players, and possibly others. You will either way need to check whether these people are prepared to take on this task and whether they can free up enough time, time that is needed to take courses and for the actual supervision.
- If you choose to use volunteers, activities supervisors and/or health care professionals, you have to ensure they receive proper instructions. We recommend a short training course to make sure that the supervisors become experienced users. The objectives of such a training course are getting familiar with the game, learning how to work the game and how to manage the different settings. Group training sessions are the most effective on account of the mutual support *(peer support)*. The elderly users themselves should also be involved during the training phase. The supervisors, after all, also serve as a group of game ambassadors.

Introduction and acceptance

- The introduction of a game involves communication with the target group and the professionals, volunteers and/or informal carers in question. They should be up to

date with the availability of the game, know for what purpose the game can be deployed, and be prepared to work with it.
- Having the parties involved play the game has a positive effect on the level of acceptance. Demos and walk-in sessions are ideal candidates to increase acceptance. These should as much as possible be organized in the actual place where your target audience is located, for example during billiards evenings or activities in the gym. You may also want to get the elderly user's family involved. Enthusiastic children or grandchildren can positively influence acceptance levels. Both individual and group demonstrations are possible. We advise organizing demos that are geared to the context within which the game is used.
- It is important for the initial introduction to be a positive one. For demonstration purposes use a fairly straightforward game (or one with straightforward settings) so that the elderly user can experience immediate success. You can demonstrate additional game options to professionals, supervisors and informal carers.
- You can additionally use support materials such as a flyer or video clip. Many elderly people feel more comfortable if they can take their time reading the information from the walk-in session or demo at their leisure. For dissemination of this information you can use the regular communication channels.
- Find potential ambassadors, such as enthusiastic players and care professionals. It is important that when relating their experiences they paint a realistic picture of the game (in other words, not overly positive), and are able to address people's preconceptions and anxiety.

In conclusion, below please find a number of important issues/ recommendations regarding the introduction:

- Involve end users and potential supervisors in the introduction of the exercise game.
  Even better is to allocate them a role in the selection phase, for example by having them test the selected options.

- Be honest about the expected effects and (potential) disadvantages of the use of the game.
  This creates realistic expectations, for example in terms of the time it will initially take to properly learn to control the game.

- Remove any preconceptions the professionals, supervisors and informal carers may have.
  Let this target group see with their own eyes that elderly people are able to use the exercise game and enjoy playing it.

- Give users the opportunity to ask questions and offer support where necessary.
  This support can be provided by the game provider or trained volunteers. It is important for the (first) use to be as comfortable and enjoyable as possible.

- Demonstrate how the exercise game fits the user's regular activities.
  Presenting the exercise game as a component of prevention, support or care, will make the whole concept easier for elderly people to grasp.

- Provide proper information.
  It is important for the target group and other people involved to have a clear picture of what the exercise game involves and how to use it.

Stimulate use

Below we have listed a number of tips to help you make playing the exercise game as attractive and comfortable as possible.

- Offer the right level of challenge.
  The level should not be too low, but certainly not too high. On first use, it is important to make sure the experience is a success. The supervisor plays an important role in configuring the right game level settings.

- Fun comes first.
  Experience shows that elderly people sometimes play exercise games in a different way than intended. This is not a problem as long as they do not mind and have fun while playing. Too much criticism by the supervisor ("you are not doing it right") can easily backfire. It is better to adopt a flexible attitude and gradually introduce adjustments if necessary.

- Turn the game into a social experience.
  Many elderly people state that they consider the social aspect of playing exergames as the main motivator. Supervisors play a facilitating role in creating a good atmosphere. This role is given shape, for example, by encouraging and cheering people on, and offering assistance when needed. The supervisor can also encourage players to play against other users.

- Organize additional activities.
  The motivation to play can be enhanced by adding extra activities, such as team competitions, playing together for a good cause, or an activity with the user's (grand)children. These extra activities provide variety and ensure playing is fun and appealing.

- Combine the game with other physical activities.
  Exercise can be done through other means than exercise games. You can occasionally combine the game with going for a walk or other exercise activities.

- Ensure high visibility.
  High visibility plays an important factor in inviting and encouraging people to (continue to) play. This ensures that people know and remember that the game is there to be played. An accessible room that is available for long periods

of time allows elderly users to play the game at times that suit them best.

- Promote regular use.
  Regular use is important to embed the playing of exercise games in people's daily/weekly patterns. You can, for example, choose a moment when people are just out of bed or are having coffee in the morning, or every Wednesday afternoon after lunch. You can promote regular use by making the game available at the same time of day for a long period of time. It is advisable to establish the most appropriate moments in consultation with the target group.

- Embed the game in prevention, welfare and health activities.
  Give supervisors and caregivers the opportunity to integrate the exercise game in their regular activities. An additional reason to do so is that playing the exercise game can be linked relatively easily to existing activities and goals. This also guarantees the presence of a supervisor at all times.

Setup of the parameters

- People
  Arrange for an internal project leader to coordinate the project. It is important for this person to have sufficient available time, that he or she has a wide network within the organization and an affinity with the exercise game in order to get other people enthusiastic.

- The game area
  Make sure you have a room available to set up the exercise game. Decide whether the room needs adjustments. See to it that there are sufficient electrical outlets, proper lighting, a large screen, enough space to move, adequate cooling and a pleasant atmosphere. Also pay attention to the safety of the room (no loose rugs or cables). There should be enough room for people to watch and cheer others on.

- IT support
  Make sure it is clear who is responsible for maintenance, repairs and user questions. Within this context it is often possible to enter into a service contract with the provider. Other matters, such as WiFi, screens, and an exercise bike if needed, can be managed by the organization itself.

- Availability of information and instructions
  Information about the use of the exercise game should be readily available, for example on the internet or in centrally placed flyers. This way elderly users and staff can read the information received at their leisure. You also need to make sure that the user instructions to the exercise game are easy to find, for instance in the form of a poster next to the exercise game or a short step-by-step plan.

- Communication
  It is important to draw attention to the exercise game on a regular basis. This can be in the form of people talking about their experiences or by highlighting its benefits. Communication is also important to continue to attract new elderly users and supervisors.

Regular use is important to embed the playing of exercise games in people's daily/weekly patterns.

Business case

Page 26 provides a description of the required one-off and long-term investments. We are not able to make general statements on the implementation costs involved as these strongly depend on the setup. In Annex 2 you will find an overview of all potential investments. You can use this overview to draw up a budget. When doing so you can select options to reduce the investment, for instance by purchasing a second-hand exercise game or leasing one.

The (social) business case

When outlining the strategy (see page 46) the intended returns from the exercise game are established. The investments should be proportionate to the expected returns. One way of determining whether they are, is by formulating a social business case (SBC). An SBC will reveal which stakeholder will achieve which returns and what are the main *value drivers* involved.

A simple, qualitative SBC provides the answers to three questions:

- Which stakeholders are there? Annex 3 provides an *overview of all potential stakeholders.*
- What contribution does each stakeholder make (in cash or in kind)?
- What returns are there for each stakeholder?

You can initially enter the returns per stakeholder as 'low', 'medium' or 'high'. There are various tools available for establishing a quantitative SBC assessment, such as the TNO tool for primary health care[89] or the Social E-valuator[90] web tool.

Funding options

In principle there are two funding options:

1. complete funding from within your organization;
2. (partly) external funding.

The SBC can serve as an effective starting point for external funding. The overview below lists a number of general external funding options. The options particularly relate to the initial investments. Recurrent costs for management, maintenance and supervision are usually difficult to finance externally. We recommend you include these costs in your regular budget.

Funding options	Comments
Personal contribution	A (small) contribution seems to be an option when the returns mainly benefit the elderly. A contribution of this kind can be used for both one-off and recurrent costs. Personal contributions are often asked for other activities as well (such as bingo nights). A disadvantage is that such contributions can serve as a barrier, in particular when it comes to giving the exercise game a try.
Crowdfunding	Crowdfunding campaigns are particularly suitable for the funding of purchase and introduction costs. You need to bear in mind, however, that the organizing of an effective crowdfunding campaign also requires an investment. A good example of a crowdfunding campaign is the 'Friends of Bernhoven' campaign, organized for the purchase of a DiFiets system. Together with local shopkeepers the initiators organized a spinning marathon and recreational bike ride through the countryside.
Grant or donation	Grants or donations are particularly suitable for one-off investments. Grants are generally linked to a research goal. NutsOhra (a Dutch foundation that provides financial support to health care projects) for example awarded a project grant for the evaluation of the SilverFit and Sona sound arch. The success rate of grant applications varies widely. A few years ago the Dutch National Foundation for the Elderly donated Wii systems to a number of care institutions.
Renting out the game (area)	Income can also be generated by renting out the exercise game and/or room, for example to a primary physical therapist, fitness center, or for recreational purposes (family gatherings, activities organized by associations for the elderly). The income generated can cover part of the regular costs.
ZvW, Dutch Health Care Insurance Act	Does the exercise game contribute to (fall) prevention and increased exercise levels? If so, the costs of the exercise game program may possibly be reimbursable. This option only exists if use of the game is demonstrably related to reduced health care costs. Practice has shown that it is difficult to have new care services included in basic health insurance packages. Supplementary insurance policies offer more room to maneuver.
AWBZ, Care under the Dutch Extraordinary Medical Expenses Act	The AWBZ (as of January 2015 to be replaced by the Long-Term Care Act, Wlz) offers no separate funding options for the costs of exercise games.
Wmo, Care under the Dutch Social Support Act	Under the Wmo provisions municipal authorities can (partly) reimburse the costs of sports and exercise initiatives that contribute to the elderly users' personal autonomy. Whether this is actually possible, varies from municipality to municipality. Different municipal authorities apply different Wmo implementation policies.
Policy regulation health care infrastructure	The Dutch Policy Rules on Health Care Infrastructure can be used for construction investments in the health care infrastructure and technological infrastructure. The objective is to allow people who are dependent on long-term care to continue to live at home as long as possible, or allow them to return home. The transition of the Wlz on 1 January 2015 will be the start of the phasing out of the Dutch Policy Rules on Health Care Infrastructure. At the time of writing this document a transitional arrangement and new scheme are being looked into. There is a chance that the new scheme wil provide scope for the use of exercise games. This will most likely not be part of the transitional arrangement.
Dutch Policy Rules on Innovation	The Dutch Policy Rules on Innovation can be used to launch small-scaled experiments with a maximum term of three years. Experiments under the Dutch Health Care Insurance Act Zvw, are paid for by the health insurer. On a national scale, €19 million euros have been reserved for AWBZ experiments.

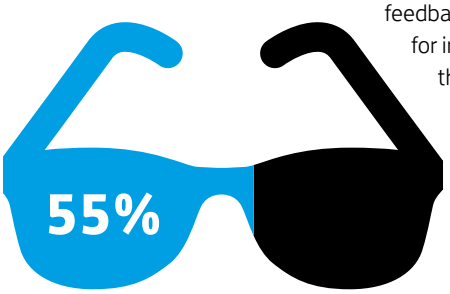
10 **RECOMMENDATIONS** FOR THE **DEVELOPMENT** OF EXERCISE GAMES

Earlier in this paper we mentioned the development opportunities for game developers (see page 43). The focus is on increasing the range of suitable exercise games for the elderly. We call on the Dutch applied gaming sector to focus on increasing this availability. We are presenting ten recommendations for the development of exercise games that are geared to the wishes and requirements of elderly users, as well as the specific market in question.

More and more information is becoming available on the type of games that elderly people like to play, such as games with a puzzle element and no components of violence. Playing together and/or social interaction are generally perceived as highly motivating factors.

1. **Allow for sensory, cognitive and motor impairments.**
   Aging is often inextricably linked to certain impairments. Some 25% of the 65-to-80-year-olds are confronted with visual, hearing and/or mobility-related impairments. In the age group of over-80s this is 55%.[91] You therefore need to make sure that the interface, menu structure and game levels are sufficiently clear-cut and clearly laid out for elderly users. To ensure this you should use general information where design components for the elderly are concerned[92], and specific information regarding the design of easily accessible games.[93]

2. **Ensure the gameplay is tailored to the target group.**
   More and more information is becoming available on the type of games that elderly people like to play, such as games with a puzzle element and no components of violence.[94,95] Playing together and/or social interaction is generally perceived as highly motivating factors. Competition appears to be particularly successful when it is perceived as 'fair', in other words if the players are well matched. Generally speaking, elderly people tend to play games that they find both fun and useful. It is therefore important to give players feedback on the benefits of the game, for instance by providing insight into their progress.



Some 55% of the over-80s are confronted with visual, hearing and/or mobility-related impairments.

3. **Offer the right level of challenge.**
   With a view to acceptance it is important for the user's first experience to be a positive one. You can do so by guaranteeing that this first use is always a success. At the same time you need to offer the right level of challenge if you want to guarantee long-term use. Customized levels or profiles can promote this continued use, even though this may be at the expense of accessibility. It is important to find a proper balance.

4. **Adapt the game complexity to suit the context.**
   The more options and customizable features a game has, the higher the game complexity and the lower the user friendliness. You therefore need to take the specific user situation into account. Is there (professional) supervision? If so, proper training may be sufficient for users to play more complex games. Is the elderly person supposed to start and use the game by him or herself? In that case, user friendliness is crucial; the menus and settings should not be a prominent feature, and the playing level should be automatically adjusted.

5. **Imitate the dynamics of real life**
   If the game is being developed to train people for situations in everyday life, it is important to simulate the dynamics of real life.[39] The power of exercise games lies in the composite task feature: the combination of cognitive tasks (processing the input from the environment) and physical actions (successfully respond to the processed input). For an optimal effect on, for example, a reduced risk of falling, it is important for the offered incentives and expected responses to be sufficiently chaotic. In other words: unexpected and varied.

6. **Provide access to relevant game data**
Generate data on the game use and use the data for the further development of the game. Make sure that the players – and care providers if applicable – also have access to the data. This can involve data related to progress monitoring, level adjustments, or standard tests (such as walking speed and Timed Up and Go tests). It is important to determine at an early stage and in consultation with the (intermediate) users, what data are required so that this can be taken into account during the technical design phase. Are the data used as part of a treatment plan? In that case, inclusion in the Electronic Client/ Patient Record should be straightforward.

7. **Involve the elderly user early on in the design process**
The target group and game developers are two very distinct groups in terms of impairments, technical skills and lifestyles. This is why it is particularly important to involve the target group early on in the design phase and in the form of playtests to determine whether the selected design will catch on. There are various publications that provide tips and advice about the ways in which to get elderly users involved in a user-centered design process. These tips and advice include the methods that best suit different types of elderly people and at what stage[96], as well as how best to implement these methods during the design and playtest phase of games for the elderly.[97]

8. **Invest in sales and marketing**
A good idea or good pilot game is not enough for a successful market introduction. Especially in the complex market of applied games for the elderly it is important to sufficiently invest in marketing and sales. At SilverFit, for example, over three-quarters of the employees are engaged in marketing and sales. If your own organization does not have the right marketing and sales knowledge, we recommend you call in the help of partners. No matter how useful and fun a game may be, without the right marketing and sales strategy you should ask yourself whether it is wise to invest in it.

9. **Provide support for installation and use**
The easier it is for future players (and supervisors, if applicable) to start playing the game, the better they will be at it and the more enthusiastic they will get. We therefore recommend offering installation assistance – either directly or through a partner – as well as long-term support. It is also important to provide clear instructions for use, both for the game itself and its deployment within the scope of the care and welfare activities. Experience shows that professionals are reluctant to use the game if it is not immediately clear how to use it in practice.

SilverFit in use at St. HilverZorg, Flat Kerkelanden

10. **Develop new business models**
One of the bottlenecks frequently mentioned when it comes to the purchase of exercise games for the elderly, is the cost involved. A large-scale roll-out will require games to become less expensive than the current high-end games. This approach calls for new business models in which, for example, clever use is made of cheap hardware or hardware that users already own. A second point of focus is the development of reusable software. The development of games for a specific target group within a specific context, will be cheaper if this development can take place on the basis of a generic platform. Within such a platform only the separate components will need to be adjusted, such as the game menu or the existing subgames.

IN CONCLUSION

The Applied Gaming for Healthy Aging Coalition sees a great many opportunities and possibilities for the use of exercise games that will benefit the health and fitness of the elderly. To achieve true social impact this use will need to be scaled up, an ambition that the Applied Gaming for Healthy Aging Coalition will devote itself to wholeheartedly. We welcome all interested parties to join us.

- We call on (organizations for) the elderly, municipal authorities and care and health welfare organizations to start using the exercise games already available.
- We challenge the gaming industry to broaden the range of exercise games to cater for the needs of different groups of elderly people.
- We call on all relevant parties to contribute to the market development by investing in development and scale-up.
- We very much welcome all other interested parties to join our coalition. Please feel free to contact us (see editorial credits).

EDITORIAL CREDITS

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ANNEX 1

CHECKLIST **IMPLEMENTATION STEPS**

Strategy

- ☐ Description of the motivation to start using exercise games for the elderly (why).
- ☐ Description of why exercise games are a suitable choice (how).
- ☐ Description of the exact plan (what):
  - ☐ description of the target groups (desires, needs, possibilities, size, etc.);
  - ☐ description of the deployment setting (where, what type of supervision, group size, etc.);
  - ☐ description of the intended result.

- ☐ Obtain information on and select the exercise game(s) to be purchased.

- ☐ Description of the (social) business case.
- ☐ Overview of one-off and recurrent costs.
- ☐ Overview of the returns to be achieved.
- ☐ Overview of the intended funding sources.

Implementation

- ☐ Arrange for installation of the exercise game(s).
- ☐ Arrange for instructions for the supervisors.
- ☐ Arrange for the recruitment of elderly users.
- ☐ Undertake activities to create support within the deployment context.
- ☐ Arrange for supervision.
- ☐ Take measures to make use fun (in the long term).
- ☐ Take measures to make use easily accessible.

Parameters

- ☐ Appointment of a suitable project team.
- ☐ Arrange a suitable space.
- ☐ Arrange proper IT support.
- ☐ Make all the necessary information available (for recruitment; for instruction; for supervision).
- ☐ Establish a proper communication plan.

ANNEX 2

FORM FOR COMPLETION - **COSTS AND RESULTS** OF APPLIED GAMES

'Hard' results	Short description	Total share
Prevention		
General well-being		
Physical therapy		
Rehabilitation		
...		

'Soft' results	Short description	Possible funding sources
Innovative image		
Compliance with exercise policy		
More contact with the community		
Fun for (grand)children		
...		

Cost of Applied Games[98]	Equipment *One-off*	Software *One-off*	installation *One-off*	Service *Annually*	Depreciation *Annually*	Repairs *% contingencies*
Game x						
Game y						
Total:						

General costs	Recurrent *Annually*	Incidental	Incidental funding *Grant/donation/...*
Layout of the room			
M^2 price (rental)			
Equipment			
Software			
Installation			
Service contract			
Depreciation			
Repairs			
Project management			
Marketing/Communications			
Administratie			
Total:			

Specific costs and returns per result					
Result	**...**	**Game**	**...**		
Specific costs		**Specific returns**		**Source of income**	
Supervision		Labor savings		*AWBZ, Care under the Dutch Extraordinary Medical Expenses Act*	
Education		Cost reduction		*ZVW, Dutch Health Care Insurance Act*	
		Care prevention		*WMO, Care under the Dutch Social Support Act*	
		Eigen bijdrage		*Client*	
Result	**...**	**Game**	**...**		

Specific costs		**Specific returns**		**Income from**	
Supervision		Labor savings		*AWBZ, Care under the Dutch Extraordinary Medical Expenses Act*	
Education		Cost reduction		*ZVW, Dutch Health Care Insurance Act*	
		Care prevention		*WMO, Care under the Dutch Social Support Act*	
		Personal contribution		*Client*	
Total		**Total**			

Total costs & returns					
Costs of result		**Return on result**	**...**		
Specific costs		Specific returns			
Pro rata general costs		Pro rata general returns			

Costs of result		**Return on result**	**...**		
Specific costs		Specific returns			
Pro rata general costs		Pro rata general returns			
Total		**Total**		**Balance**	

ANNEX 3

STAKEHOLDERS AND THEIR INTERESTS

Several stakeholders are involved in the development and implementation phase. In the overview below you will see the different interests and roles, and the measure of impact on the use of exercise games.[99]

Stakeholders	Role	Interest	Influence on use
Elderly people	- Use games	- Preserve self-reliance and quality of life	- Vote with their feet: acceptance of games
Social environment (family/friends/ informal carers)	- Influence elderly users	- Interests of the elderly	- Indirect influence - Recommendation or purchase of games
Associations for the elderly	- Provide the elderly with information on games - Promote the use of games through lobbying	- Provide the elderly with support as regards self-reliance - Increase innovative image of care for the elderly	- Indirect influence - Bring games to the attention of the elderly and policy-making bodies
Care and welfare organizations	- Deployment of games for physical therapy and exercise activities - Integration in daily activities	- Suitable range of activities - Exercise policy - Efficiency (fewer staff needed)	- Great deal of influence - Decision-making power as regards the range of games for own clients
Professional association	- Inform care providers - Inclusion in guidelines	- Little interest so far - Practice-based	- Limited influence - Bring games to the attention of care providers
Municipalities*	- Game purchases or facilitation of gaming for the elderly as a responsibility under Wmo or Wpg	- Healthy elderly population - Decrease need for support	- Great deal of influence - Influence on purchase and implementation (e.g. through purchase services)
Health insurer	- Efficient purchase of care based on customer requirements and quality	- Substitution and effectiveness	- Limited influence - Specific interventions - Facilitation of purchases
Game providers	- Provide games for the elderly	- Larger market	- Limited influence - Facilitate the match between supply and demand
Game developers	- Develop games for the elderly	- Larger target audience	- Great deal of influence - Supply and implementation opportunities
Government	- Remove obstacles in terms of laws and regulation (if applicable)	- Reduce cost increase in support - Self-reliance and ability	- Mainly facilitating role - National scope - Ability to facilitate the purchase or implementation and/or provide financial support
Investors/funds	- Invest in promising game concepts - Stimulate implementation	- Return on investment - Social objective	- High-quality range of games - Stimulate implementation

* This item is based on the situation as of 2015 in which the municipal authorities will be responsible for preventive measures, day care, and support at home.

FOOTNOTES

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[81] *[in Dutch]* For an overview of all factors that play a role during the preparation, introduction and continued use of an innovation, both at micro level (the shop floor), meso level (the organization, mutual relationships and agreements), and macro level (the opportunities and limitations of laws and regulations, and funding), please refer to the ImplementatieWijzer. Department of Psychiatry and Nursing Home Medicine VUmc. Published in cooperation with Universitair Netwerk Ouderenzorg and Centrum voor Ouderenonderzoek (ACA-Vumc-VU), Amsterdam, 2011 www.vumc.nl/afdelingen-themas/4851287/27785/5214110/ImplementatieWijzer.pdf.

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[99] *[in Dutch]* For an interesting overview of innovation routes in health care and a more detailed explanation of the roles of the various stakeholders for these different routes: www.innovatieroutesindezorg.nl


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