Personalization of Gait Rehabilitation Games on a Pressure Sensitive Interactive LED Floor

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Abstract. This paper describes the design and evaluation of a suite of movement-based games for gait rehabilitation with personalization based on gait characteristics. We used an eight by one meter pressure sensitive interactive LED floor. With the interactive games we attempted to steer different dimensions of people's gait, increase motivation, provide an enjoying experience, and create an additional platform for gait rehabilitation by physical therapists. We performed several days of exploratory user tests with the created set of games, in total 56 patients and 30 therapists were involved. The set of games was positively received by therapists, who stated they could train a variety of targeted domains with it. Furthermore, many rehabilitants indicated they liked it more than normal training exercises. The possibilities for personalization and the variety of games allowed users with a wide variety of skills and limitations to train their gait, although not all rehabilitants could be offered an appropriate level of challenge. Nonetheless, we do believe one reason for the positive responses is that the games can be adapted to the rehabilitants' gait characteristics with several settings in the games, and that a second reason seems to be that therapists can choose between games to target different aspects of rehabilitation suitable for the type of rehabilitant.

Keywords: Gait rehabilitation; Steering behavior; Persuasion; Interactive floor; Physical therapy; Adaptable; Perzonalization; Individualized therapy

1 Introduction

In the last decades, more and more interactive body-controlled games have been used in rehabilitation by physical therapists. One of the key reasons for this use seems to be that many forms of rehabilitation require repetition which can become boring quite quickly. The strength of many interactive games is that they make known repetitive

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movements engaging. Furthermore, games can easily be personalized to provide more efficient and enjoyable training fitting the skills and limitations of user, and different kinds of games can be used to train different aspects in rehabilitation. In this paper we will introduce several games that can be targeted and tailored to the characteristics of specific users. The games are intended to support behavior change regarding peculiarities in their gait in the context of their rehabilitation.

Many rehabilitants, including those that suffered from a stroke, will have a tendency to show asymmetrical walking patterns, both unbalanced and arrhythmic. This behavior leads to lengthy recovery and increased chances of additional injuries. In traditional therapy therapists also use a set of exercises to address such atypical walking patterns. The exercises are guided by the therapist and are done repetitively (a *tunneling* approach) but this can become boring and lead to diminished motivation. With our games we try to motivate the rehabilitants and make them move towards the wanted direction, e.g. steering towards a balanced time they stand on each leg and a more balanced step length. The approach of therapy sessions with our games consists of explanation by therapists, explicit steering of behavior during the exercise, and reflection on performance to change people's behavior.

Many persuasive technology (PT) and behavior change support systems (BCSS), take the form of websites, apps, and home-based automated systems. Health care is one of the main application areas but (especially in BCSS) there often is a focus on changing or supporting behaviors regarding lifestyle such as smoking, (un)healthy diets, medication intake, and increasing physical activity [5]. In this paper we argue that using ambient intelligent systems, such as our games for rehabilitation that will be played on an interactive floor, might also play an important role to address health related issues other than lifestyle. For instance, the picture frame for proper posture by Obermair et al. indicates how reflection on physical posture can influence motorical patterns with persuasive technology [9].

This paper explores interactive gait rehabilitation games using types of persuasive technology. Our research is focused on inspiring therapists, patients, and other people, and to explore the requirements for successful development of such games. As such, we do not yet intend to perform generalizable user tests showing the effectiveness of the platform as a medical device. Instead, we first want to get the experience of the games right, and make the games appropriate from the perspective of the therapist. That is, the therapists should feel that the game is motivating and that they can carry out their usual therapy exercises within the game. In this paper we thus share the users', therapists', and our experiences of a set of personalized games for gait rehabilitation played on a pressure sensitive interactive LED floor.

As a platform for this project we used an eight by one meter setup of the commercially available high-end pressure sensitive interactive LED floor of LedGo[1]. We developed games that can be used for different types of users in gait rehabilitation.

[1] http://ledgo.tv/home/129-updates/202-eurovision-2015-met-ledgo-s-black-spinal, last visited at 12-2-2016

These users include both the slow and quick, the old and young, and the weak and strong. This wide variation in types of users is one of the reasons why personalization has an important role for the games, and why different types of games have been created.

It is essential to tailor this platform to preferences and daily practice of the therapists. Therefore, we start from existing rehabilitation exercises. We mapped these exercises to existing entertaining game principles. This starting point might in the future help achieve better long-term in-situ use by therapists.

2 Related Work

There has been an increasing amount of research on technology in rehabilitation. A large part of this work focuses on monitoring, the detection and analysis part of rehabilitation [18]. For instance, some systems detect pressure patterns of a walk cycle with a pressure sensitive mat [1, 11, 14], or use technology, i.e. motion capture system and pressure sensors, to measure the effect of standard tests [12]. However, the other important aspect of rehabilitation is correcting, and training the correct movements. With the introduction of affordable kinematic systems, such as the Kinect and Wii, we have seen a rise of interactive gaming technology specifically for this part of rehabilitation therapy. Personalization in this context concerns fitting form and difficulty of the exercises to the skills and limitation to the user [10, 16]. Many existing games for rehabilitation focus on more stationary rehabilitation (e.g. improving balance) and for training only the upper body in smaller spaces. Examples of this are posture games with the Kinect [10] or Wii [2], or games with tangibles where the users are not required to stand or walk [16].

Nonetheless, there is also a variety of commercial installations for *gait* rehabilitation having been put on the market in the recent years. The C-Mill is a treadmill for training gait using a projector and automatic detection of feet placement to provide interactive therapy, including several games[2] . The Computer Assisted Rehabilitation ENvironment (CAREN) is an immersive CAVE like environment in which a user walks on a rotatable treadmill. Original started as a device for gait analysis, it makes use of pressures sensitive plates and detailed motion analysis to provide a variety of activities. For instance, walking over a wiggling suspension bridge, steering a boat or walking through a city[3]. Simple interactive camera-projection systems such as the Magic Carpet have also been used to help in motor skills training sessions[4].

One of the disadvantages of treadmill devices is that they tend to have smaller surfaces. Furthermore, they do not allow for walking back and forth with sudden turns, or abrupt changes in speed. For such more natural walking behavior a bigger, flat and static floor is more appropriate and will be used in our research. One system that also

[2] http://www.forcelink.nl/index.php/product/c-mill/, last visited at 12-2-2016
[3] http://www.motekmedical.com/products/caren/, last visited at 12-2-2016
[4] http://www.roessingh.nl/nieuws/Interactief-spelen-bij-het-Roessingh, last visited at 12-2-2016

makes use of pressure sensitive floors is the 'Playware interactive tiles'. The system is used in multiple rehabilitation and therapy settings. It consists of mobile modular tiles of 30cmx30cm, one force sensitive sensor, 8 circular placed RGB LEDs, the tiles are typically arranged in a grid like structure [7]. In some of the games for this platform training balance was addressed. For this they not only had a set of tiles on the floor but also a row put against the wall to be pushed with their hands. The tiles had to be pushed with either the right or left arm and on the floor with the right or left leg depending on the color it was emitting [7].

With some of the games for the playware installation the authors managed to heighten the heart rate for cardiac arrest patients, increase motivation and showed significant improvement in different physical measurements for the elderly [3, 6, 7]. An important feature for such movement-based interactive technology in therapy is the ability to set difficulty according to the user [15].

Changes in behavior can also be reached with more reflective systems that uses other types of ambient intelligence, such as an interactive picture frame responding to (in)correct posture. For such a picture frame, Obermair et al. proposed to use a human instructor (explaining how to sit and why) with the reflection supporting capabilities of an interactive system (continuous monitoring) leading to awareness of the (un)healthiness of current behavior [9]. Furthermore, they pointed out that using a personalized approach (using known people) can be beneficial.

3 Design

Our approach is to develop a *suite* of games, adaptable by the therapist, that together allow to train many aspects of gait. The reported success and availability of several interactive game based gait rehabilitation tools gives us reason to believe that modifiable games on a pressure sensitive LED floor can lead to a promising gait rehabilitation tool. With the ability to use detailed graphics as a way of feedback in normal walking conditions (a floor instead of a treadmill), it could be possible to target different kind of activities (e.g. more towards balancing exercises instead of those focusing on strength and endurance). Furthermore, the more detailed graphics compared to systems such as the above mentioned playware allow for different types of games, to increase reflection of the user, and allow more flexibility in steering the in-game behavior or persuading people to perform certain actions.

Based on experience with gait rehabilitation therapy, we decided on a set of dimensions that could be addressed by such games. First, all the games should be able to motivate the user and push their boundaries. Other than that, they could help train on: coordination, walking speed, balance, strength & endurance, rhythm, reaction time, attention & memory, and/or vision & focus. We developed a set of games in order to cover (different combinations) of these training goals. The games are intended to train normal walking behavior. Therapists can either train this as a whole, or focus on the specific dimensions in order to work towards normal walking behavior. For instance, one game targets all these goals a little at once and another game is designed to spe-

cifically target the latter more cognitive training goals (reaction time, attention & memory, and vision & focus).

Fig. 1. One of our gait rehabilitation games in use by a rehabiltant (left) and personalization of the game on a tablet (right).

We made the individual games modifiable to different types of users. These adaptable features were included to be able to optimize the training of the rehabilitant, providing a challenge that was just within the reach of the rehabilitant. This does not only involve configurable difficulty levels but also adaptation to rehabilitant's current gait characteristics, such as track width, stride length, or the affected leg. We implemented these settings from the therapists' point-of-view, so in order to make a game suitable for a specific user the therapist could set the appropriate track width, stride length, number of obstacles, duration, and speed. These settings would then translate to settings of certain game mechanics. We incorporated these ways for personalization (games and such settings) via a tablet that interacted with the floor. This allowed us to quickly set the next type of game and within the game make modifications, as shown in Figure 1.

We have chosen a size of eight by one meters for the floor to suit these training goals, the one meter width allows for support from the sides by therapists for those rehabilitants needing this, see Figure 1. We will now explain the developed games fitting this size on this floor, and explain the settings we used for personalization of the games and the game mechanics that steered their gait and movement in certain ways.

3.1 PadWalk

The first game consists of walking over leaves (lily pads) on water, see Figure 1. The gait of the user can be steered through the placement of the lily pads. To keep players standing on the lily pads, in order to train coordination and balance, we used sound effects and we added a shark that would attack within a configurable duration after stepping in the water instead of on a lily pad. Rhythm and speed of the user's gait, were influenced by the appearance rate of new lily pads and a controlled decay (disappearance) of the currently visible lily pads.

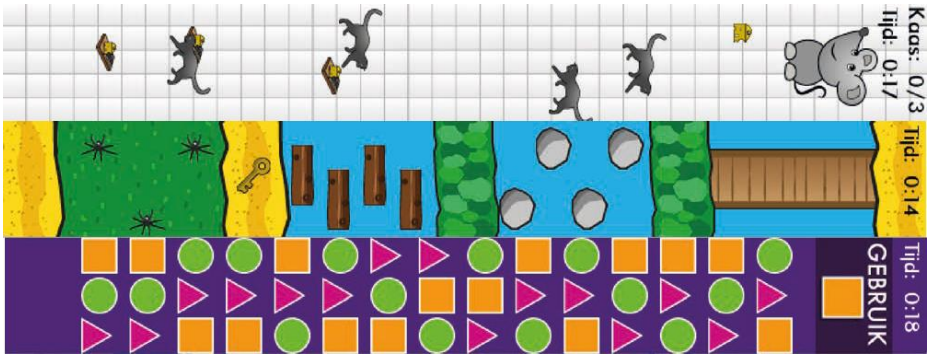

Fig. 2. Three screen shots of the games used in the second set of tests: *Swiss Cheese*, *Treasure Hunt*, and *Crazy Object*.

The game can be played in two modes: random placement and forward placement of lily pads. The random mode focuses on training coordination, balance, endurance, reaction time, attention, and pushing boundaries. The normal game mode focuses more on training normal walking patterns. In this mode the appearance and disappearance rate of then lily pads train walking rhythm and walking speed to improve the gait.

Both variations of the first game have the possibility to set a limited amount of parameters to fit the game to the rehabilitants. These parameters include the difficulty (time a lily pad stays and allowed time in water), the step size (distance between lily pads), speed (time between appearance of lily pads), and the game difficulty for the random version. After each game a score is shown containing (where applicable) the difference in time between standing on their left leg compared to their right leg, percentage of time needed to finish the game and percentage of time the player correctly stood on the lily pads. In this way rehabilitants are steered towards normal gait patterns but are also triggered to reflect on their abnormalities in their gait; a similar approach can be seen in the other games.

3.2 Swiss Cheese

The second game consists of a tiled floor with a randomly positioned small piece of cheese, see Figure 2. The player has to gather this piece of cheese by standing exactly on it, then deliver it to the mouse at the end of the floor. Every new piece has to be delivered to this mouse in the same way. This requires the user to make a full rotation of the body while keeping in balance. The game thus keeps triggering the alternation of rotation and straight walking. Especially for people that suffer from a stroke, dealing with the proper orientation is an important part of rehabilitation. To trigger training of vision and focus, the pieces of cheese are always placed at random position somewhere on the floor. Reaction time and coordination of the players are triggered

with the introduction of to-be-avoided objects (moving cats and static mouse traps) that could require an abrupt stop by the user. The therapist can select the duration (number of pieces that have to be collected), the number of obstacles (number of cats and mouse traps), and the speed (influencing the score and the speed with which the cats move).

3.3 Treasure Hunt

In the third game, a player has to cross a treasure island from one side to the other while carefully standing only on the right spots, see Figure 2. The position of objects to stand on (in the form of rocks and trunks) and them breaking down/sinking, are intended to enforce a certain rhythm of walking and an increase of speed. Again balance can be trained during walking and standing on the small objects. In order to trigger the reaction time (and some vision & focus) spiders move over the grass and tree trunks move up and down the water, see Figure 2.

The therapist can adapt the game to the gait characteristics of the user. Setting stride length influences the amount of rocks and tree trunks, and the distance between consecutive rocks and tree trunks in the walking direction. The second setting is the track width, which sets horizontal distance between rocks and between the tree trunks. The third setting is to account for which leg is affected by a stroke (where appropriate), which is used in the game to allow for a slightly longer time before an object disappears for that foot. Finally, the therapist can set the speed of the game which influences 1) the time a rock and a tree trunk can be stepped on before they sink, and 2) the movement speed of moving tree trunks and spiders.

3.4 Crazy Object

The fourth game consists of a grid of shapes in which the user is only allowed to step on one specific shape to reach the end of the floor (e.g., only stepping on squares as shown in Figure 2). This game is primarily intended to focus more on the cognitive aspects, reaction time, attention & memory, and vision & focus. The proper shape to step on is indicated at the end of the floor. This can change during the game, steering players to change their vision & focus and respond quickly. To stimulate motivation, the game can also be played in a multiplayer mode. Both players start at their side of the floor and move towards each other. In order to account for different types of users the therapist can set for both users individually the number of different figures (requiring less cognitive resources to stand on the right one as the decision space is reduced), the step length (influencing the number of objects and distance between them), the speed (changes the time with which a target object changes and the offset time before the player has to step on the right type), and select which leg is affected (influencing the placement of the first correct object).

4 User Study

We carried out two sets of user tests in order to explore the engagement, to explore whether these games were suitable for therapy, and whether a wide range of participants could make use of this set of games and its possibilities for personalization. We tested for two and a half days (± 18 hours) with the 'PadWalk' and three and a half days (± 25 hours) with the other games. Therapists were informed with personal communication, mail and posters about the user test. The therapists were free to enter the room with their rehabilitant and to participate. Sessions took roughly between 5 and 30 minutes, mainly depending on the endurance of the rehabilitant and if other participants were already waiting for their turn. The settings were explained to the therapists, after which they could change them (or instruct the facilitator to do so if therapists needed their attention to be on the rehabilitant at that time). The participants received explanation on how the game was played, after which they (or their legal guardian present) had to give their consent in order to participate.

4.1 User Study 1, PadWalk

We performed a first small user test with the PadWalk game with 19 patients, ranging from 10 to a 73 year-old and equally balanced over a 3-level ability indication. This included six level-1 patients, not able to walk or stand without support; seven level-2 patients (able to walk without support, but still having exercise goals - the patient does not walk flawlessly); and six level-3 patients walking well and mainly training strength and endurance. Besides the rehabilitants we also included six physical therapists in the user test, including one of the authors of this paper. At the end of the study these therapists also filled in an online questionnaire. After the play was finished the patient participated in a semi-structured interview.

Rehabilitants' Responses –
All but one of the patients stated they liked the game more than the normal therapy session. A 40-year-old woman for instance stated '*It is addicting to improve your scores. You want to do better every time.*'. The one patient with no clear preference, normally played sports games and was already functioning on a high level. All rehabilitants seemed to understand the game properly and were able to play the game. Similarly to normal rehabilitation sessions some rehabilitants needed physical assistance of the therapists and one of these rehabilitants indicated in the interview he was not yet able to play the game properly. Two rehabilitants (functioning on the highest level) indicated that the game was too easy, others either indicated the difficulty was good or it was quite hard. However, no one thought it was frustrating. Most players indicated they put in the same effort during the game than during normal exercises, but four players stated they had put in more effort. All players, indicated they would like to play the game again. Some of them also did this during another day of the tests.

Observations showed that especially the rehabilitants below the highest level of functioning were eager to finish the game and improve their scores. Many of these players displayed clear indications of tiredness, transpiration and heavy breathing. Around 80% of the rehabilitants were clearly enthusiastic and smiled. A young girl at level-2 (±10 years) indicated that the game triggered the to-be-trained movements '*You are forced to use your 'wrong' leg in the random game mode, that is very good!*'.

There was a great interest by the higher level functioning players to improve their scores. However, most other rehabilitants still lacked in speed and they mainly focused on their non-speed (gait distribution) scores.

Therapists' Responses –
All but one therapist answered they could train everything they normally do. One therapist required more space in which more dynamic exercises could be done. All therapists also indicated there were not too many settings, although one of them missed the flexibility to change types of paths or even personally place the lily pads.

All therapists indicated they would like to use the game in their rehabilitation sessions. Several therapists also stated that they were at times surprised about how their rehabilitants performed. One therapist also noticed this performance increase when he was working on the floor with a rehabilitant with aphasia (± level-2 and 40-year-old), '*I never get him to run, he just does not want to. Now he is just running and he enjoys it too!*'. Two therapists mentioned that the dimensions can be trained with many other things but this platform would be a nice addition especially because of its novelty. Other positive points that were mentioned about the game were the appeal, challenging people to move and one therapist stated '*I don't know any other games where I can use this many relevant parameters*'.

Negative points were the lack of space, the need to look down, inability to train certain specific muscles instead of complete movements. Suggestions for improvement included a bigger variation of games; tracking personal (high) scores; enabling the use of body weight support systems such as a bar, crutches, walkers, or a harness; more sounds; adjusting the (width of the) walking path; a variety of themes for children; more flexible settings including smaller changes in step length and addressing asymmetry in walking; and adding cognitive challenge/learning elements.

4.2 User Study 2 (Swiss Cheese, Treasure Hunt, and Crazy Object)

We performed a second user test with the other games. In total 37 patients played one or more of the games. These players again varied in their ability (ranging from pediatric to trauma rehabilitants). Furthermore, 30 therapists, interns and other interested people observed or played, or accompanied their own patients. The majority of the therapists participated in multiple sessions. Direct observations were used to see how the games were experienced by the players (enjoyment, confusion, frustration) and

see how therapist used the platform. Patients were also interviewed afterwards where possible.

Rehabilitants' Responses –
Clear expressions of joy were observed. Some patients even started the game again directly after the previous game finished. Furthermore, almost all patients indicated in the interview they liked the games. The majority of the patients would like to play the games again during therapy (33 out of 37). However, the games were too easy for a small number of patients, who therefore did not see the benefits of playing again (4 out of 37). Some patients indicated the games would add to the variety of their therapy.

There was no clear preference for one game over the others. Some players indicated they liked the dynamic aspect of a game: jumping over objects (*Treasure Hunt*), to suddenly stop to avoid stepping on the cats and turning around (*Swiss Cheese*). Moreover, they liked that they always had to pay attention what happened around them, having to avoid certain (moving) elements. Several patients preferred *Treasure Hunt* as it contained different actions in the different sections of the game. For instance, they liked being challenged to retain their balance on the rocks and trees in the game. A few players indicated this game was a bit childish. In general, *Crazy Object* was seen as the most difficult game, and probably therefore preferred by the participants with a higher level of ability indication. Also, this game was seen as least childish, due to the abstract objects and the lack of narrative. Patients liked the multiplayer version as well, but no one preferred the multiplayer version over the single player version.

The scoring aspect of the games seemed to be quite important and really helped the rehabilitants to push their boundaries. Therapists and other bystanders also encouraged the players to perform better or faster. For a few young toddlers the score aspect was not that important, since they did not really seem to understand the score aspect. Due to two technical limitations the scores were sometimes inaccurate frustrating those that were triggered by the scores.

Some of the rehabilitants indicated they became tired when playing the game (giving an indication that it might also train the strength and endurance of users). A lot of the patients wanted to continue after a small break, since they had the feeling they could perform better than they showed before this break.

Even though we incorporated personalization in several ways, patients often indicated and showed that a game was not on the correct level for them. On the one hand, the lowest level was sometimes too difficult for patients with more severe disabilities. On the other hand, the highest level was too easy for patients with only small walking disabilities. Cognitive abilities also played a comparable role. For instance, some players were unable to incorporate the target object from *Crazy Object* appropriately in the game. However, the people with higher abilities liked this game, since it was challenging. They said that especially performing two tasks at the same time, physi-

cally and cognitively, made it challenging for them. All in all, a range of games is clearly needed to suit a range of patients.

Therapists' Responses –
In general, the therapists liked the games. However, not all therapists were convinced the games contain functionality that can train therapy aspects outside normal therapy. Other therapists indicated they would use the games as an addition to normal therapy, since they noticed their patients enjoyed the games and were motivated by the games. The majority of the therapists said the games could indeed add variety to therapy.

One aspect of the platform, which is part of more dynamic training that therapists preferred, were the tasks triggering physical actions and requiring cognitive resources as included into *Crazy Object*. However, many therapists indicated they would like the games to be even more dynamic. *Treasure Hunt* for example, always has a straight walking pattern and does not trigger the patient to speed up. Instead many therapists preferred *Swiss Cheese*; the player had to pay attention to what happens around him/her.

Therapists were positive about the possibility for personalization of the games. However, the games did not suit the patient sufficiently sometimes, since the range of difficulty of the games was too limited. Therefore, many therapists also indicated they would have liked to have even more games, to ensure that the right game suits the patient; cognitively and physically. Ideally, they would like to select some training dimensions they want to train with the patient, upon which the relevant games are displayed and can be selected to play.

5 Discussion

We believe that our work shows the potential of a combination of a robust and mature hardware platform with a suite of configurable games to cover a range of training goals. Although several LED floor platforms for gait rehabilitation exist, we belief that the reasonably high resolution of both the display and recognition help in increasing an immersive and challenging experience as well as adding opportunities for modifying variables such as target step size. When we compare interactive floors to the treadmill based platforms, training on a floor can train more on random steps and steps to the sides. Furthermore, walking on the interactive LED floor also resembles the actual movement to be trained, where walking on a treadmill introduces different resistance forces of the rotating floor. Nonetheless, a treadmill system might be better to train other dimensions such as endurance.

Games for the interactive floor could offer a challenging experience that will motivate most users. The inclusion of applicable parameters that can be tailored manually but quickly to the user could be a key reason for its future success. We also think it would be essential that the therapists could select a game targeting certain dimensions of rehabilitation fitting the kind of user, both for the cognitive and physical aspects.

We intend to add more games containing more cognitive challenges and dynamic training, especially for the older people that suffered from a stroke. Furthermore, in the end we will then do longer term studies with the suite of games to investigate the actual benefits of the platform on a larger user group over a longer time. In such studies, measuring therapists' actual intention to use the platform will also play an important role.

During our tests we have made use of steering the behavior of rehabilitants with game elements. For instance, with placing lily pads further apart we made them change their gait, basically using attractiveness as a way for tunneling design in order to lead the user through a certain course of activities repetitively [8]. By showing the users their scores and performance afterwards they were also informed about their actual behavior. Especially after a stroke several rehabilitants do not recognize their own coping strategies and imperfections in their gait (e.g. unbalanced, asymmetric, or arrhythmic). Steering behavior can be an ethically inappropriate method for many systems [4], in contrast we think that for this use case and our implementation it is an appropriate and transparent tool to use. Steering is here similar to traditional therapy where users also have to perform actions in a certain way. Our interactive floor can also help the users to reflect on their behavior (*awareness*) and are persuaded in that way to change their gait. We agree with Smids' view that *ends* do not justify (inappropriate) *means*, such as *coercion*, *manipulation* or *deception* [13]. Although the games use steering mechanisms and are intended to be played in one way, we do not *coerce* users with overwhelming or annoying feedback and only offer the exercises as an optional (alternative) way of therapy, both for therapists and the users. Although steering mechanisms can control behavior of people [17], we try to prevent *manipulation* by keeping the users aware of the rehabilitation setting, for instance, with the therapists' instructions and reflective feedback. Our rehabilitants are also explained that the games are intended to improve their gait in certain ways, this provides more complete information and differs from a *deceptive* approach. In discussions with therapists we even got the feeling that making this link with existing therapy exercises and goals more explicitly would not only lead to more transparency but might also help to increase the acceptance of the system.

6 Conclusion

Most rehabilitants of the 46 participating in our studies, with a wide range of gait characteristics skills and limitations, reported a positive experience with the games. However, during the PadWalk user study two rehabilitants indicated discomfort, a sore neck and over stimulation of reflective light. Furthermore, during the other games, we have seen that even with the personalization not all game sessions had an appropriate level of difficulty. We did see several rehabilitants that showed (and also indicated) that they had put in more or equal amounts of effort compared to their traditional therapy. Therapists responded mainly positively in their remarks, they indicated that most targeted dimensions could be trained in the game in the same amount or better as normal therapy. However, proper quantitative tests should be done first to

verify this with a wider variety of games. We think the interactive floor for gait rehabilitation can be a powerful additional tool for gait rehabilitation. We also think several improvements could and should be made, where it remains essential to keep working together with therapists and end users to better tailor the tool for longer term use.

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