

# Engagement in Game-Based Rehabilitation for Women with Fibromyalgia Syndrome

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**Abstract.** This paper reports on two linked studies exploring the general potentials, with foci on constraints and facilitators, of engagement in rehabilitation during motion-controlled video gameplay (MCVG). 17 female participants diagnosed with fibromyalgia syndrome (FMS) took part in the studies, wherein three different MCVGs were used, which were conducted by session leaders having different profiles. This investigation demonstrates the potentials of how MCVGs can act as an effective healthcare intervention for women with FMS with regards to offering activity structured around their interest, goals and choices. These aspects were found to be empowering as well as encouraging the participants to take on an active role in the activity. The analysis identified four main themes relative to the perception of constraints and facilitators to engagement in FMS gameplay-based rehabilitation: goal setting, facilitator approach, personalized gameplay and feedback and achievement. These are further elaborated and discussed in the paper. Conclusions are that deeper understanding of engagement within the FMS community, in particular related to rehabilitation using MCVGs, can be useful to enhance rehabilitation processes and better dress rehabilitation providers to better facilitate engagement and enhance the effectiveness of rehabilitation interventions.

**Keywords:** Fibromyalgia syndrome (FMS), Rehabilitation, Habilitation, Motion-controlled video gameplay (MCVG).

## 1 Introduction

This paper reports on two linked studies (programmes) exploring general potentials, with foci on constraints and facilitators, of engagement in rehabilitation during motion-controlled video gameplay (MCVG). 17 female participants diagnosed with fibromyalgia syndrome (FMS) completed the two programmes consisting of sessions using different motion-controlled video gameplay (MCVG) – namely the Nintendo Wii (Wii) using the Wii Remote handset (the Wii Nunchuk – i.e. the additional handset – was not used), the PlayStation 3 Move (PS3 Move) with two handsets, and the Microsoft Xbox Kinect (Xbox Kinect) without any handset or tangible peripheral (held, worn, or manipulated) – only torso/limbs. The consoles and handsets are shown in figures 1-3 respectively). Figure 4 shows the size of the two handsets when held in an adult's hand.



**Fig. 1.** Nintendo Wii with handset as used in our study. (image <http://en.wikipedia.org/wiki/File:Wii-Console.png>).



**Fig. 2.** PS3 MOVE showing console, camera and a single handset (image <http://us.playstation.com>)

Facilitators that had differing profiles led the sessions: a mature games/technical oriented PhD student led the first study sessions (only using the Wii), and two medical-oriented students (occupational therapists) led the second study sessions (using all three MCVGs).



**Fig. 3.** X-Box console (gamepad not-used in this study) and Kinect camera-based sensor device (image [www.microsoftstore.com](http://www.microsoftstore.com))



**Fig. 4.** Wiimote and PS3 MOVE handsets (image <http://ps3maven.com>)

The design of different session facilitator profiles was to assess the difference that the facilitator's input made to the sessions of each program. The difference of MCVGs was to assess if the participants' engagement differed according to the platforms and the difference in peripherals that capture the motion input.

Completion of the studies was problematic - as is typical in FMS research. However, those who complied gave sufficient input to the studies that is considered indicative of the goal at outset, and this is discussed and concluded at the end of the paper. The next section introduces the FMS condition. The following section outlines the studies including details of the MCVGs.

## 2 Fibromyalgia Syndrome (FMS)

Fibromyalgia syndrome (FMS) is characterized by widespread chronic pain; often accompanied by symptoms of fatigue; morning stiffness; sleep disorder; headache; anxiety and depression [1].

It has been suggested that pain symptoms may be related to abnormalities in the central nervous system, including central sensitization and inadequate pain inhibition [2].

In a recent study, the estimated prevalence of FMS in five European countries varied from 1.4% to 3.7%, with overrepresentation of women aged >30 years [3].

## 3 Studies and Session Detail

### 3.1 Studies Overview

Two studies were conducted in the SensoramaLab research complex at Aalborg University Esbjerg, Denmark. The studies were linked in that they explored FMS and the affect of contemporary MCVGs. A local specialist FMS/Rheumatism doctor invited his patients to participate and those who agreed had to travel to the university outside of the city for the sessions that comprised the studies.

One of the studies consisted of fifteen female participants diagnosed with FMS who completed a programme of fifteen sessions each with the MCVGs (i.e. 15 subjects x 15 sessions). The study comprised five sessions with Nintendo Wii (Wii), five sessions with PlayStation 3 Move (PS3 Move) and five sessions with Microsoft Xbox Kinect (Xbox Kinect). The order of the participants' exposure to each MCVG platform varied (i.e. one would start with the Wii, another would start with PS3 and another would start with Kinect) to give consistent data not corrupted by any ordered learning aspect. Once the participant was exposed to a specific MCVG platform then the full set of five with that MCVG platform was conducted until completed. Two occupational therapist graduate students conducted these sessions, one male and one female.

The second of the studies included two female participants who were also diagnosed with FMS. These were the only participants who completed the programme of 10 sessions with the Wii only. A PhD student in Medialogy focusing on the use of games technology and gameplay for therapeutic purposes from a media and technology perspective rather than a medical/physiological conducted the sessions.

### 3.2 Motion-Controlled Video Game (MCVG)

A Motion-Controlled Video Game (MCVG) is a non-immersive variation of VR, which is enhanced by use of gesture recognition [4]. Such MCVGs are commercially available via the game consoles Nintendo Wii (Wii), Sony PlayStation 3 Move (PS3 Move) and Microsoft Xbox Kinect (Xbox Kinect). According to Taylor et al. [5], MCVGs offer new opportunities in therapeutic rehabilitation as they make it possible

for people with impairments to participate in simulated sports and game-based activities. Furthermore, it is possible that pain distraction from playing MCVGs can result in a more enjoyable experience and thereby enhances the participant's interest and engagement with a gameplay-based exercise program [5].

Engagement is acknowledged as an important ingredient in improving rehabilitation outcomes. For example, engagement has shown enhanced attendance, adherence and functional improvement [cf. 6]. However, few studies have investigated the complexities of individual's engagement within the FMS community. This study focuses in particular on the aspects of (1) game attributes, (2) participant's gameplay (inter)actions, and (3) facilitator intervention as key factors influencing the participant's engagement in rehabilitation sessions in order to offer insight into the constraints and facilitators of engagement during motion-controlled video gameplay. This requires that investigations look beyond what traditional training systems have to offer in order to consider wider scenarios for rehabilitation.

The present studies used a qualitative approach supported by the Test of Playfulness (ToP) as an observational tool for assessment of gameplay experience [cf. 7].

The study of engagement is relative to the need of a more holistic view on a complex situation. In order to consider this complexity, we used interaction analysis [8].

All data were treated confidentially. The Regional Scientific Ethical Committee for Southern Denmark approved the study.

Interviews with each participant were conducted at baseline and post intervention and followed a semi-structured interview guide with pre-selected topics.

Participants played for 30 minutes at each session and had at least two days rest before the next session. During each session, a facilitator was present, using an observational tool for assessment of play experience and giving instructions if participants had game difficulties.

Interviews were administered pre/post intervention and the facilitators used ToP as an in-session observational tool. Participants reported on ADL, pain level and fatigue pre-intervention as well as their responses to each session, which was gathered post intervention.

At baseline and post-intervention, information on ADL, pain level and fatigue was gathered using an ADL Questionnaire (ADL-Q), Visual Analogue Scale (VAS) and Brief Fatigue Inventory (BFI) respectively<sup>1,2,3</sup>. ADL-Q was used self-administered and the rheumatologist at Reumaklinik Danmark administered VAS and BFI. Baseline Interview questioning goals and expectations was conducted on the first day of

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<sup>1</sup> ADL-Q is a questionnaire used to illustrate how well a person performs ADL (19). It consist of a number of daily and weekly activities. Each item can be answered from 0 (cannot perform) to 6 (performs without any assistance).

<sup>2</sup> VAS is a scale that allows the participant to quantify pain level with numbers from 1 to 10. BFI is a questionnaire concerning fatigue and encompasses nine questions with an overall score, ranging from 0 (no impact) to 90 (big impact).

<sup>3</sup> ToP is an observational tool used to evaluate how much a person engages in play. It encompasses 18 items, each with three subcategories; (1) Extent: To what extent is the person engaged, (2) Intensity: With what intensity is the person engaged, and (3) Skill: How skilful is the person. Each of these items can be answered from 0 (not at all) to 3 (highly).

the studies together with an introduction of the first console that the participant would engage with.

Interview analysis was done using qualitative content analysis.

Selected games were consistent to a “sports” theme with participants choosing their own favorite on each MCVG platform.

Following completion of the studies it was planned to re-contact the participants after one-year via a telephone interview to hear if the participants had bought a console for themselves or played elsewhere, and if yes, if it had an impact on their symptoms and daily living.

## 4 Results

Participants enjoyed playing the games and stated that they were able to distract from pain symptoms while playing. To some the participation in the sessions had an impact on their daily living and to others it did not.

All participants stated that they did not take notice of pain symptoms while playing and they enjoyed playing the games. Several participants explained that it was a good way to be physical active. However, following the exercise sessions the participants reported that participation did not contribute to a feeling of general reduction in pain or fatigue and did not increase independence in performing Activities of Daily Living (ADL)

## 5 Discussion

The linked studies demonstrate the potentials of how MCVGs can act as an effective healthcare intervention for women with FMS with regards to offering activity structured around their interest, goals and choices.

These aspects, interest, goals and choices, were empowering as well as encouraging the participants to take on an active role in the activity.

It was identified that the participants enjoyed the slow pace and familiarity of Wii, while some considered PS3 Move to be too fast paced. Xbox Kinect was reported as the best console for exercise because of full body involvement, but was almost too demanding for some of the participants.

The analysis identified four main themes relative to the perception of constraints and facilitators to engagement in FMS gameplay-based rehabilitation: goal setting, facilitator approach, personalized gameplay feedback and achievement.

## 6 Conclusions

Chronic widespread musculoskeletal pain is the main symptom of people with the diagnosis of fibromyalgia. Other symptoms are typically including chronic fatigue and lethargy as well as sleep disturbance, fatigue, irritable bowel syndrome, headache, and mood disorders. Mease in [9] reviewed FMS concluding it as a condition that

affects at least 2% of the adult population in the USA and other regions in the world where FM is studied. In Denmark prevalence is reported as 0.7% and this ranges to a European high of 3.7% in Italy.

Prevalence rates in some regions have not been ascertained and may be influenced by differences in cultural norms regarding the definition and attribution of chronic pain states. A unifying hypothesis is that FM results from sensitization of the central nervous system. A range of medical treatments, including antidepressants, opioids, non-steroidal anti-inflammatory drugs, sedatives, muscle relaxants, and anti-epileptics, have been used to treat FM. Non-pharmaceutical treatment modalities, including exercise, physical therapy, massage, acupuncture, and cognitive behavioral therapy, can be helpful. Few of these approaches have been demonstrated to have clear-cut benefits in randomized controlled trials [9].

Some in the medical profession consider the condition psychosomatic, believed to have a mental component derived from the stresses and strains of everyday living. Distinguishing somatoform disorders (disorders in which mental factors are the sole cause of a physical illness) from psychosomatic disorders (disorders in which mental factors play a significant role in the development, expression, or resolution of a physical illness) is problematic [e.g. 10, 11]. Studies of fibromyalgia pain characteristics, muscle function, and impact on daily activities have been conducted (e.g. 12) with aberrations of pain experience literature subject of review [13].

According to Melzack and Wall in [14], pain signals can be controlled, modified and inhibited by distraction. They presented the Gate Control Theory, which proposes that the level of attention given to the pain sensation, emotions associated with the pain sensation and past experiences with the pain sensation are elements that contribute to how the pain sensation is perceived. Wismejler and Vingerhoest in [15] suggest that a good distractor involves multiple sensory modalities, emotional engagement and participation. According to Taylor et al. [5], it is possible that the enjoyment of playing VR games distract the player so that he/she will focus on the gameplay rather than pain sensations. This can result in a more enjoyable experience and thereby improve motivation to comply with the training.

Sarzi-Puttini, et al. [16], in examining treatment strategies in FMS sufferers concluded that exercise does benefit sufferers as well as psychophysiological based therapy, such as electromyography biofeedback, and interventions based on cognitive-behavioral therapy. Summing up the team suggest 'an individually tailored multidisciplinary pharmacologic, rehabilitative, and cognitive-behavioral approach currently seems to be the most effective'.

The specialist doctor (Reumaklinik Danmark) involved in our studies believes exercise and drugs as a best treatment. In a review titled "Exercise for treating fibromyalgia syndrome" [17], Busch et al., detail related work, strategies, and outcomes that was informative for our design.

Little is known about the impact playing with Virtual Reality gaming consoles have on this group of patients. The aim of this study was to explore the experience, women with fibromyalgia had, using movement-based gaming consoles and to investigate the impact on their daily living. In line with other research it is problematic to generalize and to conclude anything other than some enjoyed the experience and felt

benefit. On the follow-up after one-year some had purchased a MCVG, while others believed the benefit to not be worth the investment.

In summing up this limited investigation, which exhibited severe drop outs and thus lack of compliance, we find that a deeper understanding of engagement within the FMS community, in particular related to rehabilitation using MCVGs, can be useful to enhance rehabilitation processes and better dress rehabilitation providers to better facilitate engagement and enhance the effectiveness of rehabilitation interventions.

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