Facilitators' Intervention Variance and Outcome Influence When Using Video Games with Fibromyalgia Patients

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Abstract. 22 adult females diagnosed as suffering Fibromyalgia syndrome (FMS) participated in two explorative studies investigating potential benefits from playing gesture-controlled video games. A main goal was researching potentials of commercial gaming systems with inbuilt Internet connectivity toward home-based self-driven adaptable 'telerehabilitation' targeting means to increase tolerance to pain and thus, augmenting quality of life for sufferers. Beside this, an aim was to study variance between facilitator formal and informal intervention approaches and to analyze potential influence on outcomes; this is the core focus of this paper. Typical to FMS studies, high patient drop out numbers resulted in limited compliance. Informal facilitator intervention (non-therapist) resulted in significantly higher outcome scores (increased tolerance indicators/reported pain threshold) when compared to a formal therapeutic intervention approach. Findings, whilst not conclusive, offer a point of departure to discuss how intervention approach influences outcomes and patient benefit, especially when a self-driven training regime is designed.

Keywords: Fibromyalgia, Video Games, Pain, Facilitator Intervention.

1 Introduction

Two explorative studies investigating potentials for Fibromyalgia Syndrome (FMS) patients playing gesture-controlled video games was undertaken to explore use as an intervention to motivate participation in training.

Notable from the studies was that outcomes were significantly different, such that the positive indicators from study-A were not apparent from study-B. In querying these results (A/B), an analysis of the video material suggested a major difference in the approaches taken by the different facilitators. 'A' was conducted systematically yet non-formal in a playful way, whereas 'B', whilst also being systematic, was more formal in line with a traditional therapeutic approach. The implication of such different intervention strategies is thus explored as the core of this contribution.

Fibromyalgia is a lifelong condition involving widespread musculoskeletal pain and tenderness, fatigue, sleep disturbance, and functional impairment, without any known structural or inflammatory cause. It affects patient life quality and is costly in

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terms of consultations, prescriptions and sick leave. The main aims of therapy are to reduce symptoms, to improve function, and to help patients adapt to the condition. The medical communities are split between treatments with some believing it psychosomatic while others acknowledge that medication is possible whereby physical exercise can assist improvements.

An overall goal of this research, which is conducted in the Esbjerg region of southwest Denmark, was to augment patient motivation to participate and exercise and thus raise their energy level, tolerance and threshold before onset of the fibromyalgia pain. By using contemporary, affordable, and widely popular video gaming systems (that are already present in many Danish homes), it was hypothesized that new opportunities to achieve these goals as well as to augment social interactions via playing with family members, peers, and friends would further stimulate, motivate, and sustain the intervention strategy. The goal of this publication is to explore the impact of patient mindset from intervention influences between the playfully supportive strategies toward an enjoyable experience (study-A) versus a methodological formalized structure clearly based on targeting therapeutic output (study-B).

The next section introduces selected related researches on video games in rehabilitation, therapy and treatment; alternative control via gesture; related intervention strategies; and specific research targeting pain distraction. The following sections detail methods, the session design, and results. A discussions section critically reflects on the different intervention approaches by the facilitators that are speculated as being influential in such applied research and practices in the field. A closing section concludes the findings whilst clearly stating their speculative nature. This section furthermore includes a 'next-step' future research proposal that targets to strengthen the work beyond speculation to stimulate peer discussions on the topic.

2 Related Work

Playing VR games has been shown to distract a patient/player so that (s)he focuses on the gameplay rather than any pain sensations [1]. This can result in a more enjoyable experience and thereby improve motivation to comply with the training.

"*Acute pain is shown to be noticeably reduced in children and adult sufferers once engaged in video game activity," says Charles Friedman, D.O. of Pain Relief Centers in Pinellas Park. "These video games do certainly play a role in relieving some pain through both distraction and movement," says Friedman. "Even if you've never played video games, engaging in any sort of active gaming will reduce your pain level and even increase pain tolerance*," says Friedman.[1]

Using an exploratory approach [2] investigated the influence of movement on how players experience video games through the systematic collection and analysis of data

[1] `http://www.brashgames.co.uk/2010/11/29/video-games-ease-the-pain/` (np).

obtained from interviews; questionnaires; video observations; and a motion capture system. Achievement and relaxation were gamer-reported motivators of the play (i.e. boxing), which was evident in the gameplay via two corresponding movement control strategies. Such motivators are acknowledged as pain distractors. Outcomes from this study point to four movement-specific items influencing immersion in movement-based interaction: natural control, mimicry of movements, proprioceptive feedback, and physical challenge. These were reflected from a design perspective in respect of physical activity and emotional wellbeing. Accordingly, based on input from the patients' doctor, we have used a gesture-controlled game (held handset) as motivators and in line with studies on Energy Expenditure (EE) during Wii Sports game activities of typically developed (TD) adults and with positive results [3]. [4, 5] similarly report on cerebral palsy and chronic stroke patients using the Wii to achieve more active lifestyles.

Methods to assess game systems use in rehabilitation via psychometric evaluation to provide a personalized and automated training is exemplified by [6]. However, research of video games in Fibromyalgia has been found lacking. Also, despite the numerous studies on video games in healthcare, it has been difficult to find researches that focus on facilitator intervention approaches and strategies.

The first authors' prior research highlights how the use of tailored accessible interactive causal environments that empower digital game playing, art making, and robotic device control via gesture (i.e. play and creativity), has realised potentials in the field of healthcare rehabilitation and therapy. Included are early conceptualizations on use of Internet connectivity for *Telerehabilitation* evolving to *TeleAbilitation* [7], including for home training of pain tolerance. A common factor in this body of work has been how immersion and engagement in the playful and creative activities distract from the patient's impairment. Similar distraction strategies via video games are used by [8],[2] which is used as a pain-management tool for patients undergoing agonizing medical treatments whereby the need for potent narcotics is reduced: This a strategy also used in [9]. Thus, synthesizing these approaches, a home-based pain management tool can be acknowledged as appropriate. However, a concern would be extensive computer and video game usage that may indirectly cause non-FMS pain that would confuse diagnosis and progress. In line with this is a related study with 791 adolescent where the frequent use of computer and video games was found to not be associated with the presence of pain and musculoskeletal pain syndromes [10].

This paper's second author is an authority on non-formal learning that is innate within such interactive environments where the motivation of the participant aligns with embodied challenges such as researched in many contemporary education situations. Petersson [11] underlines that through gameplaying activities, the FMS participant determines the course of (inter)actions and, thereby, experiences autonomy in the form of actions that are selected from a range of possible choices. To select among these choices is to grasp affordances [12], i.e. to perceive and to act upon

[2] http://www.hitl.washington.edu/projects/vrpain/index_files/SCIAMFin.pdf

something in a particular way. This operation is an immediate and reciprocal action with an interactive character, which relates the participant's action to the concept of interaction. In this way, a dialogue is initiated as a part of the participant's input in the form of movement (feed-forward) and the response from the game system (feedback). This creates motivators in the form of iterative feed-forward-to-feedback loops. Halliday [13, p. 68] terms such turn-taking activities as speech acts and emphasizes:

An 'act' of speaking /.../ might more appropriately be called an 'interact': it is an exchange in which giving implies receiving, and demanding implies giving in response.

Feed-forward and feedback evolves as an iterative loop encourages exploration and development of skills and competencies. In terms of [14] the competencies in question are those involved in the mastery of the gameplay. Bruner describes the exploration as an exercise, through which the participant can augment his or her actions to new limits of already achieved skills. When the participant becomes absorbed by the gameplay-based exercise, the exploration develops into play. Intense concentration of the exploration and the gameplay is core as a basis for non-formal learning [11, 15, 16]. Here, where the conditions are created so that the feed-forward-to-feedback loop provides an invitation to explore and, then, to begin to play and to continue playing, the gameplay can be considered as active creation of meaning (or learning), and not just use of a game. [11] states that the use and the design of such gameplaying interventions are dependent on idiosyncratic tendencies. How to use and overcome possible constraints in such situations is a crucial facilitator consideration. In the context of this paper, the facilitator contemplations are suggested to also include framing consideration in terms of formal- and non-formal-based mindsets in order to create appropriate motivators for therapeutic gameplay interventions.

3 Method

The study as such included two pilot studies: A and B. A [17] investigated gesture-based control of video games to promote and motivate self-driven home-based aerobic exercise (AE) training regimes to improve pain threshold associated to FMS. 10 patients were randomized to 10 sessions each led by a nonmedical 'game-savvy' PhD Medialogy student. Control was treatment-as-usual (TAU) patients via the patient's doctor who conducted pre- and post- interviews, tests, and VAS registrations of pain, disturbed sleep, lack of energy, and depression. Included was patient-reported global subjective improvement or otherwise. A Nintendo Wii was used with a sports compilation game 'Sports Resort' with the Wiimote MotionPlus accessory to increase accuracy of gesture. Only two completed the study.

Study B [18] was conducted with two occupational therapist students as session facilitators of 12 participants. Three game platforms were studied: the MS Kinect, Sony MOVE, and Nintendo Wii, with 5 game sessions of one hour being played by each patient in regular lab visits (=15 sessions each). Control was again treatment-as-usual (TAU) patients and collection of data by the doctor as in study-A. High dropouts were again apparent with only 7 completing all sessions.

3.1 Procedure

In both studies an introduction session guided the patients to be able to play the games. In study A, the Wii 'Sports Resort' compendium game was used where patients could select the specific gameplay and level.

Similar games were used in study B.

In both studies, a 107 cm screen size TV was used for the patient to monitor the gameplay that mirrored input motion. The use of a large screen size had been found optimal in prior research where optimum experiences, immersion, and engagement was reported by participants where interactions were mirrored as a direct and immediate response delivered on a one-to-one scale [19, 20, 21, 22, 23, 24, 25]. In study A the facilitator supported where necessary targeting fun experiences from the play situation rather than evoking a therapeutic-focused intervention.

The Wiimote handset was enhanced via the MotionPlus accessory for extra sensitivity. The test area was set-up with a tape marker for the patients' gameplay start position consistency between sessions. Data collection was via three cameras with different viewing angles were routed to 1, 2, and 3 inputs of a Roland V-4 four-channel video mixer (figure 1).

The component output from the game console was split and routed to the input of channel 4 and to the TV. This was to enable a quadrant view of patient activity so that stimuli and responses could be automatically synchronized to optimize intervention/interaction analysis.

VAS registrations of: pain, disturbed sleep, lack of energy, and depression were among the tests, conducted by the patients' doctor, as well as interviews questioning global subjective improvement. Outcome measures and interviews were at baseline and at treatment completion.

Fig. 1. Two quad screen views (left = session 2, right = final session)

The complexity of researching a disabling condition such as fibromyalgia where much is still being debated on the disease itself (e.g. psychosomatic versus medication/exercise) as well as the innate challenges of assessing human condition in general, means that each case is individual when considering progress.

Whilst initial results are positive, a reflection on the generic viability against the TAU control in such a limited study is speculative due to the large drop out of 8 from 10 patients. However, the significance of the findings in this pilot study led to a follow-on comparative study (including handheld device for motion tracking versus non-handheld) with 39 patients invited under the same doctor.

Thus, study B was conducted with two occupational therapist students replacing the Medialogy student as session facilitator. Three game platforms were studied: the MS Kinect (non-handheld), Sony MOVE (handheld), and Nintendo Wii (handheld), with 5 game sessions of one hour being played by each patient in regular lab visits (total =15 sessions each patient). This is detailed next where the formal data collection process is outlined.

Data collection process.

- Data collection at the clinic (pre- and post-programme) (VAS etc.)
- Data collection – Home =ADL-Q (Completed and brought at the baseline interview)
- Data collection at Aalborg University Esbjerg/SensoramaLab (test site)

1. Baseline interview + Platform 1 game selection
2. Platform 1 – Session 1
3. Platform 1 – Session 2
4. Platform 1 – Session 3
5. Platform 1 – Session 4
6. Platform 1 – Session 5
7. Platform 2 – Game selection + Session 1
8. Platform 2 – Session 2
9. Platform 2 – Session 3
10. Platform 2 – Session 4
11. Platform 2 – Session 5
12. Platform 3 – Game selection + Session 1
13. Platform 3 – Session 2
14. Platform 3 – Session 3
15. Platform 3 – Session 4
16. Platform 3 – Session 5

- Data collection – Home = ADL-Q (Completed and brought at the post-intervention interview)
- Data collection at AAUE/SensoramaLab = Post-intervention interview (2 handheld video cameras recorded)

4 Results

Facilitator in vivo observations and multiple angle (3) video recordings synchronized to the game play provided substantial data to analyze study-A. Outcome measures were at baseline and completion. Short-term results were positive of those patients who completed the study (n = 2). 50% drop out at study commencement suggested a skeptical patient attitude. Further dropouts (n = 3) were due to a car accident (n = 1) and recurrence of pain (n = 2). Both patients who completed showed significant motion improvements and substantial rise in reported onset of pain threshold indicators (VAS) and each purchased a Wii for home training following the study. Follow up interviews and tests are undertaken to question compliance and long-term outcomes.

Videos were analyzed and further viewed by a representative from the Danish Fibromyalgia union. The videos clearly indicated a common pattern that, following initial trepidation and caution by the patients, and once comfortable, the patients' dynamic motions were stimulated via the gameplay so that a new level of engagement and motion was evident by the end of each session. The Danish Fibromyalgia union expert evaluated positively.

In study-B doctor interviews the patients who dropped out informed that after the training session they got worse and he suggests this may explain their stopping. When interviewing and testing those who completed there was no significant change on pain (pre-post) and negative on fatigue (pre-post). Participants stated that they did not take notice of pain symptoms while playing and that playing VR games was a fun way of doing manageable exercise. The session facilitators said that those who completed mentioned less pain and more energy while they played. They were observed as seeming very focused and enjoying themselves and "lifted" when they are leaving post-session. Although no general reduction in pain was attained, participants did see VR games as a good way of doing exercise. Participants stated that they did not take notice of pain symptoms while playing and that playing VR games was a fun way of doing manageable exercise. Most participants did not engage in a lot of exercise at baseline, because they related this with increased pain and fatigue, but playing VR games they managed to be physical active for 30 minutes and had fun with it. Reasons could be that playing VR games was not being perceived as exercise but as play.

5 Discussions

The medical doctor who reported significant results between pre- and post- VAS outcomes and other collected data substantiated the findings from study-A, yet was confounded at the negative outcome from study-B, suggesting the only explanation as "*the two first patients had a special positive personality*". This study looked further into the videos from the sessions and reflected on preliminary comments. In study-A, the video games engaged the patients to previously unseen dynamics of motion gesture and participation. They also had lots of fun both in the gameplay and interactions with the facilitator and this was analyzed as offering positive reinforcement and scaffolding for the patient playing the game. One patient reported using the training sessions as a family event (she brought her daughters to the sessions for encouragement). The other patient used sessions as a self-training regime without family support and would change into a Lycra aerobics outfit. Her approach was that this was her private time and space. Both of these were session participants that evolved to become self-driven eventually without researcher intervention. Notable was that the two patients that completed all sessions each purchased the Nintendo Wii for home use. This is in line with a report by Dr. Ben Hertz, a director of Occupational Therapy at the Medical College Georgia [26], who explained that in a study with Parkinson's disease and the Wii participants showed significant improvements in rigidity, movement, fine motor skills and energy levels. Perhaps most impressively, most participants' depression levels decreased to zero. The report states that about 60 per cent of the study participants decided to buy a Wii themselves, suggesting that that speaks volumes for how the study made them feel. The play aspect, which was a major issue in study-A where the facilitator was the games-oriented PhD student, was also reported positive in study-B as patients preferred to think of the activity as play versus training and this motivated participation. However, the video footage of session gameplay suggests a different priority for the facilitators in their approach to intervention such that study-B therapist facilitators had 'therapy' as a priority. Thus, a question arises whether the facilitator mindset affects the patient mindset and subsequently reported outcomes. This speculation is complex to prove due to the challenges inherent of researching humans is a subjective and qualitative manner, and especially over only a short period where findings are limited.

6 Conclusions

FMS, by its nature, presents a challenge for full study compliance and dropouts should be expected [27, 28]. The studies presented were no different with many stopping to attend for many reasons. However, the results between the studies were significantly different, thus necessitating a closer analysis of what had happened to cause the changes. The facilitator intervention was thus observed according to non-formal approach analogized from [11]. When outcomes between comparative studies are so significantly different questioning of variances is an obvious thing to do. In querying A/B results, video analysis suggested a major difference in the approaches taken by the different facilitators with study-A being conducted systematic yet informal, whilst study-B, whilst also systematic, was more formal in line with a traditional therapeutic approach. The implication of effect impact on patient mindset from intervention influence between a playful yet supportive strategy toward an enjoyable experience (study-A) versus a methodological formalized structure clearly based on targeting therapeutic outcome (study-B) is thus explored as the core of this contribution. With advances in such game-based systems prevalent alongside their increased use in healthcare, this contribution posits the need to consider patient mindset influence by facilitator intervention, suggesting further research with this focus to establish additional strategy models that are not framed in traditional formality but more open to improvised yet systematic and adaptive intervention. An example of such a model is the Zone of Optimized Motivation (ZOOM) as emergent from the first author's body of research [e.g. 3, 4, 5, 6, 7]. Such models are posited required to support the predicted future service industry trained personnel shortages of those that care for impaired, aged, and others in need. It is envisaged that such healthcare facilitators will increasingly use ICT in their practices and likely increasingly collaborate across disciplines with non-therapists, and especially with those capable of creatively programming such ICT.

Conflict of Interest Statement. The authors have no conflict of interest to disclose.

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