Motion-games in Brain Injury Rehabilitation:
An In-Situ multi-method study of inpatient care

Cynthia Putnam, Jinghui Cheng
College of Computing and Digital Media, DePaul University
243 S. Wabash, Chicago, IL, 60604
Telephone number, incl. country code
cputnam@cdm.depaul.edu; jcheng13@mail.depaul.edu

ABSTRACT

In this project, we explored how commercial motion-based video games were used in a rehabilitation hospital with patients who have had a brain injury (BI). We interviewed therapists and observed game sessions. Major findings included: (a) the social aspects of gaming were highly valued; (b) therapists had varied physical, cognitive and social goals when using games; and (c) therapists made game decisions primarily based on familiarity versus choosing games that best match therapeutic goals and patient profiles. Our exploration exposed a need for decision tools to help therapists make evidence-based decisions about commercial games; i.e. to help them choose games that match session goals and patient profiles. We have expanded our research to include diary studies in order to gather data for 'seed cases' for decision tools that use case-based reasoning.

Categories and Subject Descriptors

K.4.2. Computers and Society: Social Issues (Handicapped persons/special needs); K.8.0. Personal Computing: Games

General Terms

Human Factors

Keywords

Motion-gaming, therapists, brain injury, case study

1. INTRODUCTION

The Center for Disease Control and Prevention (CDC) in the US recognizes that brain injuries are a major public health issue; the CDC estimates that in the US 1.7 million people sustain a brain injury (BI) annually [1]. Clinical experience and literature have identified that it is often challenging to motivate BI patients to engage in the repetitive exercises commonly prescribed for rehabilitation [4, 5]. As a result, many therapists include commercially available motion videogames in their therapy sessions to help make repetitive actions fun and engaging [4]. (Motion videogames as those played using gestures and/or sometimes-specialized controllers, e.g., Xbox Kinect and Nintendo Wii). Previous research has supported motion-games

as effective motivators for performing rehabilitation exercises [2]. Research has also supported commercial motion-games as effective in meeting therapeutic goals for BI patients, including increasing balance and range of upper extremity motion [6]. While this is encouraging, the studies employed small samples; as such, commercial motion-game efficacy across a wide range of BI patients has not been established.

In this paper, we describe on our initial work with therapists who used commercially motion-games as part of their therapies for BI patients. We collaborated with therapists at the Schwab Rehabilitation Hospital (SRH) in Chicago [1] to explore how commercial games meet therapeutic goals, the levels of cognitive and physical help required to play a variety of games, and attributes that affect engagement and enjoyment. In the following sections, we present our initial exploratory studies that exposed a need for a decision tools that will help therapists make evidence-based choices about commercial game use.

2. Methods

2.1 Participants

We interviewed eleven therapists; among them, three were occupational therapists (OT), three were physical therapists (PT), three were recreational therapists (RT), and two speech-language pathologist (SLP). All therapists worked with BI patients and had between two and fourteen years experience. We also observed 16 play sessions that involved five therapists (two PTs, one RT and two OTs). Patients ($N = 16$) ranged in age from 43-64; BIs had occurred within 30 days of observations.

A patients' day at SRH is structured around 45-minute sessions with 15-minute breaks; patients are scheduled with multiple therapists for up to four sessions throughout the day. At SRH therapists' patients were scheduled with PTs, OTs and SLPs (as lead therapists) who in turn would work with the RTs if they felt that their patient could benefit from recreational therapy.

2.2 Data collection and analysis

Interviews. Interviews were conducted June-September of 2012 at SRH. Each semi-structured interview took between 30 and 45 minutes. Questions included: (1) which games they used; (2) to describe their experience using the games, e.g. their goals in using the games, the effectiveness of the games for meeting those goals, and problems they had with the games; (3) approximate percentage of patients that they used video games

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with; (4) what features they would include games if they could design games for their patients; and (5) to describe the best and worst experiences in using motion-games. Interviews were video recorded and later transcribed. We independently analyzed transcriptions and inductively coded for major themes and patterns and then combined our findings.

Observations: We conducted 16 observations between July and October 2012; sessions were video recorded from the front (for facial expression) and back. (Only patients that were judged as cognitively capable by therapists to understand consent were included in the observations). Patients played one to three games/mini-games a session. After each observation we asked therapists how they felt game(s) met the play session therapy goals, how much cognitive and physical help was needed, and about how they perceived the patient's engagement and enjoyment during the game session. Patients were also asked to discuss (a) how they enjoyed the games and (b) other activities they enjoyed (this was early exploration of matching patient preferences to game types).

3. Summary Findings

Interviews. The OTs, RTs, and SLPs described using motion-games for less than 20% of their patients; RTs reported using video games in approximately 25-50% of the sessions they were involved. The most common reason therapists choose to use motion-games was to support social interaction; seven therapists explicitly discussed how the video games provided a shared space that was useful for therapies. Therapists choose games to meet varied session goals, see Table 1.

Table 1: Commercial games discussed by role

Role	Common games	Session Goals
OT	Bowling, Boxing, Wii Fit, Michael Jackson's Dance	Fine movement, gross movement, static balance, strength
PT	Bowling, Soccer Wii Fit	Weight shifting, balance, gait, adjusting for neglected limbs
SLP	Bowling, Family Feud, Wheel of fortune	Socialization, social language development, focusing attention, turn-taking
RT	All the above	Depended on other therapists they were working with

Therapists also expressed many desired changes and/or features they would like to see in commercial games. The most common desires were: (1) need to support assistive devices, e.g., a wheelchair or support from a therapist; (2) means to modify (slow) pacing, remove time limits, and an ability to modify movement parameters; and (3) means to modify the scoring and remove negative character behavior.

Observations: During our 16 observations, we saw 37 games played on the Wii and Xbox Kinect which included: (a) Wii Fit games, (b) sports games, and (c) dance games. Findings reported here are focused on those related to the need for decision tools.

It was important to minimize set-up and know ahead of time if the games were a good match for the patient and the patient's therapeutic goals to fully utilize the 45-minute session. If a game was not a good match to the patient skill level the session was not productive. In these cases, patients were visibly frustrated and often verbalized negative feelings about themselves.

When choosing games, therapists relied on their own knowledge or that of the RT. In other words, there was a knowledge gap about (a) new games/systems and (b) which games were the best

fit for their session goals and the patient profile (e.g. abilities and play preferences). This meant that most patients played games in which the therapists were familiar; not necessarily games that were best suited for the session goals and/or patient.

4. Future work and conclusions

We expanded our project to include diary studies in which therapists at SRH recorded game session details (over three 2-week collection periods) that we will use as 'seed cases' for case-based reasoning (CBR) decision tools. CBR systems solve problems by referencing previous solutions or 'cases'. (The diary forms have also permitted information gathering from sessions we cannot observe; i.e. those in which patients are not cognitively capable of signing consent). Tentatively, a 'case' in our system (i.e. a diary entry) will identify relationships among: (1) patient variables (abilities/preferences); (2) therapy session goals; (3) game/console affordances and requirements; and (4) subjective and objective measures of session outcomes. To date, we have information from 63 play sessions involving six therapists, 52 different patients and 122 games/mini games. To expand our dataset, we will work with with a new site (Marianjoy Rehabilitation Hospital) starting in fall 2013.

While therapists we have worked with have expressed that commercial motion-games are a good augmentation to standard therapy, there remains a lot of dissatisfaction with how commercial games meet both their needs and the needs of their patients; other researchers have also reported on the many limitations of commercial games [e.g. 2]. Creating CBR decision tools will not only help therapists make evidence-based choices about games, but also provide a platform for continued information gathering on therapeutic choices and outcomes. As such, the system will: (a) establish efficacy about commercial motion gaming across a wide range of patients who have had a BI; and (b) inform guidelines for designers when ideating new custom motion-games to support therapists and BI patients.

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