



# Improving Patient Motivation towards Rehabilitation Treatments with PlayTherapy Exergame

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Personalized Health

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# Outline

1. Introduction
2. PlayTherapy exergame
3. Evaluation and discussion
4. Conclusions and future work

# Problem statement

## Introduction



Physical therapies [1] involve  
**slow, repetitive and often  
painful exercises [2]**



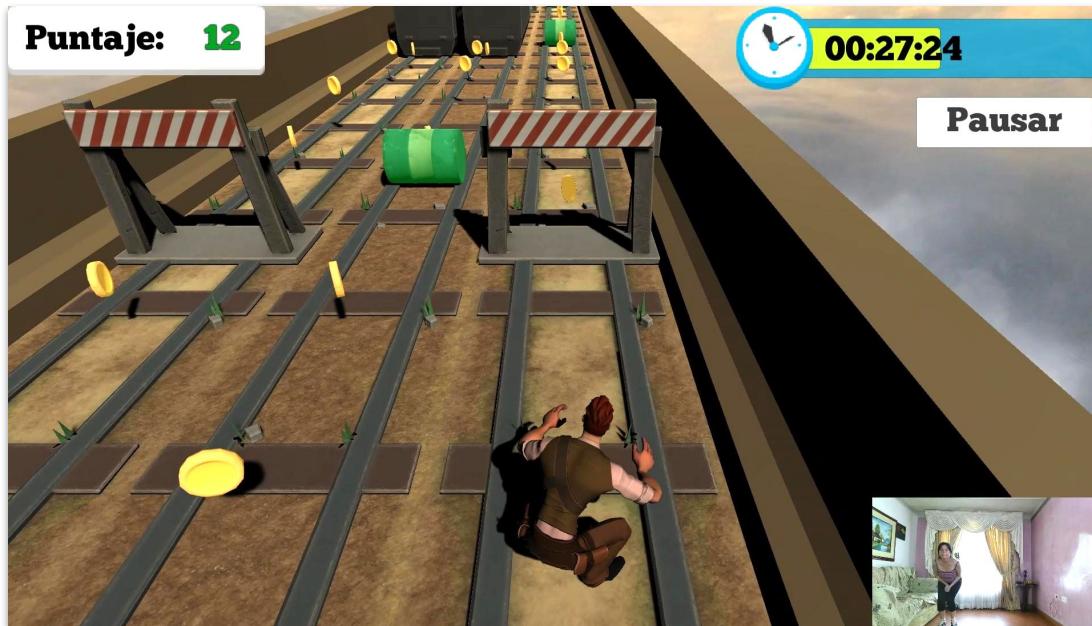
**Lack of motivation**



Longer or incomplete  
therapies

# Proposal

## Introduction

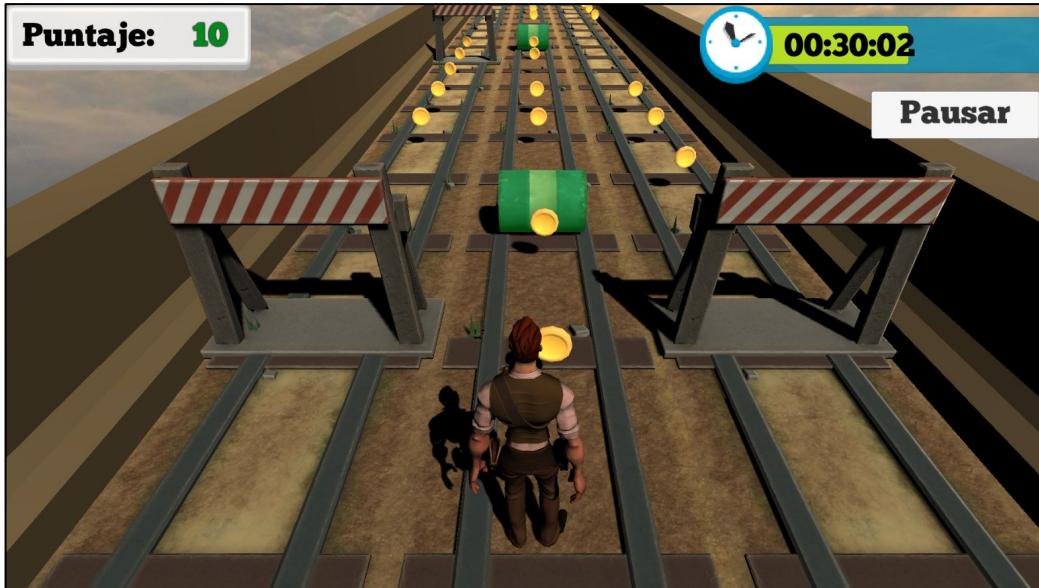


Digital games may provide a **motivating**, compelling and engaging **experience** to patients [3, 4, 5]



# Proposal

## Introduction



Therefore, we developed **PlayTherapy** as a tool to assist physical rehabilitation therapies

# Exergame component

PlayTherapy exergame



PlayTherapy is intended to **increase patients' motivation** towards completing physical rehabilitation treatments

PlayTherapy is composed of **two components**

# Exergame component

PlayTherapy exergame



A set of a rehabilitation mini-games to offer a compelling and personalised experience to patients

# Web component

PlayTherapy exergame



A web application to manage and visualise data associated to therapy sessions assisted by the exergame

# Minigames' components I

PlayTherapy exergame



**Parameters Screen:** allows physiotherapists to set up a mini-game



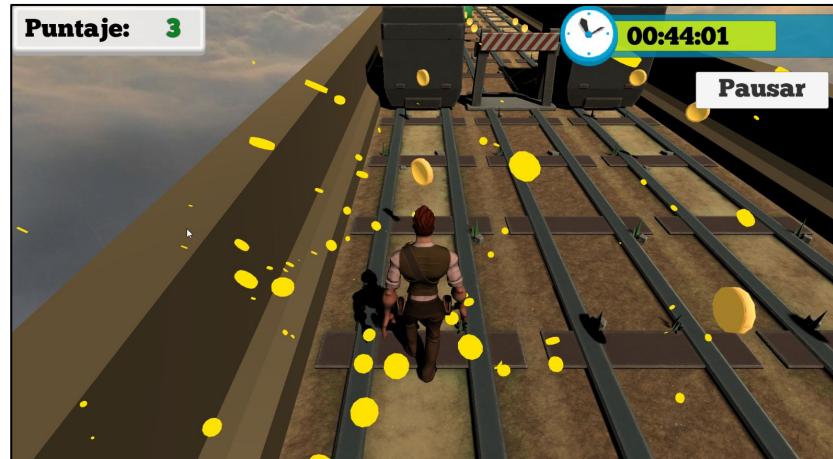
**Tutorial:** explains the game objectives, rules and mechanics

# Minigames' components II

PlayTherapy exergame



**Results Screen:** presents the performance of a player/patient along with visual feedback



**Feedback system:** animations and sounds triggered by certain players actions or movements

# Minigames' components III

PlayTherapy exergame



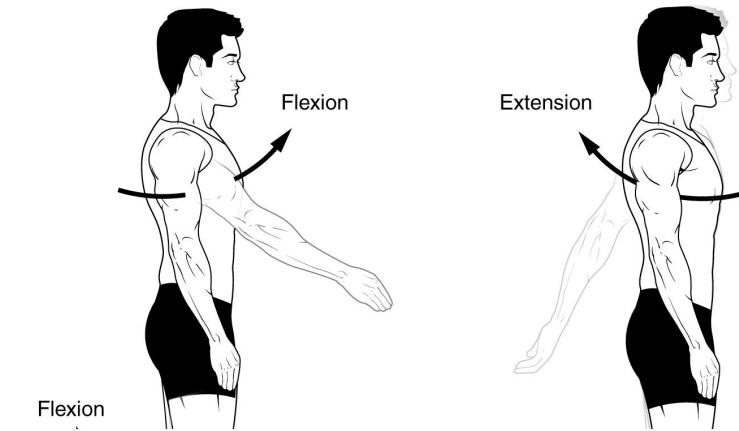
**Game screen:** allows players to perform a game session



**Final animation:** provides a smooth and compelling transition from Game and the Results screens

# Mini-game: Sushi Samurai

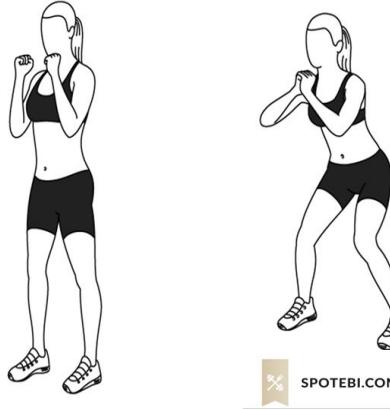
PlayTherapy exergame



Players have to cut fishes coming out of water  
**Movements:** Shoulder and elbow flexion and extension

# Mini-game: Tiro Libre

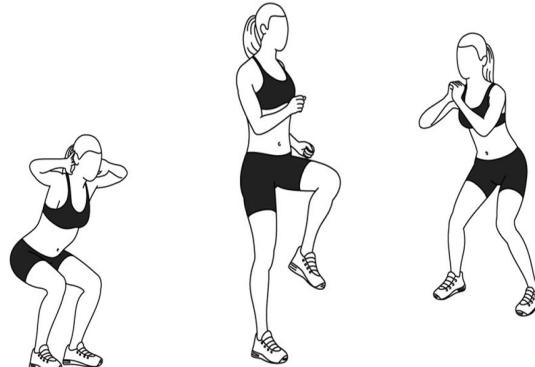
PlayTherapy exergame



Players perform kick movements to strike a ball against some targets placed in a goal  
**Movements:** Hip flexion and extension, lateral shifts

# Mini-game: Rieles

PlayTherapy exergame

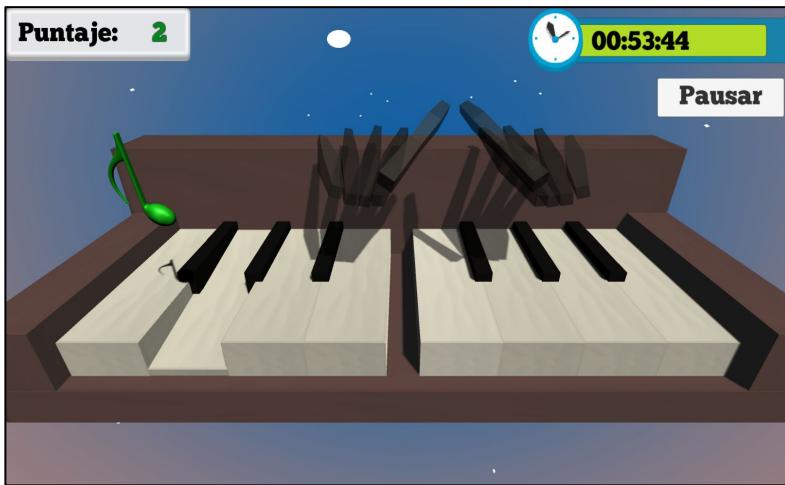


Players have to jog to go forward and squat and jump to avoid obstacles while collecting as many coins as possible

**Movements:** Jumps, squats, jogging and lateral shifts

# Mini-game: Piano

PlayTherapy exergame



Players have to perform finger flexions or pinches to play a piano keyboard  
*Metacarpo-phalangeal flexion and hand pinch*

# Mini-game: Topos

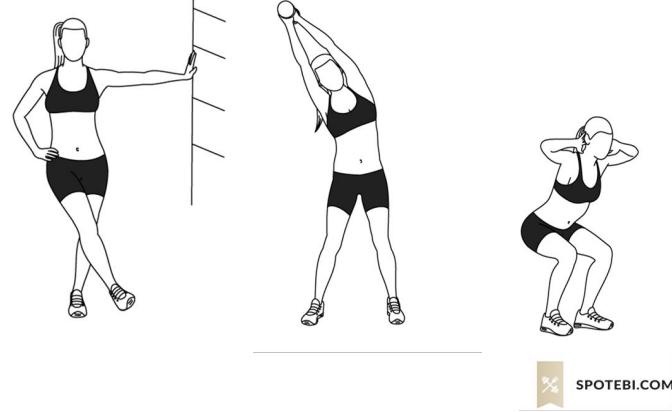
PlayTherapy exergame



Players have to perform a grabbing movement (fist) to catch moles or directly touch them by moving their hands  
**Movements:** Hand touch and grab

# Mini-game: El Gran Viaje

PlayTherapy exergame



Players control a plane moving their body and have to collect gems and avoid obstacles

**Movements:** Hip abduction, lateral and frontal trunk inclination, squats

# Mini-game: Vecinos Invasores

PlayTherapy exergame

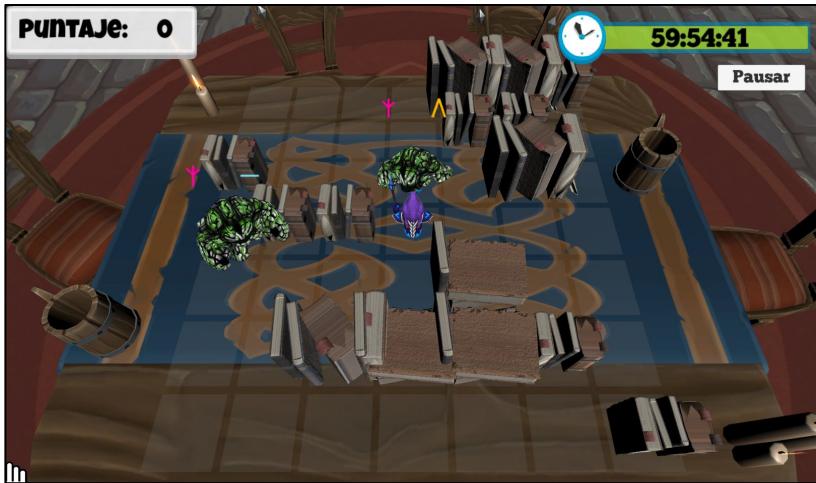


Players have to defend farm animals from being abducted by destroying alien ships  
using their hands

**Movements:** Hand touch and pinch

# Mini-game: Figuras Mágicas

PlayTherapy exergame



Players have to draw figures using their hands to eliminate approaching enemies  
**Movement:** Hand-eye coordination

# Mini-game: Viajando en el Espacio

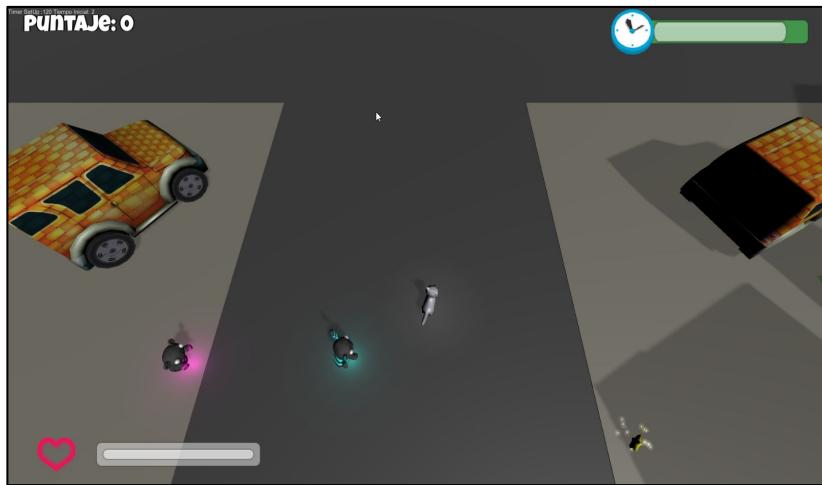
PlayTherapy exergame



Players control a spaceship using their hands to collect stars and overcome obstacles  
**Movements:** Ulnar and radial deviation, pronation and supination, wrist flexion and extension, hand grab

# Mini-game: Dulce Hogar

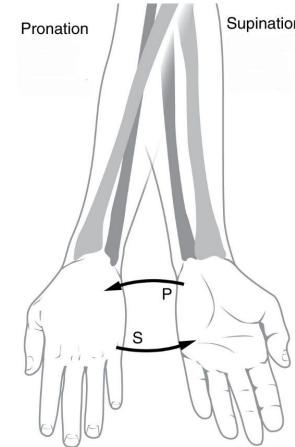
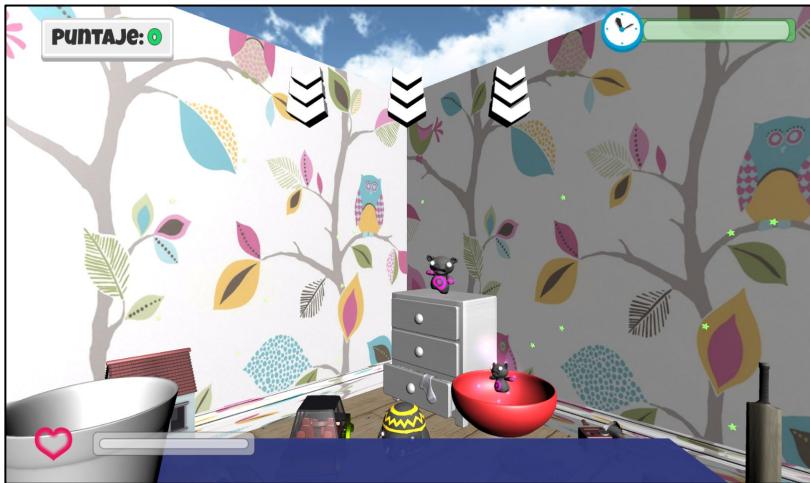
PlayTherapy exergame



Players control a cat using their hands to collect stars while avoiding enemies  
**Movements:** Ulnar and radial deviation, wrist flexion and extension

# Mini-game: Cavano

PlayTherapy exergame



Players control a bowl using their hands to gather falling objects and drop them into a jar

**Movements:** Pronation and supination

# Mini-game: Guerra medieval

PlayTherapy exergame

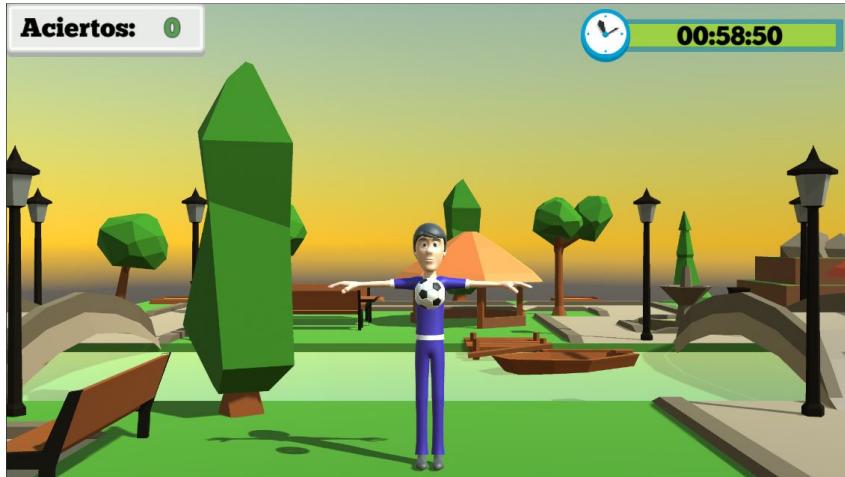


Players have to defeat enemies using hand movements

**Movements:** Ulnar and radial deviation, pronation and supination, wrist flexion and extension, hand grab

# Mini-game: Estilo Libre

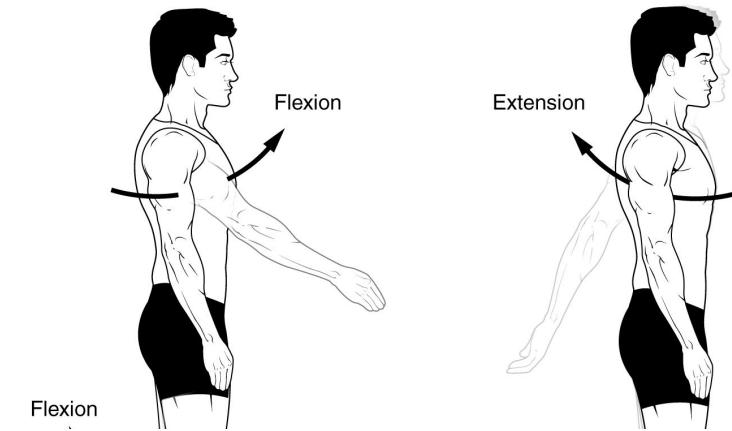
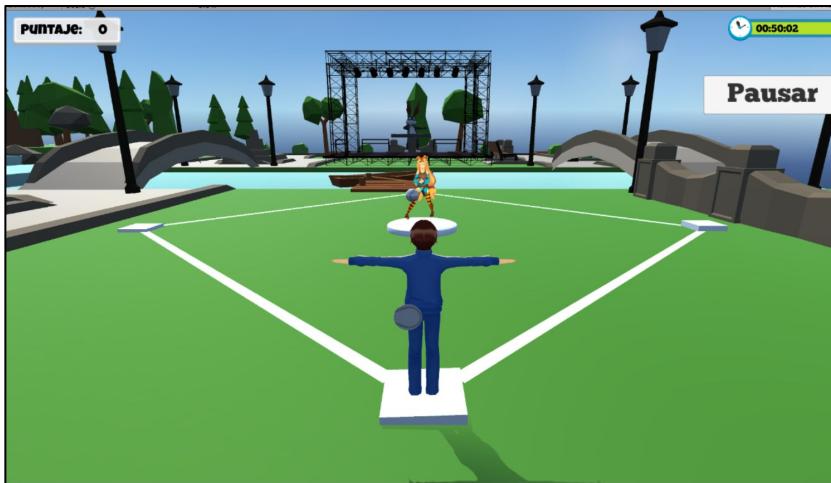
PlayTherapy exergame



Players have to maintain a ball in the air using their legs  
**Movements:** Hip flexion and extension

# Mini-game: Béisbol

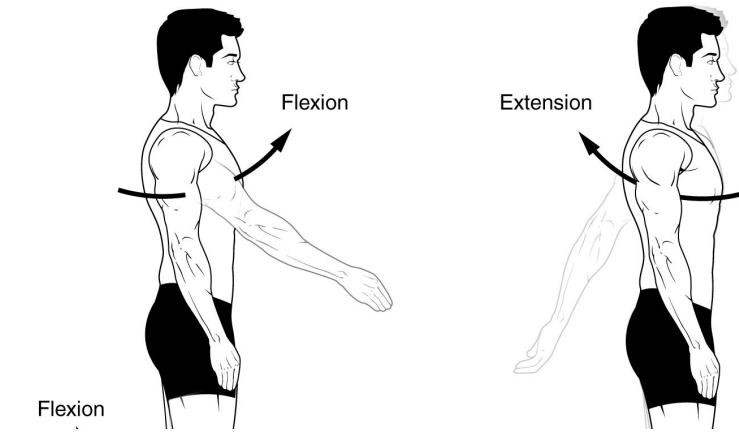
PlayTherapy exergame



Players have to grab balls being thrown at them using their arms  
**Movements:** Shoulder and elbow flexion and extension

# Mini-game: Fight

PlayTherapy exergame



Players should use their arms to perform magic tricks and defend the city  
**Movements:** Shoulder abduction, flexion and extension

# Motion tracking devices

PlayTherapy exergame



**Kinect 2**

Shoulder, elbow, hip, knee, and spine motion detection

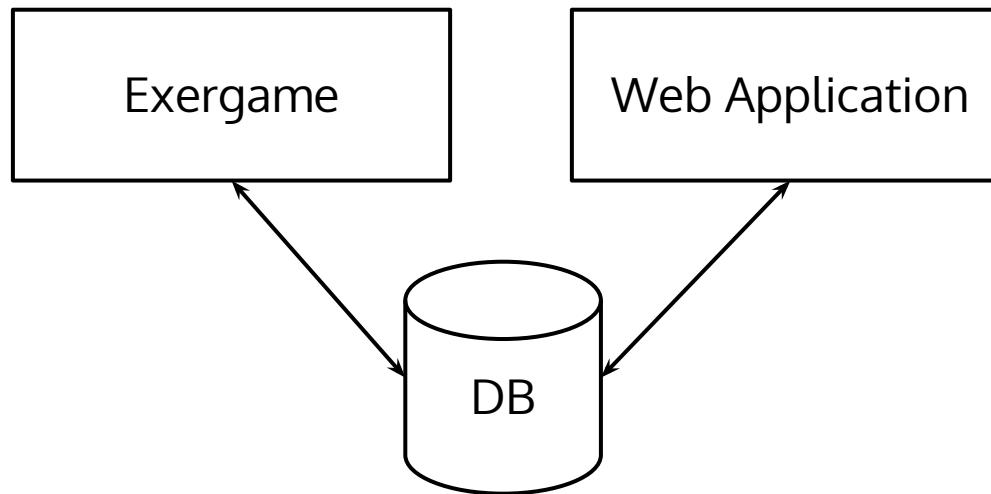


**Leap Motion**

Forearm, wrist and some fingers motion detection

# Architecture

PlayTherapy exergame



# Related platforms

## PlayTherapy exergame

Alternative	PlayTherapy	Jewel Mine [6]	MIRA Rehab [7]	VirtualRehab [8]	GestureTek Health [9]
Availability	Open source	Open source	Proprietary	Proprietary	Proprietary
Body tracking	Yes	Yes	Yes	Yes	Yes
Upper limbs support	Yes	Yes	Yes	Yes	Yes
Lower limbs support	Yes	No	Yes	Yes	Yes
Hand tracking	Yes	No	No	Yes	Yes
Functional movements	Yes	No	Yes	Yes	Yes
Mini-game based	Yes	No	Yes	Yes	Yes
Progress tracking	Yes	No	Yes	Yes	Yes

# Evaluation

Evaluation and discussion

**Participants:** 5 patients and 3 physiotherapists

**Location:** *Hospital Universitario del Valle*

**Methods:** Field-Observation and Question asking protocol [10]

**Number of sessions:** 2



# Results I

Evaluation and discussion

## Parameters configuration screen

**Helpful** to personalise a mini-game for different patients and pathologies

**Easily manageable and understandable**



# Results II

Evaluation and discussion

## Exergames

**Dynamic** alternative to therapy routine

Patients had **fun** and got **distracted** from their environment

Patients expressed their enthusiasm to **keep playing**



# Results III

Evaluation and discussion

## Recommendations

Improve some **color combinations**

Include more mini-games to support **more movements**



# Discussion

Evaluation and discussion

PlayTherapy is the outcome of **continuous improvement** and validation involving physiotherapists and patients

The mini-games include **meaningful** objectives and challenges

The mini-game provide **positive** and encouraging **feedback**



# Conclusions

## Conclusions and future work

The conducted UX evaluation showed that PlayTherapy may **increase patient motivation**

Physiotherapists considered PlayTherapy as **practical and useful** to perform configuration, personalisation, and assessment

**Compared alternatives** included numerous features, but they **are mainly proprietary**

PlayTherapy positions itself as an **all-around solution** that could be used by different companies and organisations in the future

# Future work

## Conclusions and future work

PlayTherapy could be enhanced by **including a monitor system** to provide real-time feedback on the correctness of movements

A more integral UX evaluation should consider **specific characteristics of rehabilitation exergames** which may affect patients' experience

The **effectiveness of PlayTherapy** to motivate patients in the long-term and impact of the platform in patients' rehabilitation processes should be studied



# Thanks

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