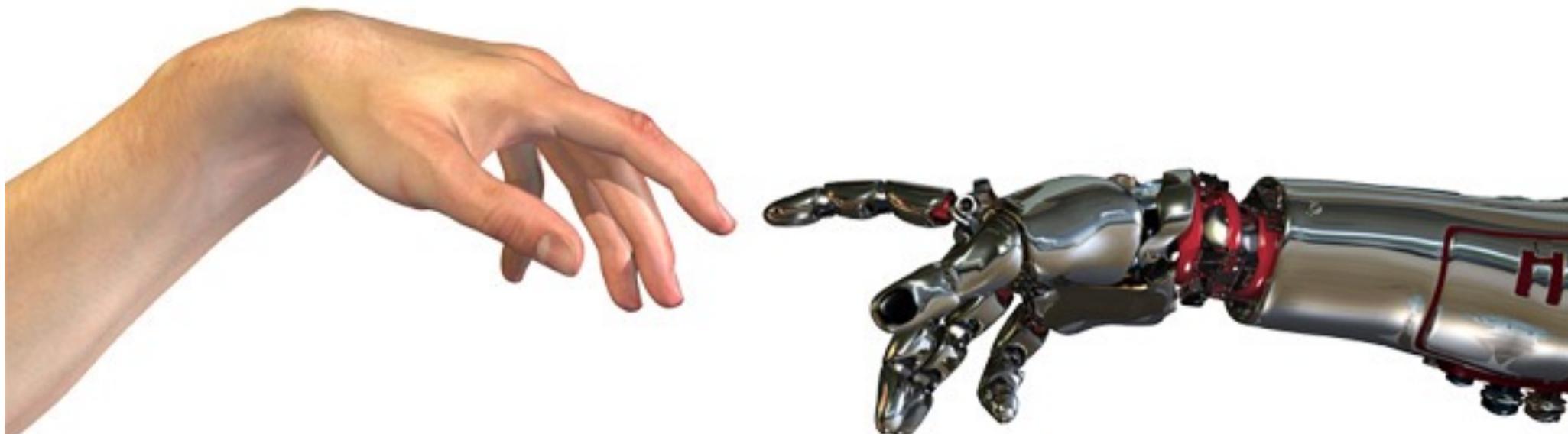


HUMAN-COMPUTER INTERACTION

UNIVERSAL PRINCIPLES OF HUMAN-COMPUTER INTERACTION DESIGN



OBJECTIVES

- 1.) *Color Psychology – Virtual/Mixed Reality Use Cases*



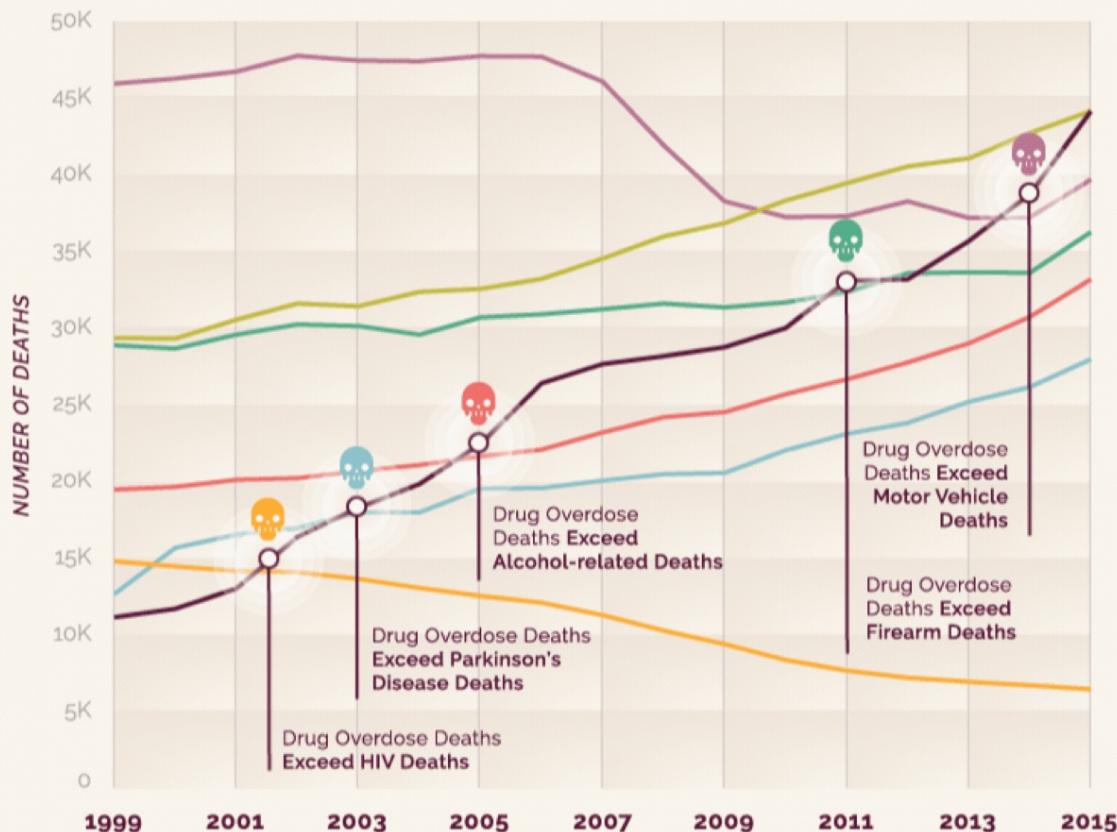
HOW MIGHT THE ATTENTION RESTORATION THEORY & COLOR PSYCHOLOGY BE USED BY HCI/UX DESIGNERS FOR PAIN MANAGEMENT (AND+ HELP THE “OPIOID EPIDEMIC”)?



The Number of Annual Deaths in America

BY COMMON UNDERLYING CAUSES

- ◆ Motor Vehicle ♦ Suicide ♦ Firearm ♦ Alcohol-Related
- ♦ HIV ♦ Parkinson's Disease ♦ Drug Overdose



Sources: Centers for Disease Control and Prevention [CDC], National Center for Health Statistics, "Underlying Cause of Death 1999-2015," CDC WONDER Online Database

Note: Drug overdose deaths limited to unintentional poisonings

Created by DrugAbuse.com

OF THE ~100 COMING OUT OF SURGERY:

~ 30 WILL MISUSE YOUR PRESCRIBED DRUGS

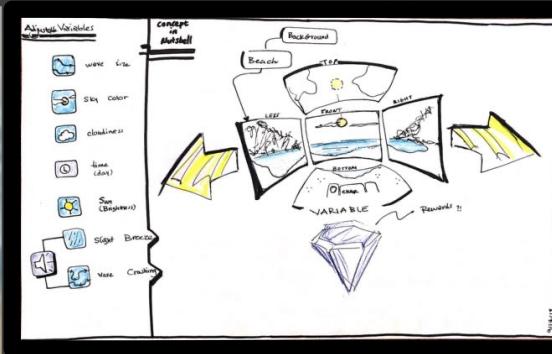
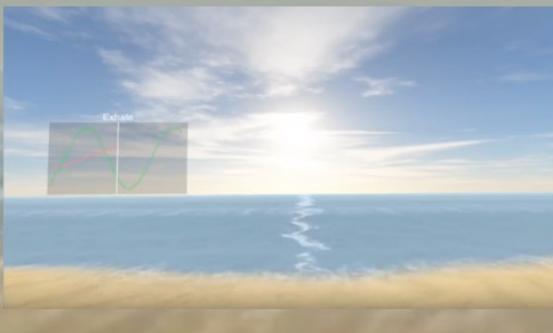
~ 10 WILL DEVELOP AN OPIOID USE DISORDER

~ 1 TRANSITION TO HEROIN



Affective Computing Application using Physiological Markers

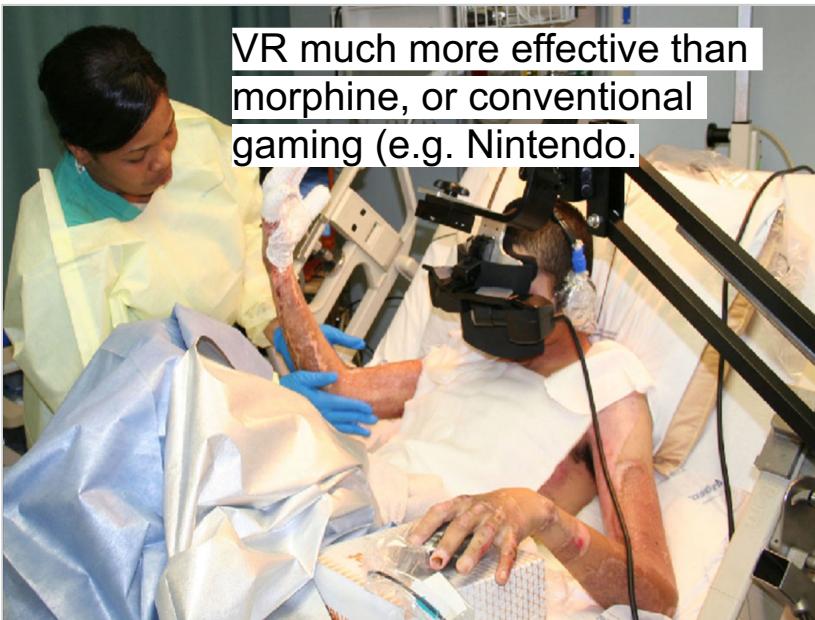
Clinical Trials at Prisma Health



https://drive.google.com/a/g.clemson.edu/file/d/1b0PsfpfxenNLc369ILazMKaQ8V4dotMn/view?usp=drive_web

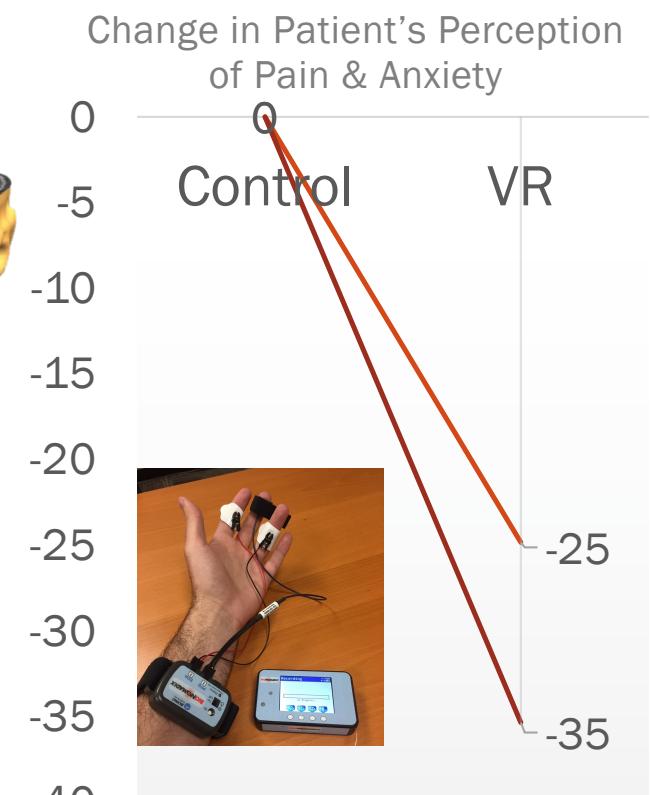
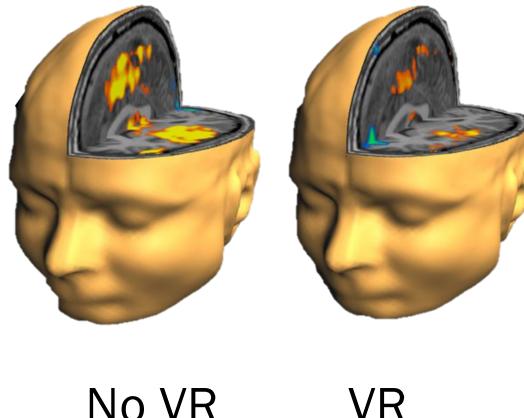


VR much more effective than morphine, or conventional gaming (e.g. Nintendo.)



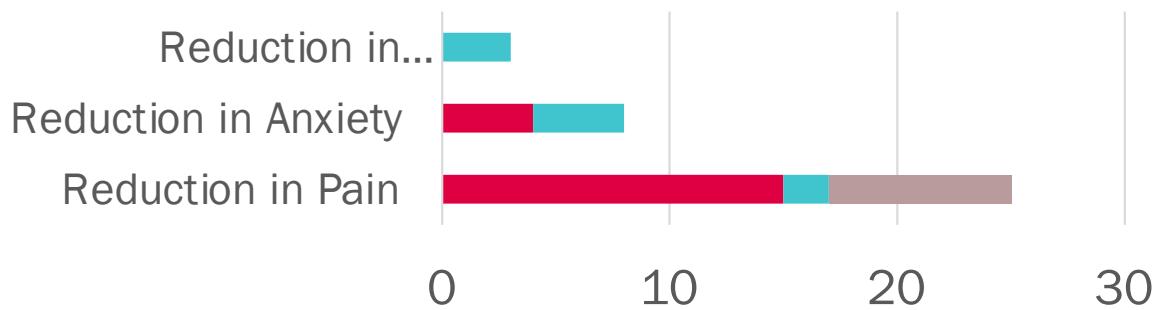
A burn patient uses SnowWorld during a wound cleaning. The wide-view goggles, audio headphone, and simple hand controller help keep the patient from focusing on their pain. (Photo courtesy of Hunter Hoffman)

Efficacy of VR for Pain & Anxiety



VR Studies on Pain, Anxiety, & Distress

■ Burn ■ Cancer ■ Physical/Occupational Therapy





Cubicle Ninjas



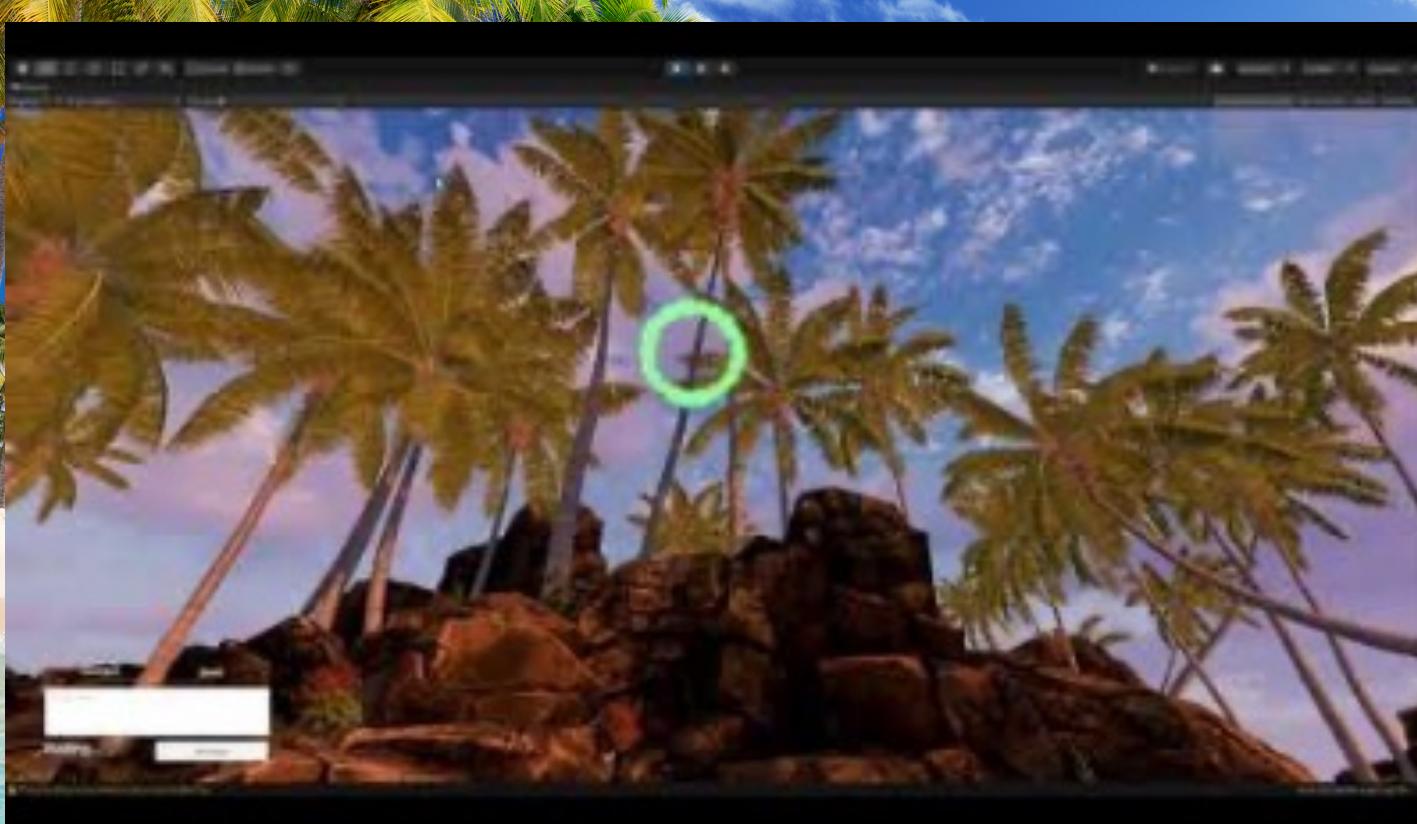


OPERATIVE STUDY – OVERVIEW

- Aim: Explore the efficacy of VR as an alternate method for pain and anxiety management pre/post operation.
- Target population: 48+ years old patients undergoing knee replacement operations.
- Three groups (N=60):
 - VR Group
 - Video Group
 - Control Group
- VR “doses” post operative, aim:
 - Reduce amount of narcotics given
 - And/or increase time between narcotic doses



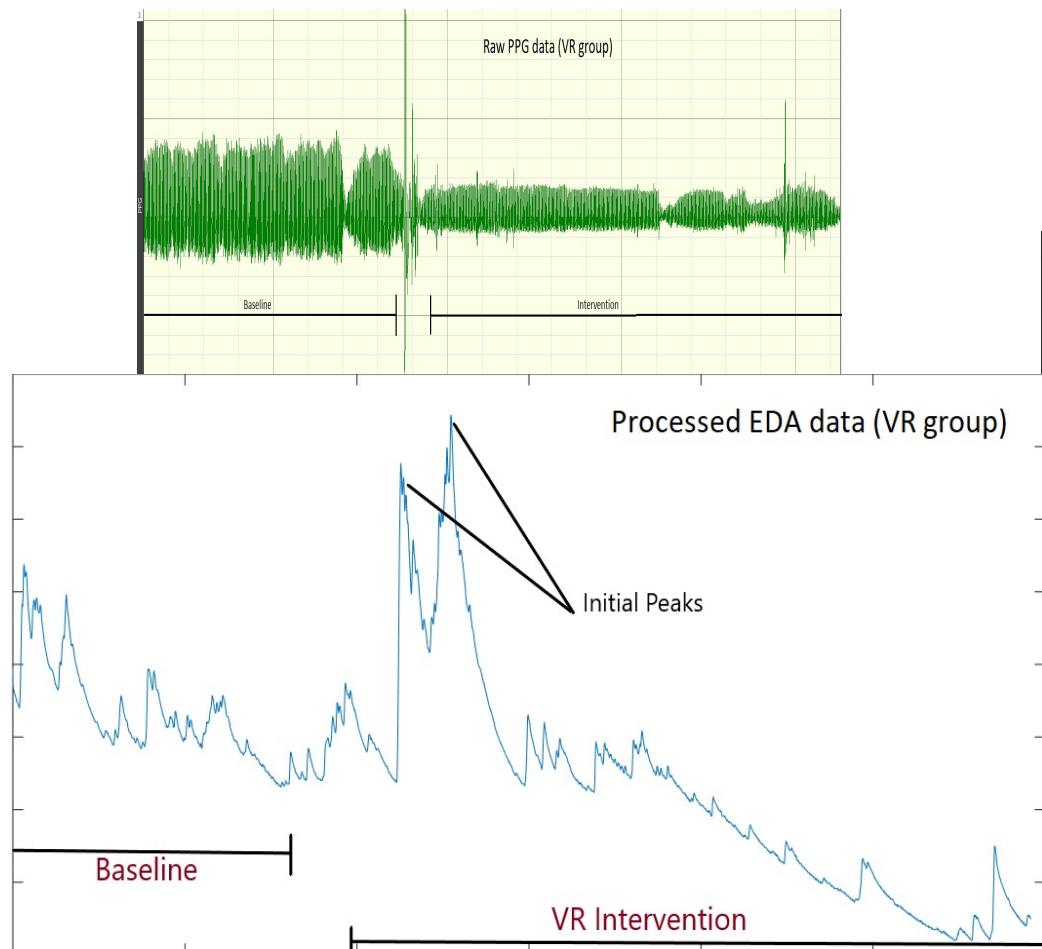
Use of Biofeedback (via Heart Rate Variability + Respiration) to engage the parasympathetic nervous system utilizing virtual environments...



https://www.youtube.com/watch?v=0JUITeFJ6HU&ab_channel=LauraStanley

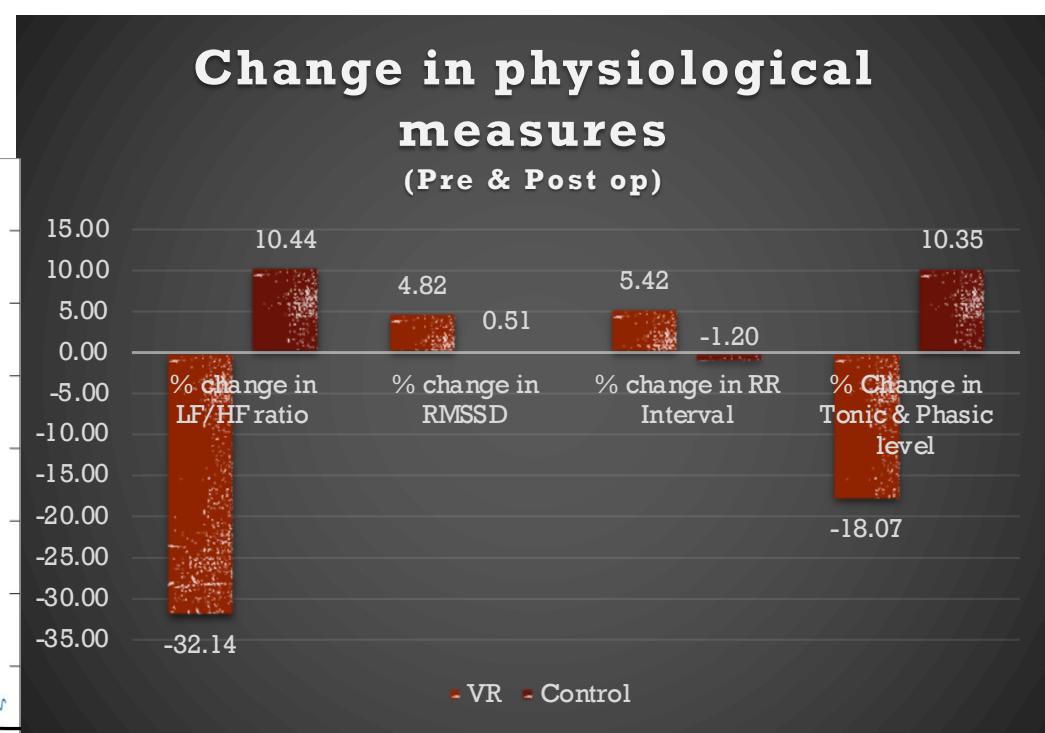


**How do we measure the efficacy & the
UX of Virtual Reality for pain
management and opioid reduction?**



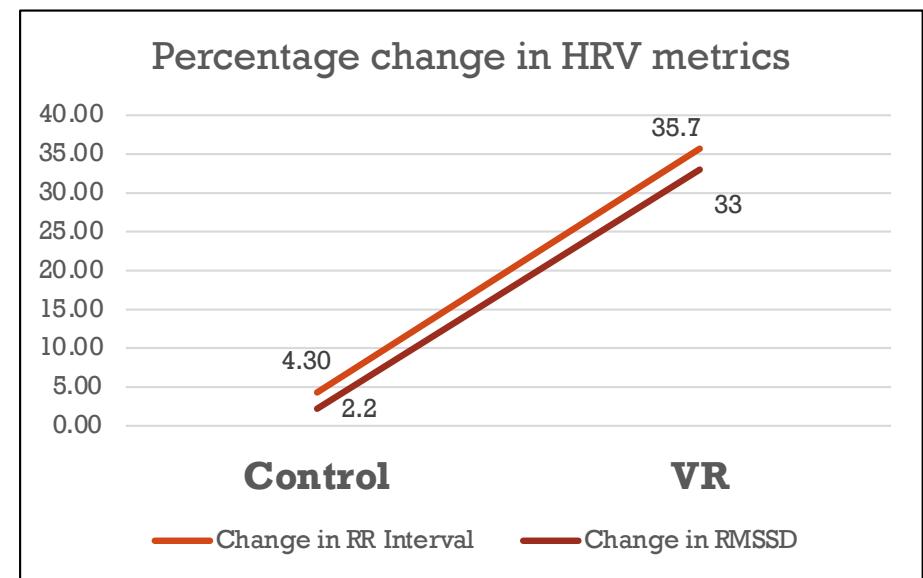
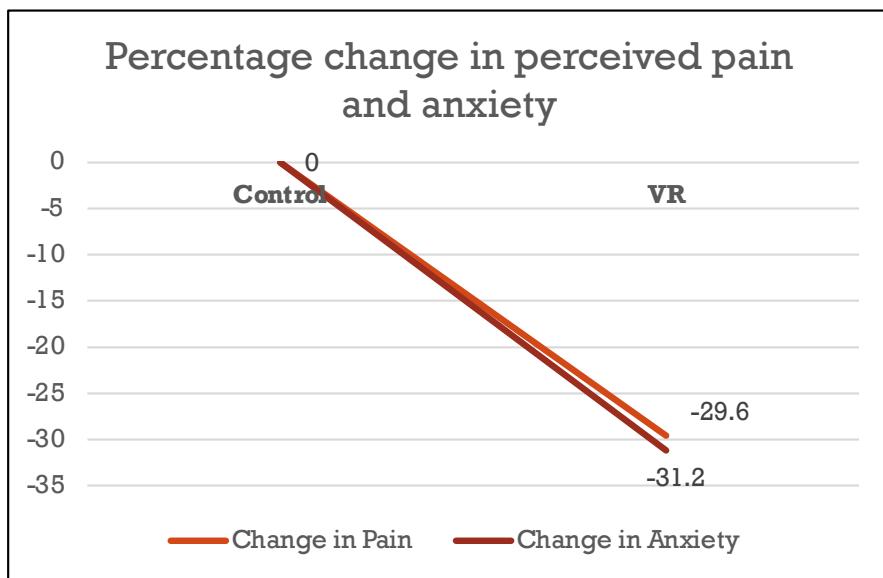
Some Results

- HRV analysis showed significant difference in frequency domain as well as time domain metrics among the VR group.
- EDA analysis showed significant reduction in the tonic and phasic activity among the VR group



SAMPLE RESULTS

- 12 patients undergoing Total Knee Replacement surgery (mean age= 66.1 ± 7 years, 4M, 8F)
 - 31% decrease in pre-operative anxiety perception
 - 30% decrease in post-operative pain perception
 - Physiological metrics (e.g. HRV) followed similar trends as the subjective metrics





A Longitudinal Study to Assess the Efficacy of Virtual Reality for Pain and Anxiety Management in AYA (Adolescent and Young Adults) Cancer Patients (Co-PI: Dr. Elizabeth Cull, MD)



- AYA survivors rate higher levels of depression and anxiety compared to their siblings.
 - Target Population: 15-50 yrs. undergoing chemotherapy (N=20).
 - Inpatients \geq 3 days.

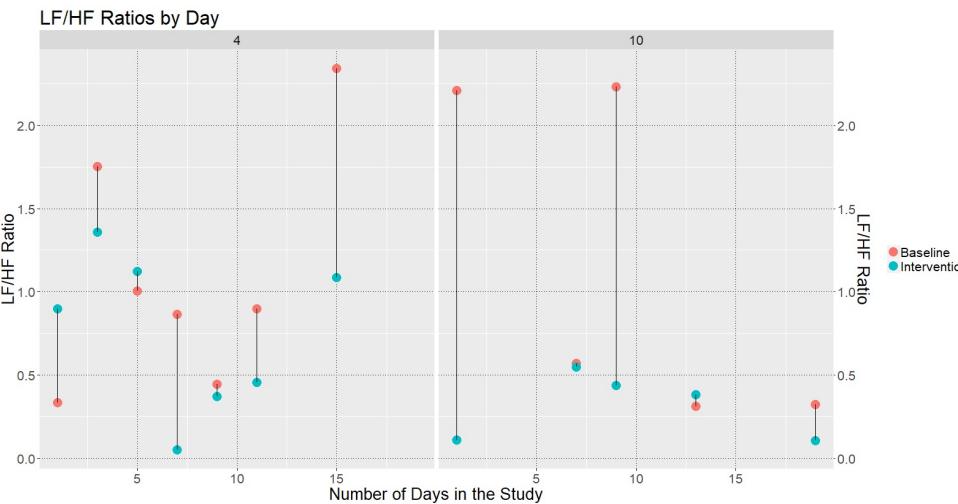


<https://drive.google.com/file/d/1kRggyQ0RV1Jl8CDhSU5GyNZ4RKoAEmkh/view>



SAMPLE RESULTS - COMPARING QUANTITATIVE VS. QUALITATIVE DATA

- LF/HF Ratio
 - Red = Baseline (Before Intervention)
 - Blue = During Intervention
 - Red → Blue patients were objectively more relaxed during VR intervention



- Pain
 - Red = Pre VR Intervention
 - Blue = Post VR Intervention
 - Red → Blue patients reported less pain after VR intervention

