The Use of Targeted Video Games to Enhance Cognitive Characterization and Remediation

Joaquin A. Anguera, PhD

Director - Clinical Program | Neuroscape
Director - Digital Health Core
Assistant Professor - Neurology and Psychiatry
University of California, San Francisco
Research Motivation

- Identify alterations in fundamental brain mechanisms that underlie the broad spectrum of cognitive deficits.

- Leverage these mechanisms to enhance deficient cognitive control processes.
Cognitive enhancement

- Traditional Education
- Pharmaceutical
- Physical exercise
- Enriched Environments
- Nutritional
- Neurofeedback
- Meditation
- Neuromodulation
- Video games
The next wave of studies

★ Patricia Arean

• Depression & Aging

• Geriatric Depression

• Mobile At-Large Intervention
Research Motivation

- Older adults with cognitive control deficits respond poorly to antidepressants
- Individuals with Late Life Depression have difficulty ignoring irrelevant information
- NIMH (2015) strategic plan called for ‘novel interventions’ that treat known cognitive & behavioral correlates of depression
Games for Overcoming Late-Life Depression

- Geriatric individuals with severe depression
- Eager to try non-pharmaceutical treatments

Anguera et al. 2016
Depression Severity

Hamilton Depression Rating (Total Score)

- Week 0
- Week 4
- Week 8

PST

G.O.L.D.

Anguera et al. 2016
Hamilton Depression Rating

Depression Severity

Week 0

Week 4

Week 8

Time

EVO

PST

Anguera et al. 2016
Assessing AND Remediating outside the lab

“Bridging Research and Innovation for Greater Health in Technology, Emotion and Neuroscience”

Can mood and brain game apps really contribute to mental health?

Anguera et al. 2016
Arean et al. 2017
Do mood and brain game apps really work?

Join our 100% mobile study to explore if these apps improve your mood, concentration and motivation. You don’t even have to leave your home to join.

Eligibility Assessment (PHQ-9)  Self-administered depression rating

Randomization
Study Arms

EVO on iPad

and

PST on your phone

and

Ginger.io to answer surveys on your phone

and

Health Tips on your phone

Study Arms

Study Arms

Anguera et al. 2016

Arean et al. 2017
Primary Assessments

<table>
<thead>
<tr>
<th>Survey</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHQ-2</td>
<td>Daily</td>
</tr>
<tr>
<td>PHQ-9</td>
<td>Weeks 1-4, 6, 8, 10, 12</td>
</tr>
<tr>
<td>SDS</td>
<td>Weeks 0-4, 6, 8, 10, 12</td>
</tr>
<tr>
<td>GAD</td>
<td>Week 0</td>
</tr>
<tr>
<td>Alcohol</td>
<td>Week 0</td>
</tr>
<tr>
<td>IMPACT-mania</td>
<td>Week 0</td>
</tr>
<tr>
<td>PGIC</td>
<td>Weeks 0, 4, 8, 12</td>
</tr>
<tr>
<td>IMPACT-mental health</td>
<td>Weeks 0, 4, 8, 12</td>
</tr>
<tr>
<td>Sleep</td>
<td>Week 0, 4, 8, 12</td>
</tr>
<tr>
<td>App use</td>
<td>Week 0, 4, 8, 12</td>
</tr>
<tr>
<td>App satisfaction</td>
<td>Week 0, 4, 8, 12</td>
</tr>
</tbody>
</table>

Passive Analytics

- Location
- Call Metrics
- SMS Metrics
- Accelerometer
- Screen Usage

Anguera et al. 2016
1. Watch the tutorial for EVO

2. Watch the tutorial for ACE

3. Use the username and password provided in your email to play EVO & ACE, and for info regarding the Ginger.io app!
Enrollment of all recruited in BRIGHTEN over 6 months
Aug1 - Jan 31 2014-2015

Anguera et al. 2016
Arean et al. 2017
Participant CONSORT table

- Eligibility survey: n = 2923
  - Partial: n = 874
  - Disqualified: n = 951
  - Enrolled: n = 972
Participant Demographics

a) % in each age range of recruited sample

- Ages 18-30: 59%
- 31-40: 23%
- 41-50: 8%
- 51-60: 4%
- 61-70: 4%
- 71+: 1%

b) Participant Ethnicity

- Non-hispanic White: 61%
- Hispanic: 17%
- African-American/Black: 13%
- Asian: 6%
- American Indian/Alaskan Native: 11%
- Pacific Islander: 11%
- More than one: 8%
- Pacific Islander: 1%

BRIGHTEN vs. U.S. Census (2013)
## Participant Acquisition Costs

<table>
<thead>
<tr>
<th></th>
<th>Initial Recruitment</th>
<th>Enrolled</th>
<th>Using Treatments</th>
<th>Using Assessments &amp; Treatments</th>
<th>Recruitment + Average Participant Payment</th>
<th>Individual “Complete” Data Set</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Craigslist</strong></td>
<td>$0.31</td>
<td>$0.81</td>
<td>$3.19</td>
<td>$4.00</td>
<td>$39 ± $21</td>
<td>$79</td>
</tr>
</tbody>
</table>

*Typical RCTs cost millions of dollars and recruit 200–300 participants in 3–5 years*

$314,264 over 2 years

Anguera et al. 2016
Remediation

Depression by Group

PHQ-9 Total Score

Start  Wk1  Wk2

Time, weeks

Control  EVO  PST

Anguera et al. 2016
Arean et al. 2017
Mental Health & Disparities Research

...what would happen if we actually tried to enroll these folks?!
Summary

Targeted cognitive control interventions for depression show promise.

Such mobile apps can reach clinical populations, but personalization is critical.
MANY MANY THANKS ...

- Adam Gazzaley
- Pat Arean
- Abhi Pratap

National Institute of Mental Health (PAA R34-MH100466, T32MH0182607, K24MH074717)
National Institute on Aging (JAA P30-AG15272)

joaquin.anguera@ucsf.edu

www.neuroscape.ucsf.edu