Feedback Control for Mental Health

Kevin M Passino
1. Approach
2. Stress reduction
3. Depression (MDD)
4. Group: Technology 4 Mental Health
Feedback control for mental health

Untreated patient

Stimuli (controlled)

Uncertainty

Measured response

Brain prosthetic

Controller

Feedback control for mental health
Feedback Control for Stress Reduction
Adaptive Ambience Using Music

Input: Music parameters
- Pitch
- Tempo
- Volume
- ...

Controller

Person

Output: Stress (HR, HRV)

Stress (HR, heart rate variability)
- RR intervals
- Frequency
- Nonlinear
Sample Results: Feedback Control of Pitch & Volume

Stroop Test Results

<table>
<thead>
<tr>
<th>Music</th>
<th>Modulated music</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.7% errors</td>
<td>20% errors</td>
</tr>
<tr>
<td>879.4 ms (mean</td>
<td>815 ms (mean</td>
</tr>
<tr>
<td>response time)</td>
<td>response time)</td>
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</tbody>
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Fewer errors and Faster response!

Scale up well?
Feedback Control for Depression Alleviation

Philips Hue Lights
Can output 14 million colors

Desired FAA

Controller

Sound Light

EEG HRV

Music:

Feedback Control Diagram:

- Desired FAA
- Controller
- Sound Light
- EEG HRV
- Philips Hue Lights
- Output 14 million colors

Preliminary
Sample Results:
Sound, light modulation

Top: Blue=FAA
Bottom: Brightness

Sound
Research Group:
Technology 4 Mental Health

Supervisor: Passino

Current members: Tassy (PTSD), L Wang (VR), Zhao (VR), Dey (ADHD), Chen (ADHD), No (MDD), Fu (Stress, group), Chiu (Educ), Jia (Speech Proc)

Past Members: Gonzalez-Villasanti (Mood disorders, stress), Zheng (Light), Everson (Stress), Ketchum (ADHD), Montero (Brain networks), Pantoja (Stress), Matthiesen (MDD), Hamamoto (MDD), Davidson (MDD)
Collaborators:

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