

MINDLESS COMPUTING: DESIGNING TECHNOLOGIES TO SUBTLY INFLUENCE BEHAVIOR

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BACKGROUND- COGNITIVE SYSTEMS

System 1

Automatic Mind

Fast

Subconscious

Parallel

Irrational

System 2

Reflective Mind

Slow

Thoughtful

Serial

Rational



Impressions, Feelings

DUAL PROCESS THEORIES

Elaboration Likelihood Model (ELM) & Heuristic Systematic Model (HSM)

- Central Route- Careful consideration
- Peripheral Route-Limited examination
- Principle of least effort: use the least amount of effort to make decision

Nudging

- Snack Basket
- 3D Paintings

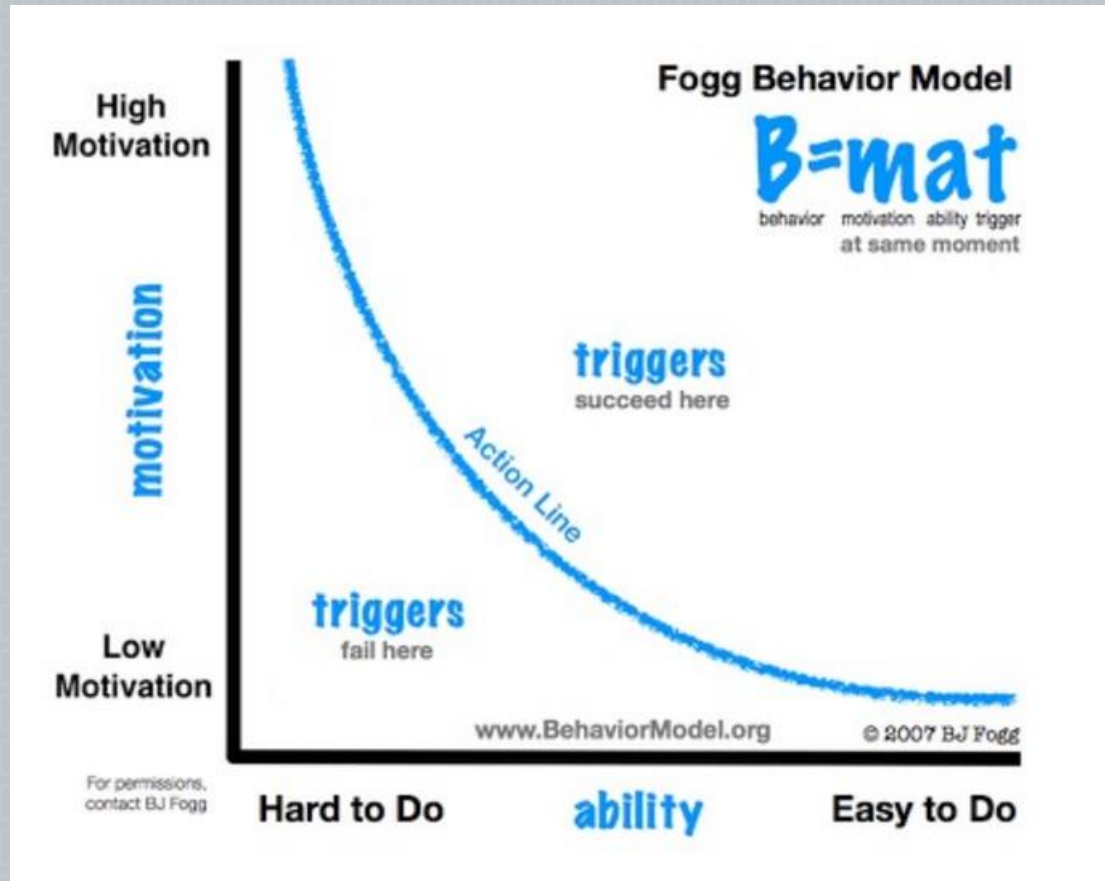
Subliminal Stimuli

- Below the threshold of conscious awareness

Author's Literature Search

- 252 articles reduced through evaluation to 11 focused on System 1 approaches

BACKGROUND- FOGG'S MODEL



Source: <http://www.behaviormodel.org/>

MINDLESS TECHNOLOGIES EXAMPLES

Mindless Technology: Mobile or ubiquitous, persuasive technology designed to subtly influence behavior of the user without requiring their conscious awareness.

Mindless Plate
Voice Feedback

MINDLESS PLATE — TECHNOLOGY

Sensors

- Force Sensitive Resistor (FSR)- senses weight
- RGB Light Sensor – senses food color

Lights

- Eight RGB LEDs

Processor

- Teensy 3.1 microcontroller (w/Arm Cortex-M4 processor)
- Digital potentiometer- controlling light emission

Plate

- Glass- top
- Layered acrylic- base, housing devices
- Mirrored Layer and convex lens to collect light for color determination)

Power

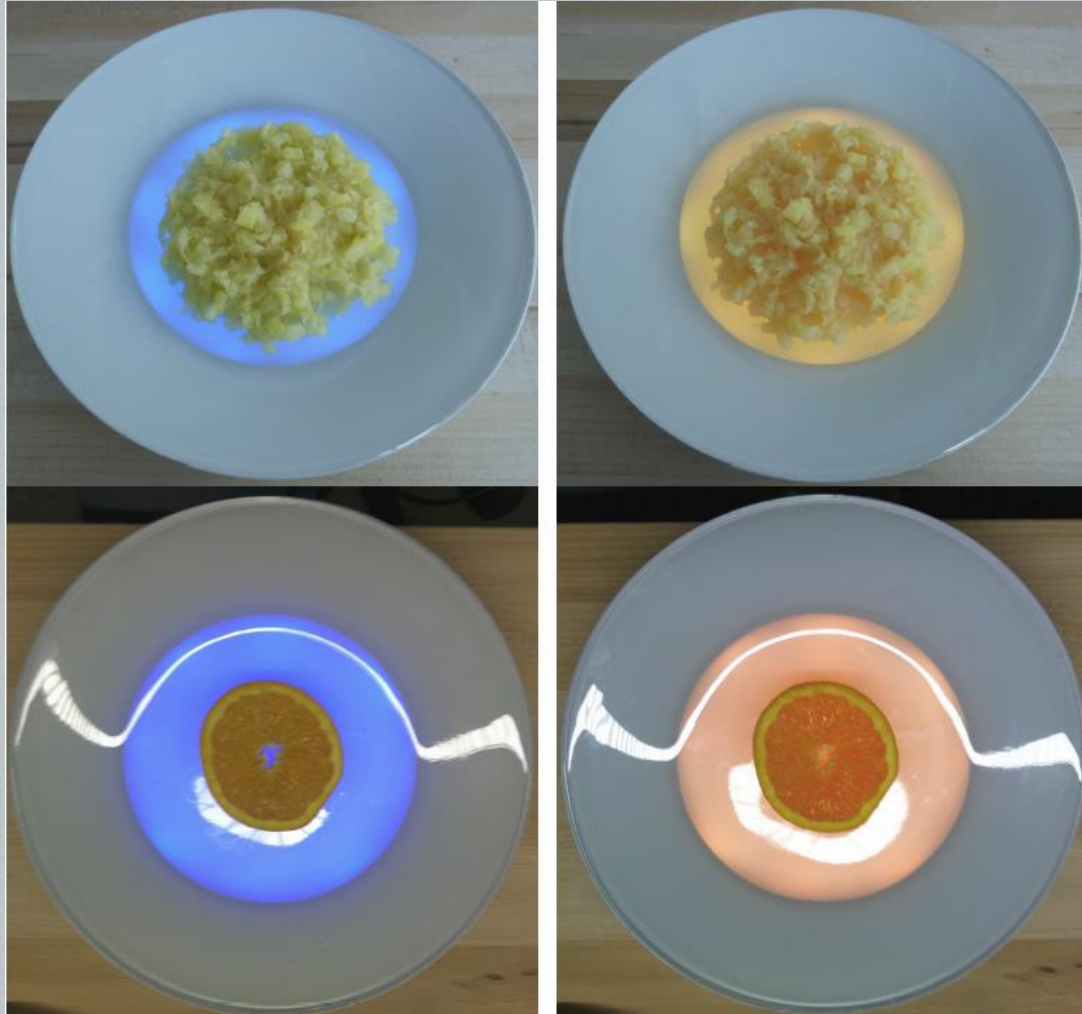
- 2000mAh polymer lithium ion battery

MINDLESS PLATE — EXPERIMENTAL DESIGN

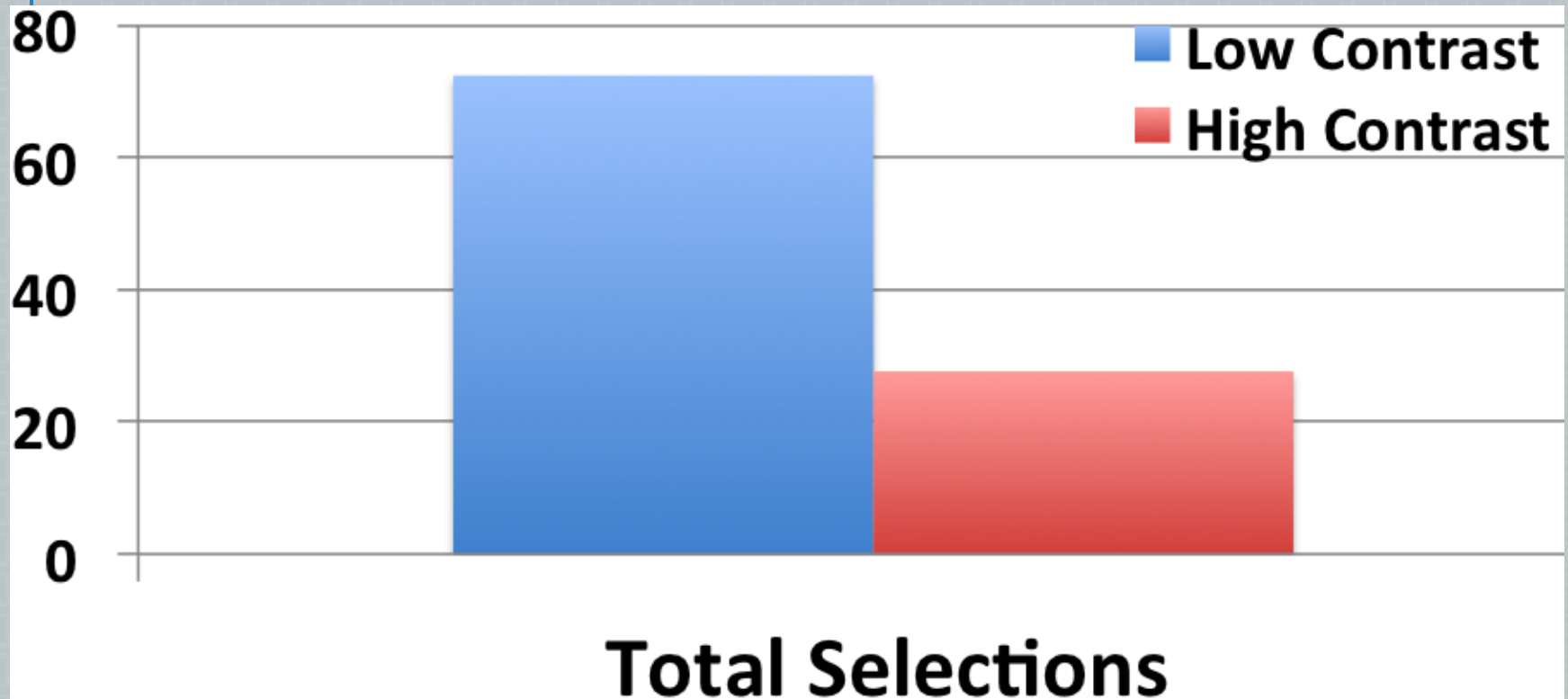
Determine if participants perception of portion size is biased when viewing on two “mindless plates”

- Participants: 12 (3 female, 9 male)
- Plates: one high contrast color, one low contrast color
- Food portion: identical in surface area and weight
- Food Types: (7 iterations)- all fine grained
 - Peas (green)
 - Kidney Beans (burgundy)
 - Potato Chips (yellow/brown)
 - Peanuts (light brown)
 - Carrots (orange)
 - Rice (white)
 - Crushed Pineapple (bright yellow)
- Activity: Food placed on dishes behind blinder; participants asked to select which plate had a larger portion. Participants forced to select one plate

MINDLESS PLATE — APPEARANCE

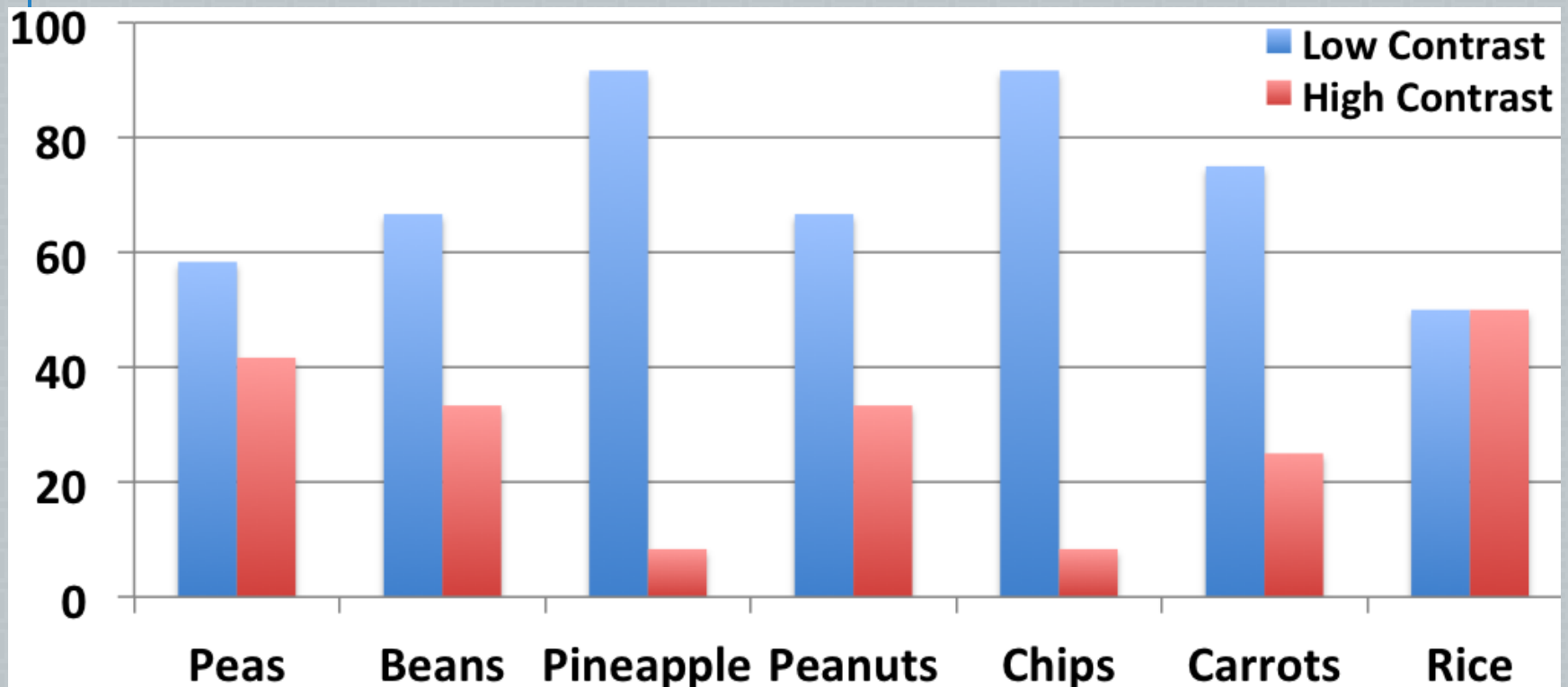


MINDLESS PLATE — GENERAL RESULTS



Percentage of choices in both conditions (High and Low contrast)
for all foods combined (probability of low contrast choice as measured by
t-tests: $p = 0.0011$)

MINDLESS PLATE — RESULTS BY FOOD TYPE



The percentage of selections in each condition (High contrast and Low contrast) for each of the different foods used in the study

VOICE FEEDBACK – TECHNOLOGY

Application

- iPhone App

Signal Processing

- Short Time Fourier Transform- feedback time $< 50\text{ms}$
- Apple Accelerate Framework- API for pitch shift

Feedback

- Earphone (JVC HA-F140)

Audio Software

- Praat

Audio Conversion

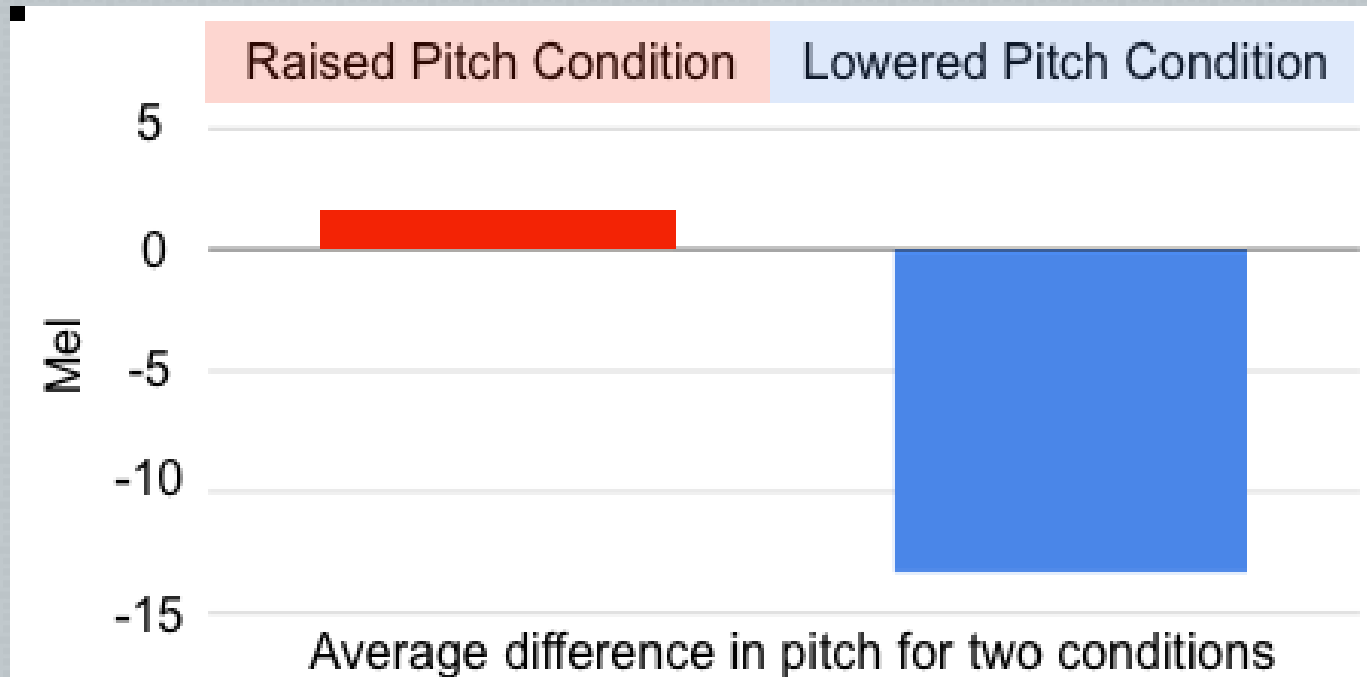
- Douglas O'Shaughnessy conversion of Hz to Mel

VOICE FEEDBACK — EXPERIMENTAL DESIGN

Determine if participants will adjust their voice pitch when adjusted real-time feedback is provided.

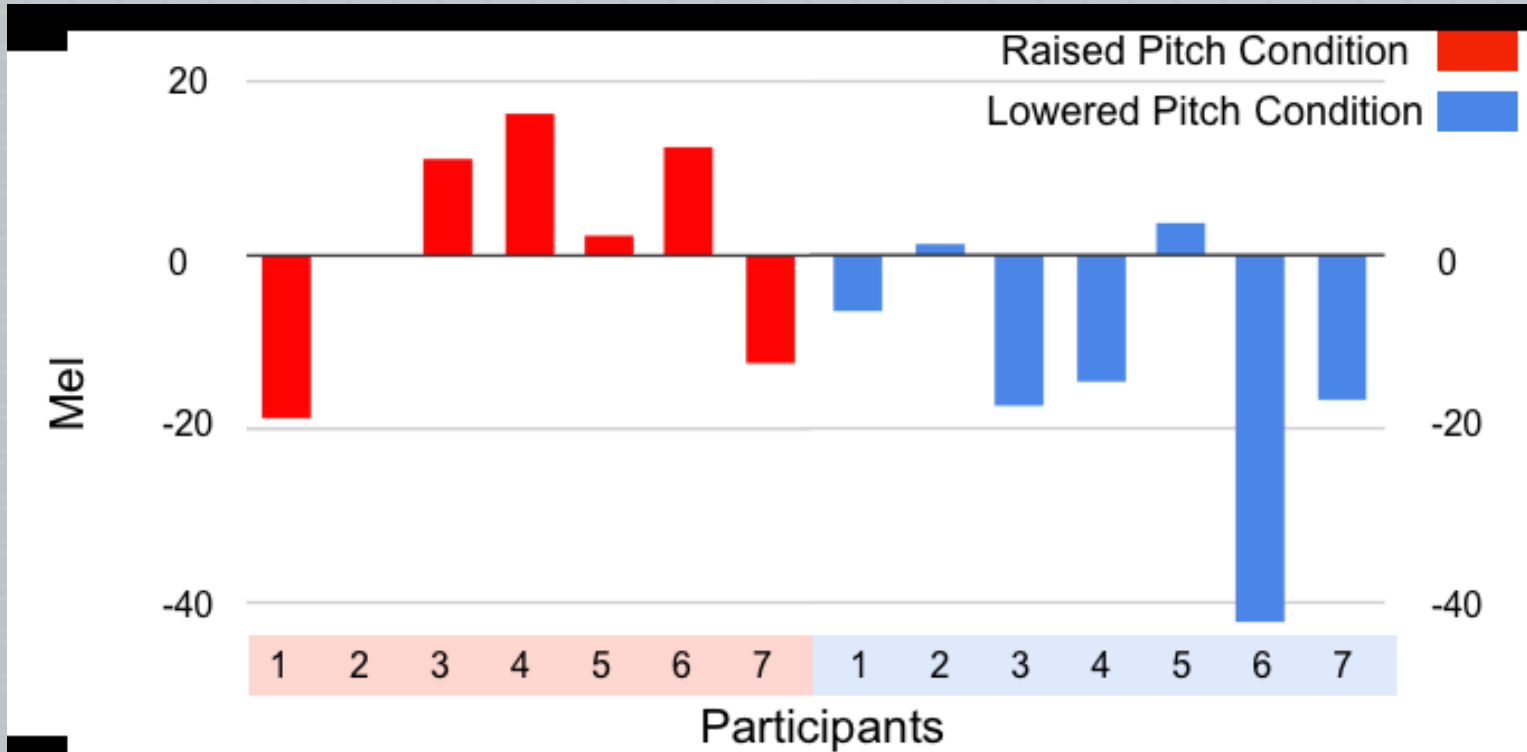
- Participants:
 - 14 (9 female, 4 male [*sic*], ages 18-27)
 - Fluent in English, no speech disorders or impairments
- Activity 1: Read text for three minutes. Half participants receive no feedback, half receive Frequency-Altered Feedback (FAF)
 - Those receiving FAF, some received pitch raised by 5%, some reduced by 5%
- Activity 2: Re-read text for 3 minutes
 - Those whom received feedback now receive none, those whom did not receive FAF, nor receive it, some high, some low.
- Activity 3: Mock interview using Google Hang-Out
 - Participants received same pitch adjusted FAF as they experienced during baseline check
 - Asked five typical interview questions to simulate social interaction

VOICE FEEDBACK – GENERAL RESULTS



Average change for both conditions (raised and lowered pitch)

VOICE FEEDBACK – INDIVIDUAL RESULTS



Each participant's change in pitch from the baseline (7 participants for each condition)

CONCLUSIONS

- The overwhelming majority of persuasive technologies focus on System 2 (slow and reflexive mind)
- Authors demonstrated that it was possible to influence behavior subliminally using System 1 (automatic)
- Approach can be leveraged to explore other modalities (e.g. vibration, ambient sound, etc.)

OBSERVATIONS

Sample size in both experiments was very small

Limited sample demographic for the voice technology regarding age

Results demonstrate System 1 persuasion can alter behavior, but did not specifically result in specific actions

QUESTIONS & DISCUSSION