# MMS4 Outline

## Previous work

### MMS

#### Oddball Task Design

##### Fixation Cross [500 ms]

##### Cue display [auditory, visual] [500 ms]

###### Standard trials: 600 Hz sine wave, Green circle

###### Novel trials: Birdcall sound (‘novelsounds.mat’), random shape + random color.

###### Note: It is only possible to have 1 type of novel stimulus (either auditory OR visual) per trial.

##### Stimulus onset: [Left/Right arrow] [1000 ms deadline]

##### Participant responds to arrow direction

##### Feedback (if necessary)

##### Total trial duration: 2.5 sec

#### Findings

##### Behavioral

###### Reaction times were significantly slower on novel trials.

##### EEG

###### P3 component played an equally active role in motor suppression across both auditory and visual modalities on novel trials.

### ALT (n = 19)

#### Hybrid Go/Nogo oddball task design

##### Fixation Cross [1000 ms]

##### Stimulus onset [‘W’ or ‘M’, Go / Nogo] [deadline 500 ms]

###### Note: Go/Nogo stimuli were counterbalanced across participants.

##### Cue onset [visual, auditory, haptic novel stimuli] [50 ms post stimulus onset]

###### Visual: background flashes blue

###### Auditory: birdcall sound (‘novelsounds.mat’)

###### Haptic: handle vibration (both, fast)

###### All novel stimuli had a duration of 200 ms

##### Participant response to ‘Go’ stimuli on response handles according to appearance to the left or right of fixation cross.

##### Deadline adjustment [25 ms increments]

###### Miss: increase deadline

###### 3 consecutive correct responses: decrease deadline

#### Findings

##### Behavioral

###### Significantly faster reaction times on haptic trials, and auditory trials compared to standard trials.

###### Significantly more haptic errors compared to standard trials.

###### Significantly fewer misses on haptic trials compared to standard trials.

###### Significantly more misses on visual trials compared to standard trials.

##### Handles were causing a “startle response” on the “fast” setting.

##### Handles were NOT causing a “startle response” on the “slow” setting.

##### Task design was not able to replicate “Leiva effect” [improved successful stopping on ‘Nogo’ trials] across modalities.

### ALT-Haptic (n = 13)

#### Task design

##### Same as ALT with the following amendments:

###### Removed novel visual events

###### Removed novel auditory events

###### Novel haptic events changed to slow setting

#### Findings

##### Significantly more errors on novel haptic trials.

### ALT-Standard (n = 13)

#### Task design

##### Same as ALT with the following amendments:

###### Standard stimuli were present in all modalities on non-novel trials.

###### Auditory

Standard: 600 hz sine wave

Novel: Birdcall (‘novelsounds.mat’)

###### Visual

Standard: Green circle

Novel: Random shape, random color

###### Haptic

Standard: Slow

Novel: Fast

#### Findings

##### Behavioral

###### Significantly more visual novel errors (p = .0032)

## Current questions

### What is stopping us from being able to replicate the “Leiva effect” across sensory modalities?

#### Haptic surprise has a fundamentally different effect than visual and auditory surprise.

#### Lack of sufficient “standard” event for haptic trials.

## MMS4

### Designed to answer the question: “do haptic novel trials leave a different p3 electrophysiological signature compared to auditory and visual novel trials?”

### Task Design

#### Same as MMS experiment with the following amendments:

##### Added haptic novel trials.

###### Setting is a hybrid between “slow” and “fast” setting.

###### Init handles with “fast” setting for 15 ms

###### Turn off “fast” setting

###### Turn on “slow” setting for remainder of cue presentation.

## Hypothesis

### Novel auditory, visual, and haptic trials will leave the same (or comparable) p3 electrophysiological signature (which acts as an index of motor inhibition) ~200 ms post stimulus onset.