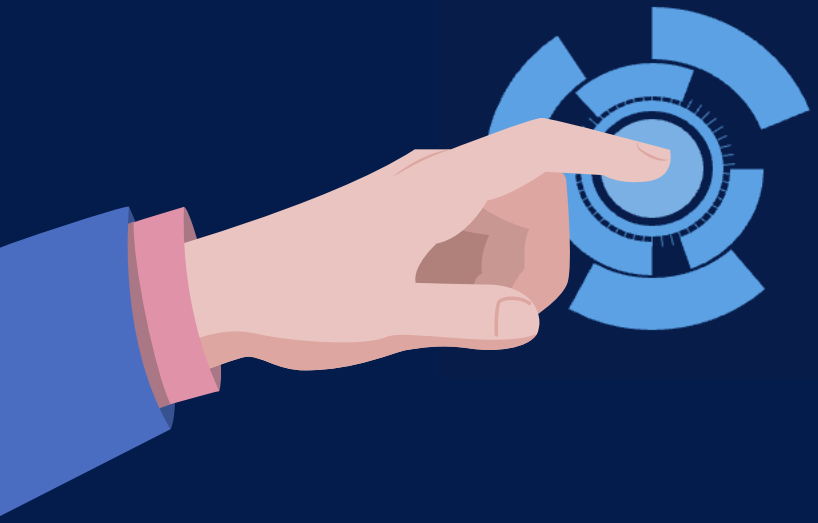
Getting in *touch* with autism: How we interact with the physical world



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As a note,

I will be switching back and forth between identity-first and person-first language language because my research participants in the autism community have expressed a range of preferences.

I will also use the term ‘neurotypical’ to indicate people who do not have a neurodevelopmental diagnosis like autism

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01

WHY IS TOUCH IMPORTANT IN AUTISM?

1st Sense to Fully Develop

Critical role in bonding with caregiver

Communication

Important role in non-verbal communication

Convey thoughts and emotions

Social-Emotional Bonding

Touch

Self-Regulation

Relationship between the self and the physical world

Distinguish between internally and externally generated movement

Motor Planning

Self-stimulatory and soothing behaviors

Role of parental touch early in development

02

WHAT DO WE ALREADY KNOW ABOUT TOUCH IN AUTISM?

ACTIVE TOUCH

- Self-generated
- Dynamic
- Predictable

**Often associated with tactile seeking in autism

PASSIVE TOUCH

- Externally-generated
- Static
- Unpredictable

**Often associated with tactile avoidance in autism

Activate different areas of the brain

(Simões-Franklin et al 2011)

PASSIVE TOUCH IN AUTISM: SCIENTIFIC EVIDENCE

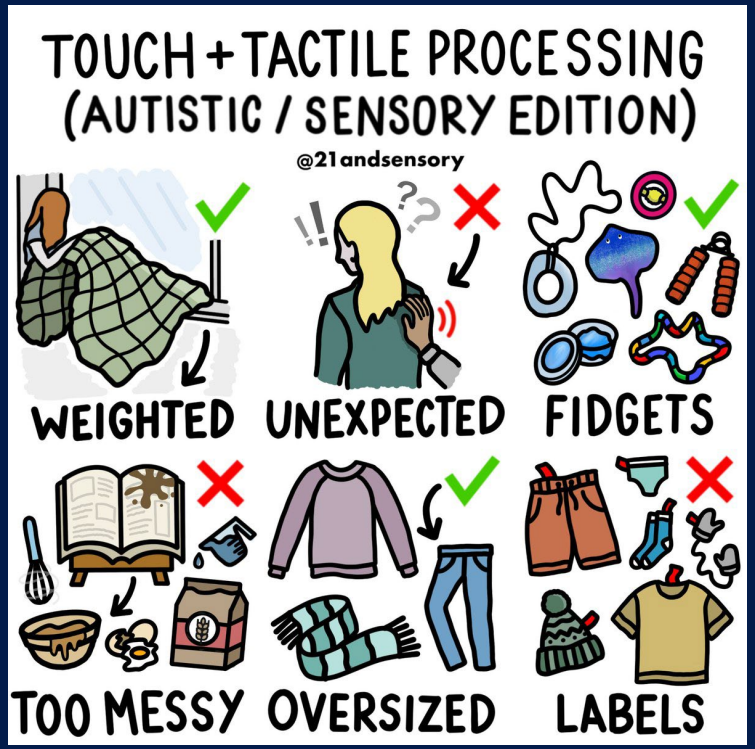
- Caregiver reports of over- and under-sensitivity to touch in autism as well as tactile avoidance

- Autistic people had greater skin conductance in response to tactile stimulation (more emotional and attentional arousal)

- Autism may involve a bigger response to light touch, not necessarily a difference in the *detection* of light touch

(Kemner et al 1994, Asmika et al 2018, Tomchek & Dunn 2007, Quinde-Zlibut et al 2020, Baranek et al 1997, Fukuyama et al 2017, Wada et al 2014, Cascio et al 2012)

PASSIVE TOUCH IN AUTISM: SELF-REPORT



"I'm taken out of the moment for however long the sensation lasts."

"I will feel actual rage if someone strokes me or touches me very lightly."

https://improbable.com/2017/12/20/hand-cooling-from-illusion-not-linked-to-change-in-body-ownership/

https://www.spectrumnews.org/features/deep-dive/social-touch-shapes-autism-traits/
https://thethirdglance.wordpress.com/about/

ACTIVE TOUCH IN AUTISM: SCIENTIFIC EVIDENCE

- Autistic people are better at picking how an object should look based on how it feels

- Higher levels of tactile seeking is associated with greater social differences and more repetitive behaviors

Overall though, we know very little!

(Nakano et al. 2012, Foss-Feig et al. 2012)

ACTIVE TOUCH IN AUTISM: SELF-REPORT

"Touching those textures gives me a feeling of calm, peace, and joy"

"Stroking this ear of this dog with my finger, and feeling the tactile sense, keeps me a bit more grounded and aware of my body so that it doesn't seem so far away."

https://www.spectrumnews.org/opinion/viewpoint/stimming-therapeutic-autistic-people-deserves-acceptance/
https://autisticempath.com/joyous-sensory-stimming/

WHY IS ACTIVE TOUCH SO HARD TO STUDY?

MOVEMENT

The person needs to be moving, which presents challenges to a lot of techniques (MRI, EEG)

MEASUREMENT

We need to be able to track what happens when the person is moving

INTERACTIVITY

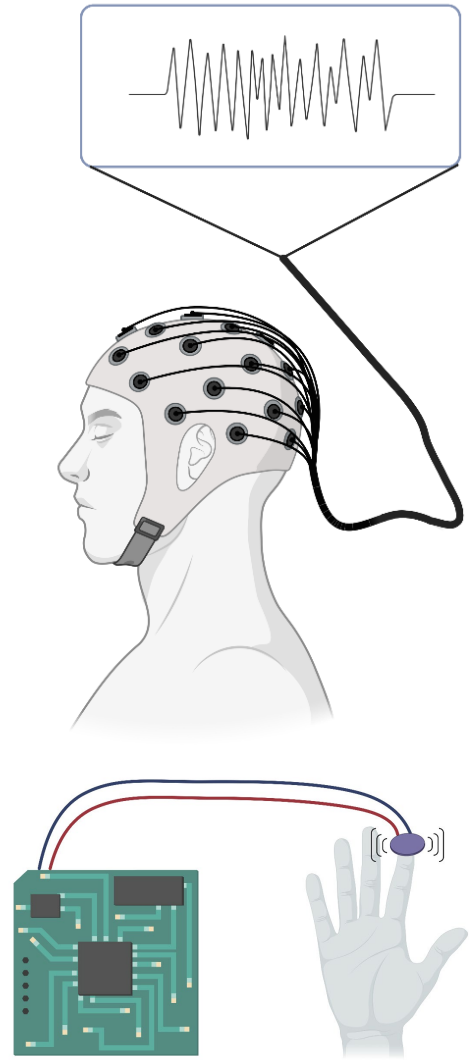
There needs to be something for the person to touch

03

HOW ARE WE STUDYING TOUCH HERE AT UR?

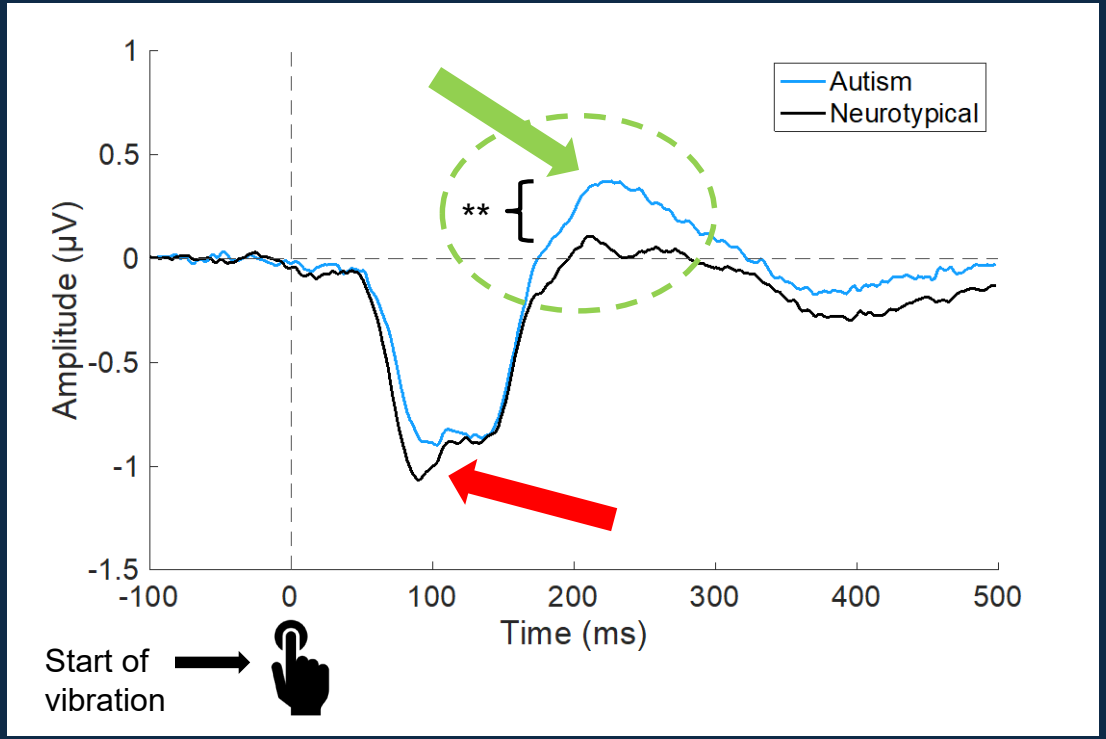
ELECTROENCEPHALOGRAPHY (EEG)

- Using EEG, we can measure when and to what degree brains respond to certain things
- My research investigates how the brain responds to different types of vibrations on the fingertip
- My current research is focused on neurotypical and autistic adults aged 18-45



Detection of Vibrations

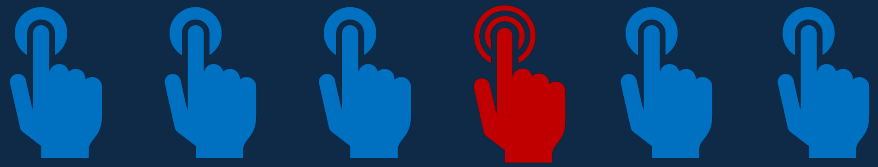
- Early negative activity is believed to represent basic detection of sensory stimuli
  - No difference between groups
- Later positive activity is believed to represent the amount of cognitive resources devoted to a task
  - This positive activity is **larger in the autism group** than the neurotypical group

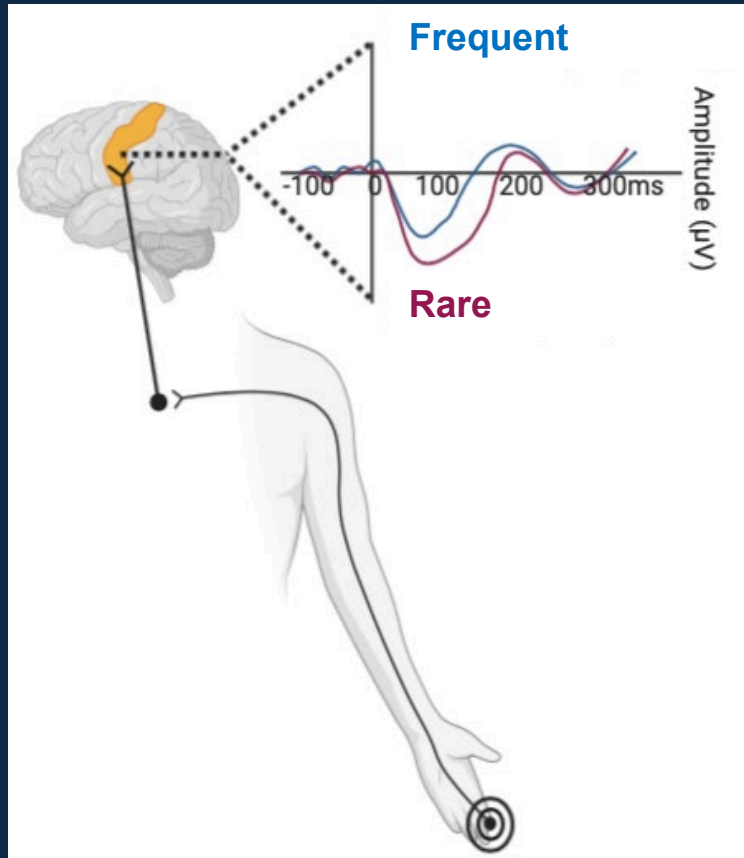


(Sugimoto and Katayama 2013; Du et al. 2016)

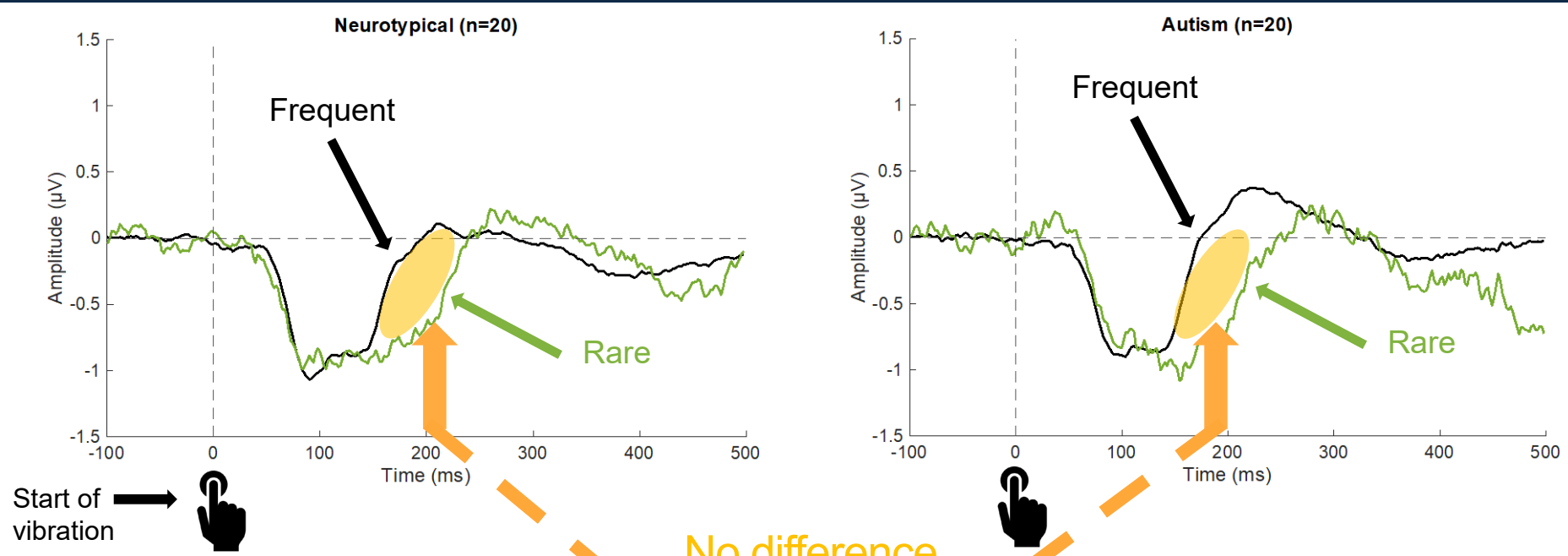
Detection of Unexpected Vibrations

- Use EEG to gauge sensitivity to detecting vibrations of different lengths
  - Frequent vibrations = 100 ms
  - Rare vibrations = 160 ms
- Does not depend on attention or participation
- On average, the brain response to the rare stimulus is larger than to the frequent stimulus





Do neurotypical and autistic people differ in how differently they respond to unexpected vibrations?



No difference between groups

This suggests that adults with autism recognize predicted and unpredicted vibrations in the same way as neurotypical adults, but may devote more brain resources to doing so

But wait…

This experiment can only show us how the brain reacts when people are:

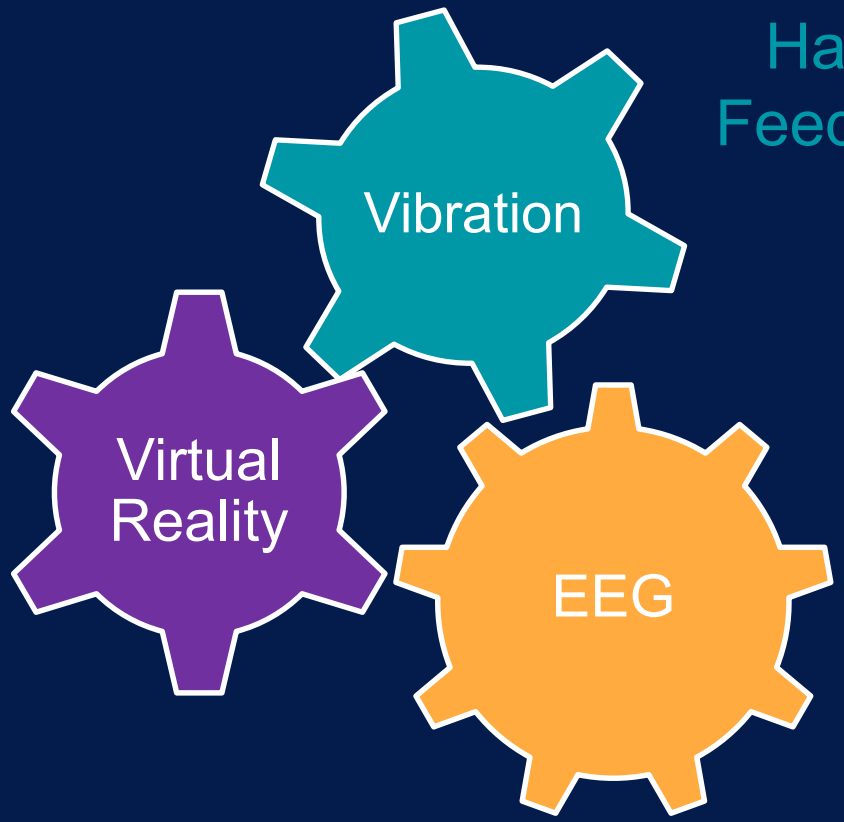
- Not paying attention to the touch
- Not in control of the touch

How can we study active, self-generated touch?

By using virtual reality! (via the Oculus Quest)

- Mobile
- Interactive
- 3D visual presentation
- Bluetooth capability
- Hand tracking capability

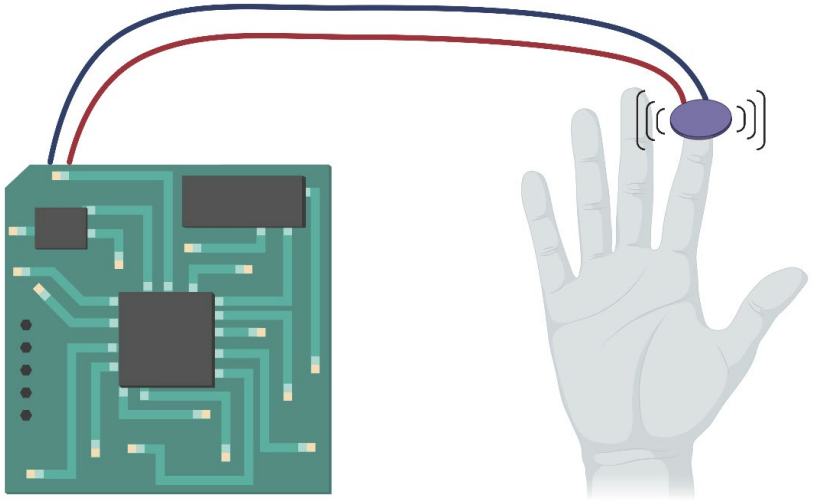
MEASURING ACTIVE TOUCH:



Haptic Feedback

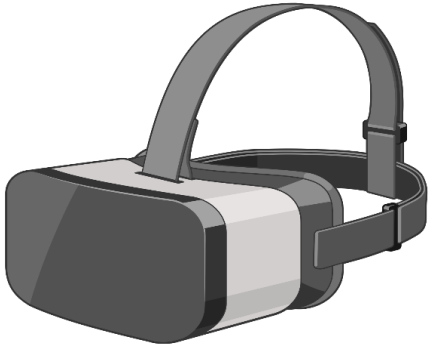
Visual Feedback

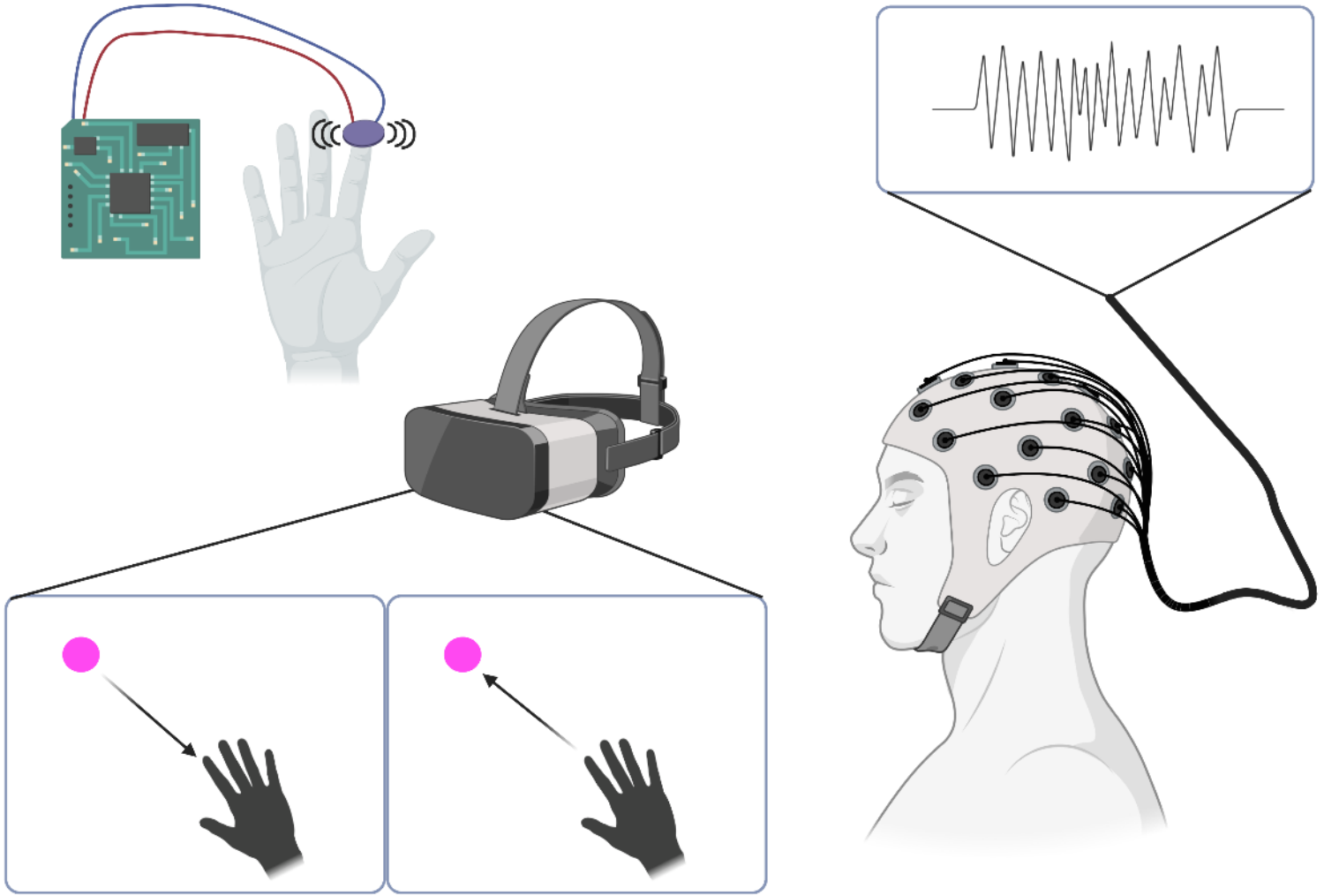
Brain Activity Recording



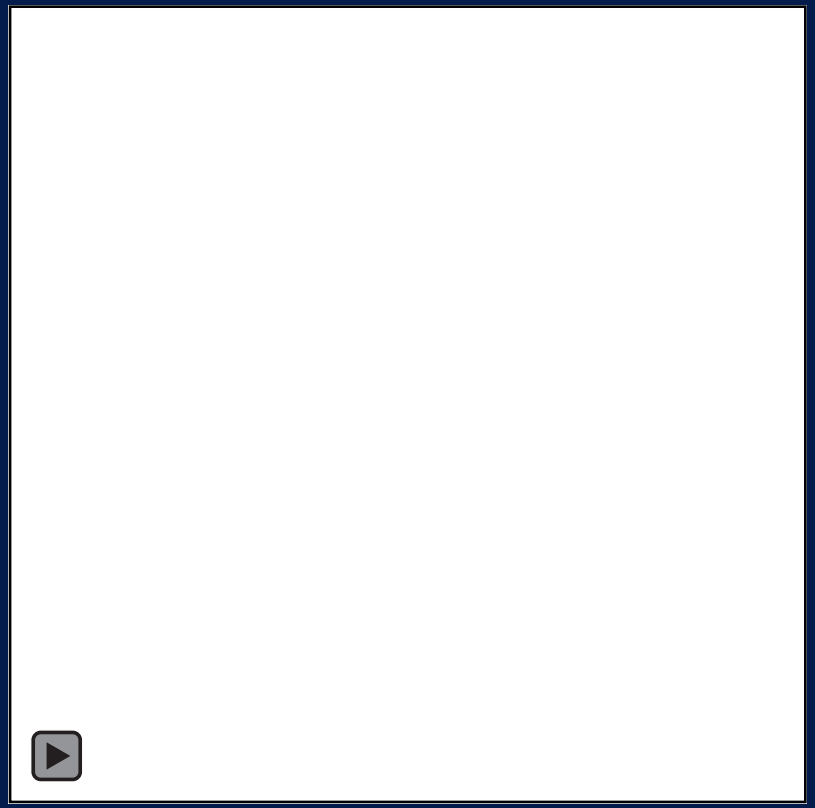
Passive

Active

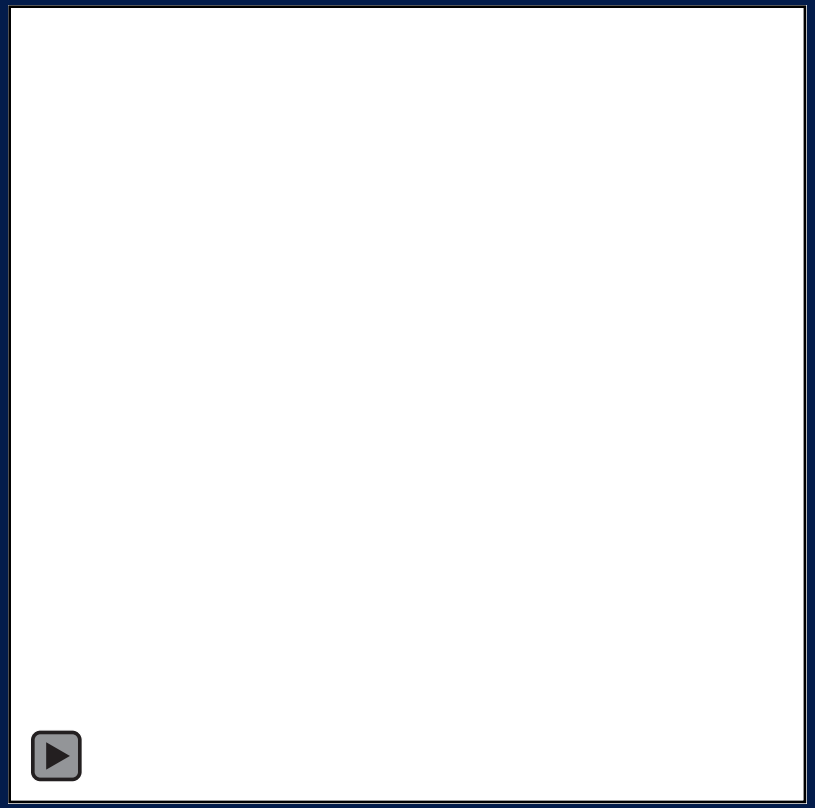




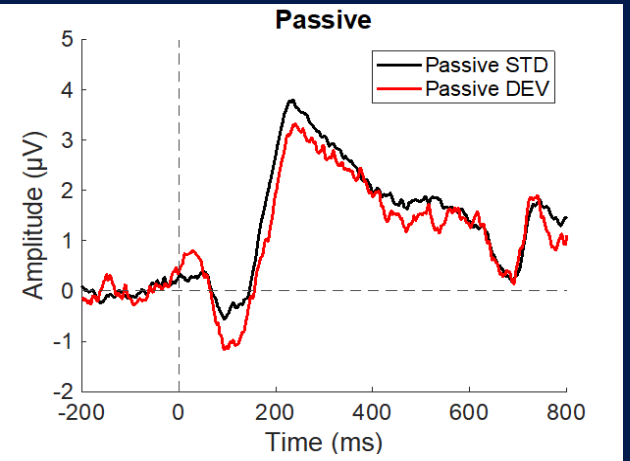
Passive

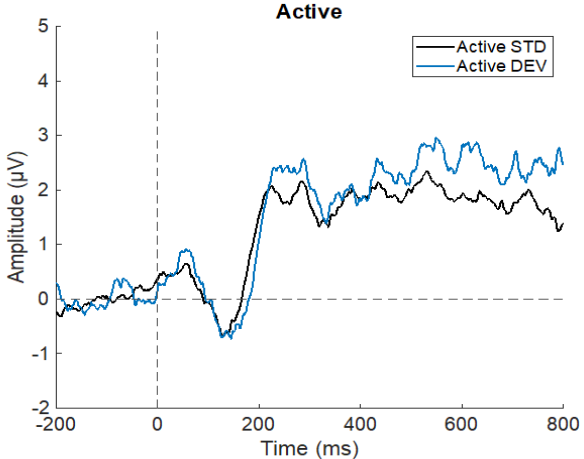


Active



Neurotypical (n=5)





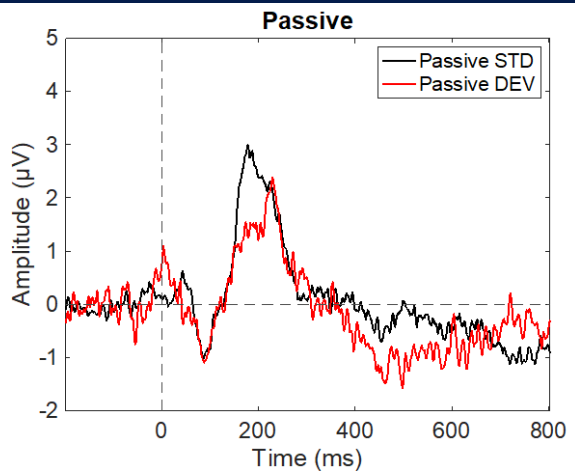
It is too early to report on any results, but we have shown that this experiment can collect robust results!

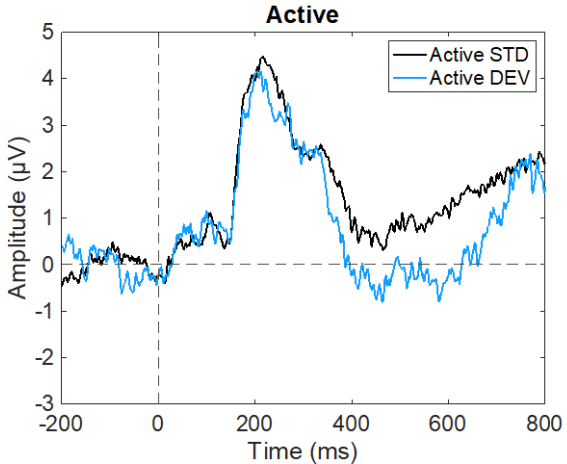
We can separate out:

-predictable (standard) vs. unpredictable (deviant)

-self-initiated (active) vs. externally initiated (passive

Autism (n=2)





04

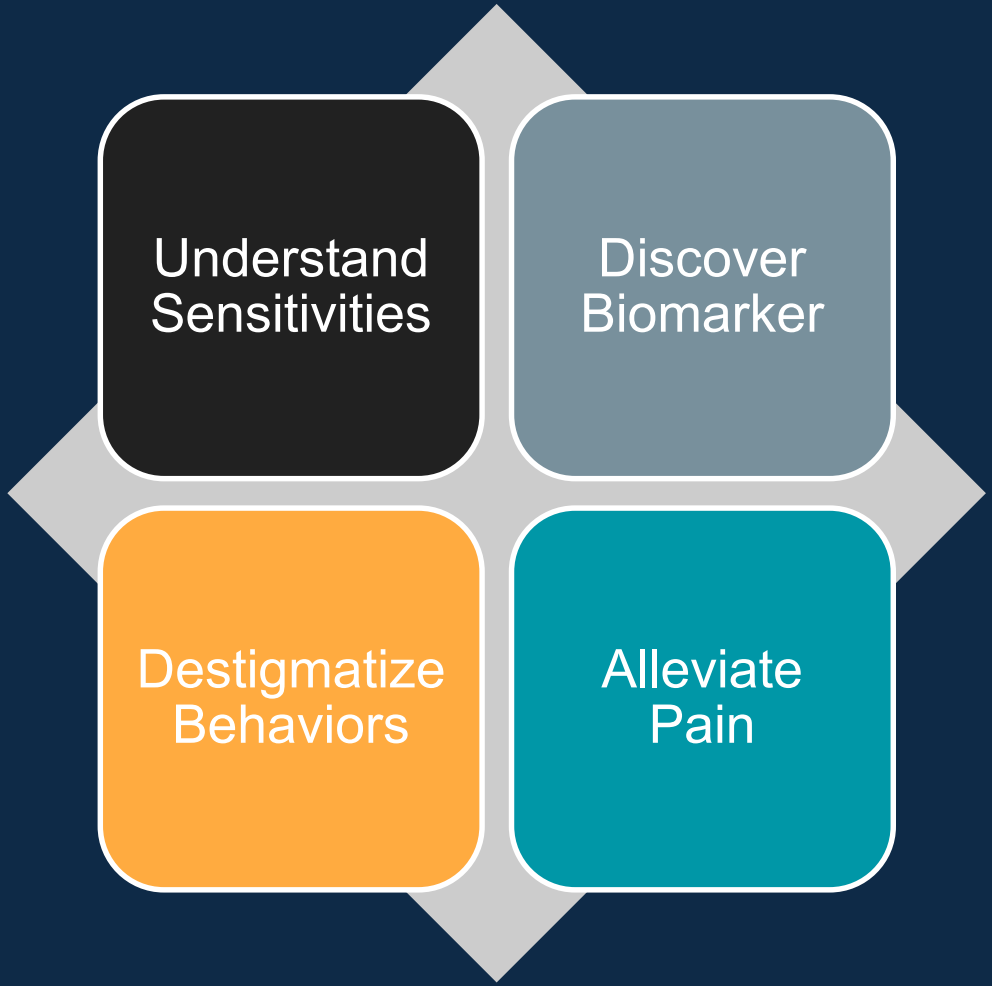
WHY DOES THIS RESEARCH MATTER?

What will the results help us understand?

1. The underlying mechanism behind abnormal tactile sensitivity in autism
2. How autistic people initially process tactile information in the brain
3. Whether autistic adults process active and passive touch differently from neurotypical adults
4. How the predictability of touch affects how it is processed

Impact

- Design adaptations to accommodate sensory preferences
- Move toward de-stigmatization of self-stimulatory behaviors (aka stimming)
- Develop ways to provide safer alternatives to self-injurious behaviors



Citations

Some Figures Created with BioRender.com, Freepik.com

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What are your questions?

Follow me on Twitter to see how the project goes!
@E_L_Isenstein