

Sign-naïve and Native Signing Infants’ Visual Preferences for Signing Avatars

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Research Questions:

1. Are infants sensitive to variation in “humanness” in virtual humanoid signers?
2. Do infants have looking preferences for signing virtual avatars?

Introduction

- Bosworth et al (2019) demonstrated that infants are sensitive to visual language contrasts, this sensitivity disappears without exposure, and sign language experience modulates this sensitivity.
- While we know infants are highly sensitive to language and can pick it up rapidly, we do not know why they cannot pick up language as quickly from video input.
- Our study explores how virtual humanoid signers can be used to provide language input to infants.

Stimuli

We designed a study to contrast young signing vs. sign-naïve infants’ looking preferences for different virtual signing avatars while also examining whether gaze patterns differed across avatar types.

The stimuli that have been chosen for this study are three different kinds of videos composed of different virtual representations of humans:

- **Motion capture (MoCap) Avatar:** Created by recording the movements of a human signer followed by digitization resulting data that allows for the development of 3D models that generate motion that more closely resembles natural, biological movements.
- **Computer Synthesized (CS) Avatar:** Developed by using computing computer graphics and coding techniques to create a virtual representation of a signer.
- **Human Signer:** A video recording of a native, fluent signer

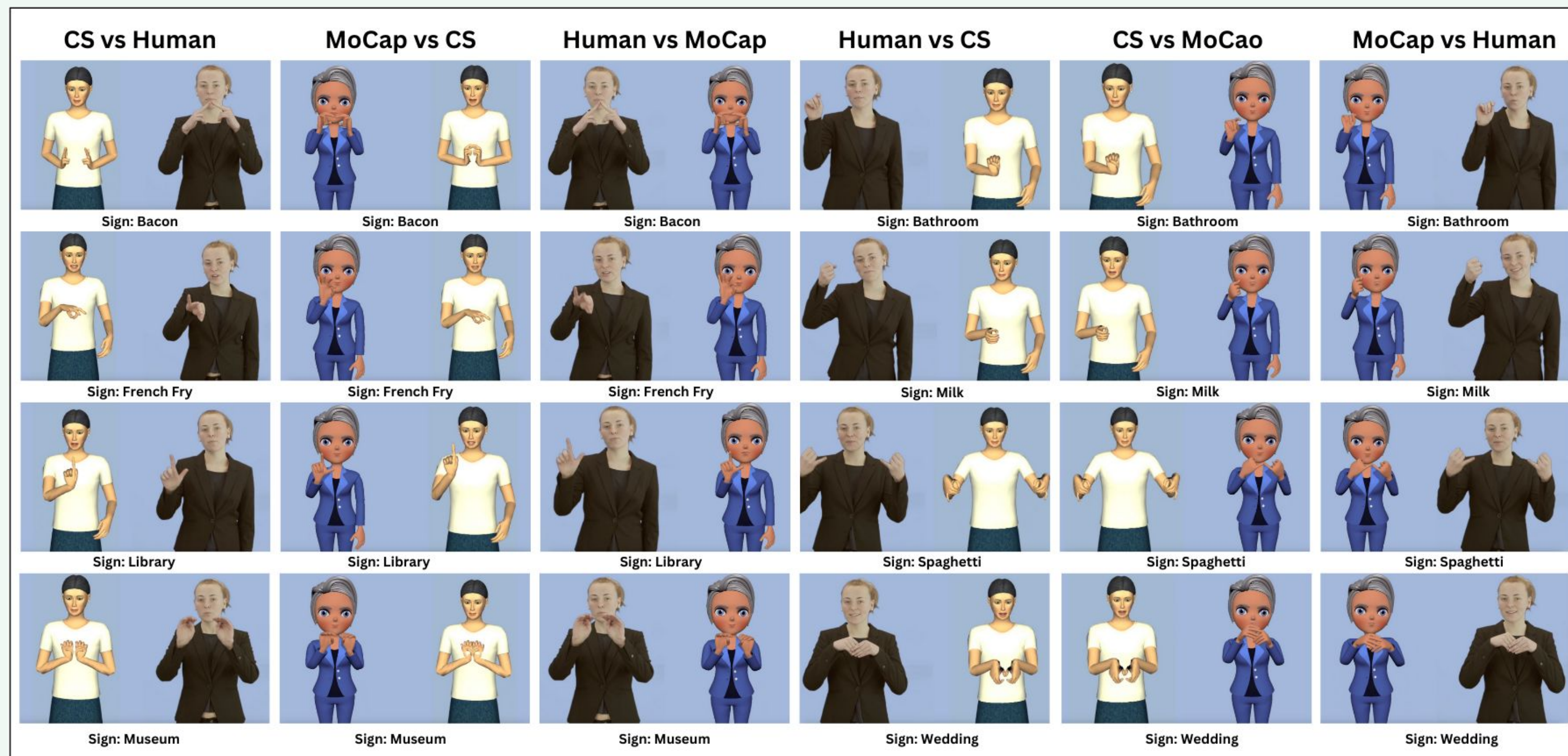
These stimuli were used by Quandt et al (2022) to study how adults perceive different representations of humans in virtual environments. The MoCap avatars were developed with the goal of producing biologically plausible movements which resemble native ASL signers, utilizing appropriate facial expressions to convey appropriate ASL grammar, and being aesthetically pleasing to encourage their use.

Results showed that adults rated MoCap avatars higher in naturalness and comprehension than those of CS avatars.

Throughout this study, we will explore how babies interact with signing avatars in order to determine if these avatars may be used to provide language to deaf or hard-of-hearing children whose parents are not signers.

Methods

- To address early visual looking preferences for such stimuli, we presented infants with pairs of stimuli, and recorded fixation duration with a Tobii Pro Fusion Eyetracker (120 Hertz).
- Aim for N = 15 each age group: 6 month olds (5-7 months) and 12 month olds (10-14 months)
- Each pair loops for 5 seconds, counterbalanced for placement (left, right).
- Dependent measure is percent looking time, which reveals which stimulus infants prefer to look at the most throughout the experiment.

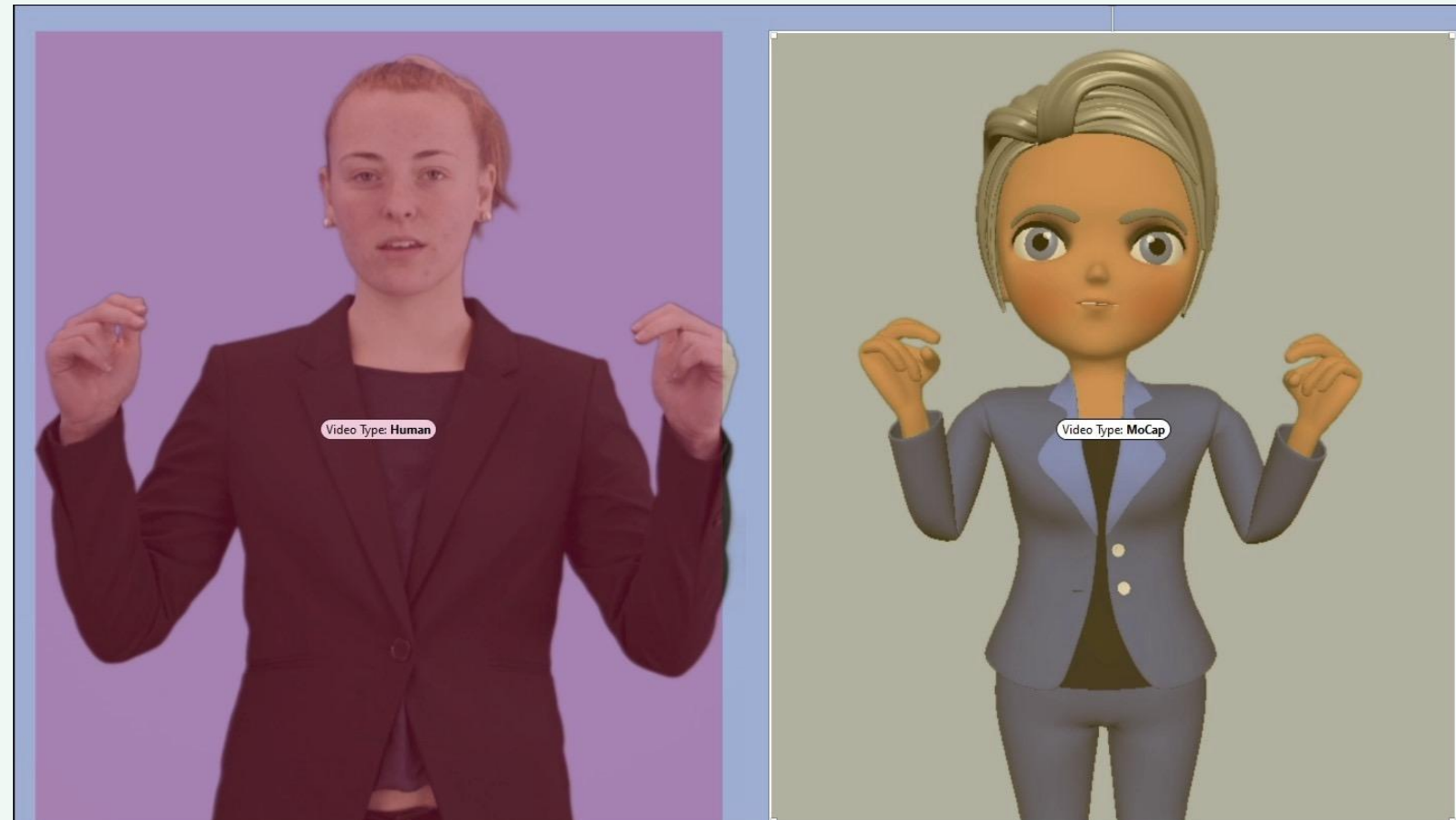


Matrix of the stimuli and presentation order used is shown above. All stimuli are presented in four blocks of six paired videos with the same order of stimuli and each sign presented three times for a total of 24 trials. Each block is presented in the following order: CS vs Human, MoCap vs CS, Human vs MoCap, Human vs CS, CS vs MoCap, and MoCap vs Human.

Planned Analyses

Age Group (6, 12 mos) x Language Group (Signing, Nonsigning) x Stimulus Type (MoCap, CS, Human)

Random factors: sign item, trial order number (1-6); block order (1,2,3) for order effect



1) **Preferential Looking** metric reveals which Stimulus Type (MoCap, CS, Human) infants prefer to look at the most over the duration of the experiment



2) We compute total looking time and fixation duration for each **Area of Interest (AOI)**, the eyes, mouth, and the area that contains the signing hands. This metric may elucidate what perceptual features drive infants’ looking preferences.

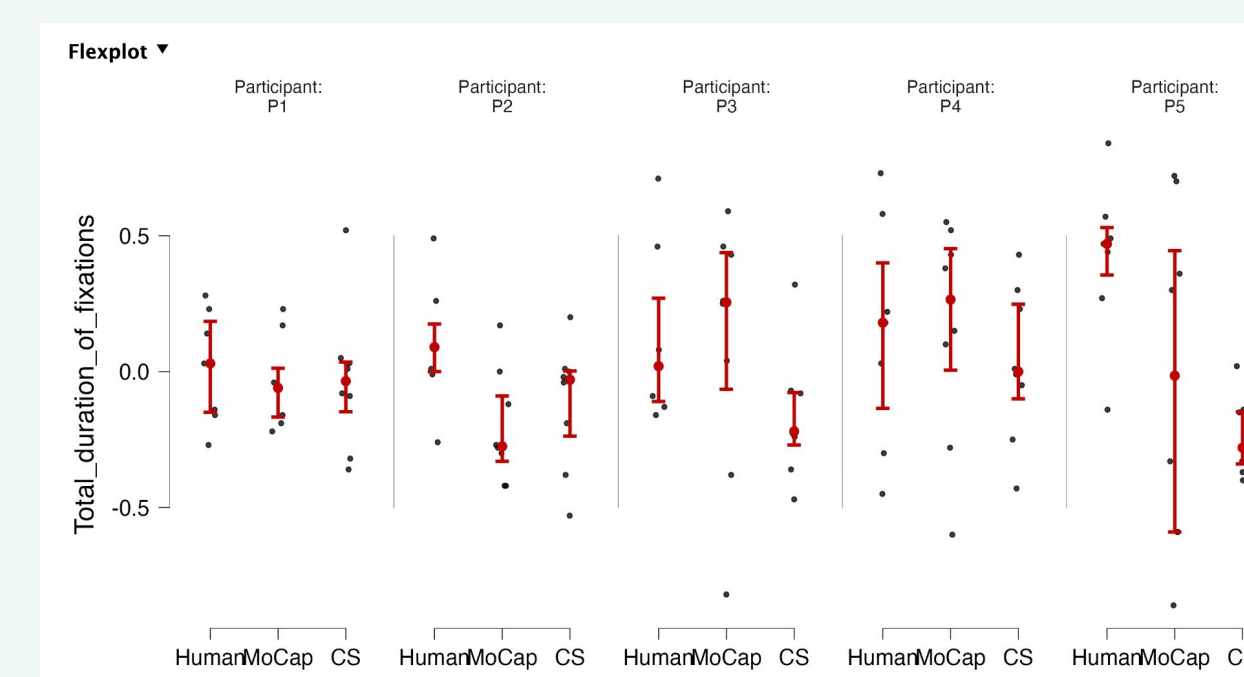
Predictions

We anticipate that babies prefer humans when compared against the Computer Synthesized (CS) and Motion Capture (MoCap) signing avatar. Younger babies may also prefer humans and as they grow older, they may prefer novel experiences and are more accepting of virtual humans (avatars).

Preliminary Findings

Findings from 5 adults are in agreement with Quandt et al (2022) findings - adults prefer videos of signers that most closely resemble naturalistic signing.

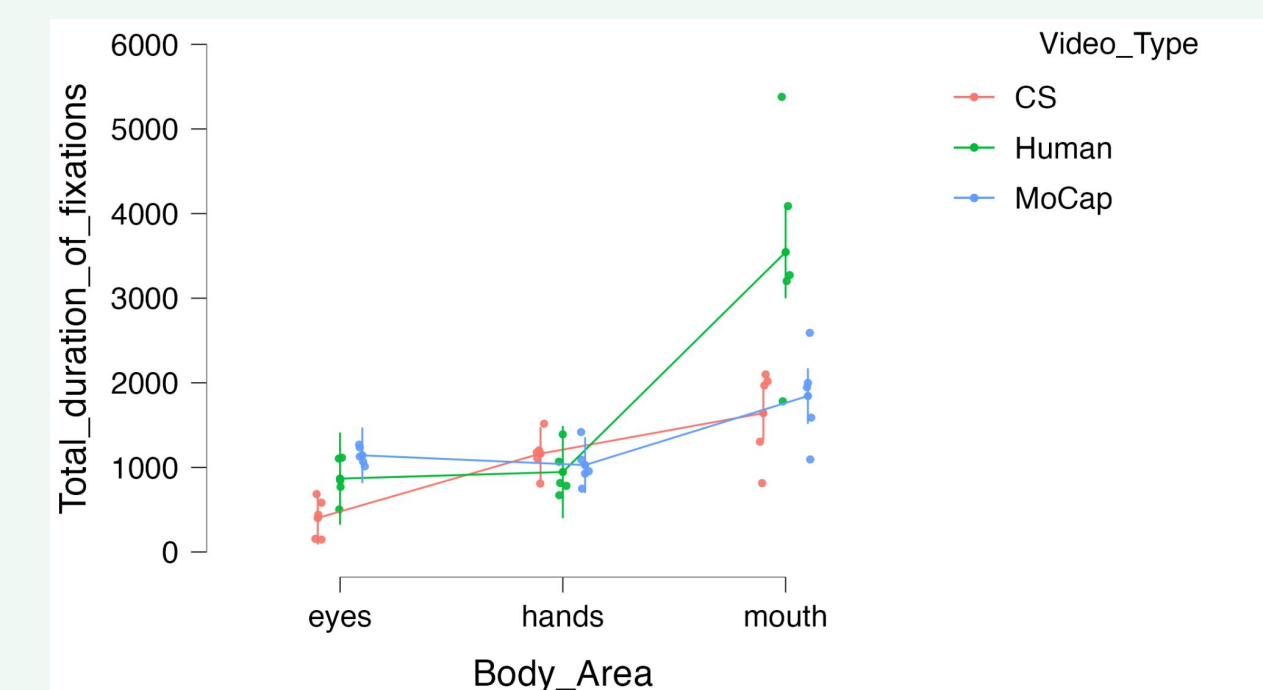
Part 1: Preferential looking



Overall, adults preferential looking indicates that there is a preference for MoCap avatars rather than CS avatar. For four participants, MoCap avatars length of looking more closely resembles how adults viewed the human signer than the CS avatar.

Part 2: Area of Interest

For the Human avatar, adults were likely to attend to the mouth. The CS avatar showed the least likelihood of attending to the eyes. These results demonstrate that adults are likely to attend to the MoCap avatar and human signer similarly.



Part 3: Goals for Babies

Based on the findings from adults, we expect babies to attend to the mouths of all the avatars as this area of interest carries grammatical information to assist in the comprehension of ASL. Similarly, babies will be expected to attend more to the eyes of the human signer and MoCap avatar and the hands of CS avatar. We also expect babies to show a preference for MoCap avatars over CS avatars as noted by longer duration of fixations.

Implications

- Avatars can be used to provide language access to deaf children of hearing parents as a preventative measure against language deprivation.
- Early ongoing exposure to AS using avatars is important for cognitive development as it ensures deaf and hard of hearing babies have access to language especially if their parents are not fluent or do not know ASL
- Determining what avatars babies prefer to look at helps guide future development of signing avatars
 - Knowing where and how long they look at the avatar helps determine which features should be emphasized more
- Showing that babies have a clear preference for a specific kind of avatars is foundational for moving forward with how we develop them further.

Miscellaneous

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To stay updated on our ongoing studies please feel free to look at our websites:

- www.tinyurl.com/ActionBrainLab
- <https://www.rit.edu/ntid/playlab>

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