

# Defining Kinematic Signatures of Reach-to-Eat Behaviors in *Ateles fusciceps rufiventris*

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## Background & Aims

- Motor planning can be studied by analyzing goal-directed actions, such as reach-to-eat behaviors.
- Reach-to-eat tasks are goal-directed actions in which subjects acquire a piece of food with the intention of consumption.
- This study examines motor planning as a function of hand pre-shaping prior to grasping food in *A. f. rufiventris*.
- *A. f. rufiventris* lack a thumb, which may influence strategies for completing reach-to-eat behaviors.
- Kinematics is used to quantify motor planning of self-generated actions in human and non-human primates.
- **Aim:** Determine if kinematic signatures are associated with grasp selection for reach-to-eat behaviors in *A. f. rufiventris*
- **Hypothesis:** Pre-shaped grasps indicate greater motor planning.
- **Predictions:** Reaches with pre-shaped grasping will be characterized by lower peak and average velocities, and a greater degree of smoothness when compared to reaches with no pre-shaping.

## Methods

- **Subjects:** 4 Colombian spider monkeys (*Ateles fusciceps rufiventris*) were assessed for completing goal-directed actions.
- **Reach-to-eat Task:** Subjects were presented with one of two foods that differed in size in a pseudo-randomized order: 1) fruit loops (small) or 2) grapes (large). Reach-to-eat actions were assessed across three nonconsecutive test days and a total of 434 actions were recorded.
- Reach-to-eat actions have two distinct motor components: 1) reaching and 2) grasping.
- Reaches were digitized offline with the program MaxTRAQ 2D using a single point on the wrist (**Fig. 1A-C**). Kinematic data were extracted and processed with Matlab using custom programs. Grasping was scored independently of reach kinematics.
- **Dependent Kinematic Variables:**
  - Average reach velocity: mean velocity of hand during the reach.
  - Peak reach velocity: maximum velocity of the hand during the reach.
  - Reach smoothness: number of peaks in the hand-speed profile (values closer to 1 = smoother reaches).
- **Independent Variable:** Two types of grasps were examined: 1) grasps with pre-shaping and 2) grasps without pre-shaping.

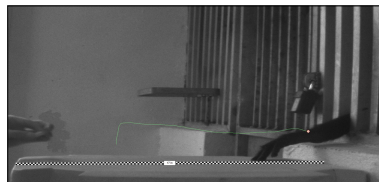


Fig. 1A. Reach onset of a small food trial.

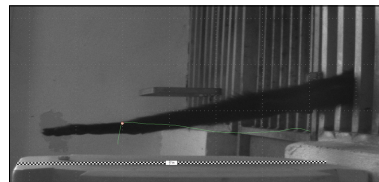


Fig. 1B. Mid-reach of small food trial

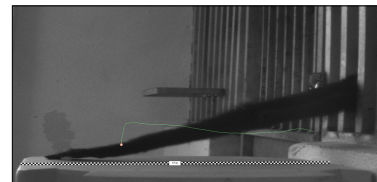


Fig. 1C. Reach offset and absence of pre-shaping in grasp of small food trial.

## Preliminary Descriptive Data

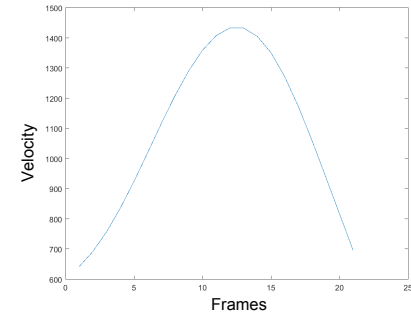


Fig. 2. Example of a reach-to-eat action where pre-shaping was used. A single movement unit indicates a smoother reach.

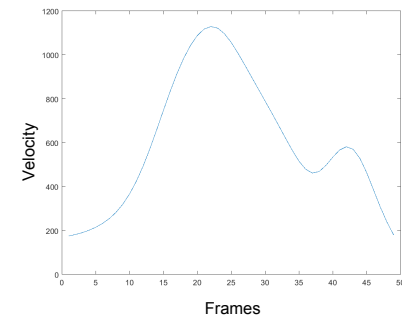


Fig. 3. Example of a reach-to-eat action in the absence of pre-shaping. Two movement units indicate the reach was less smooth.

## Planned Analyses:

- ✓ Linear mixed effects models will be used to examine the relation between reach kinematics and grasp selection to determine if the preliminary descriptive findings indicate kinematic signatures.
- ✓ Future findings will provide valuable insight into the evolution of reaching and grasping in primates.



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