

Motor planning in Colombian spider monkeys (*Ateles fusciceps rufiventris*): A test of the morphological constraint hypothesis



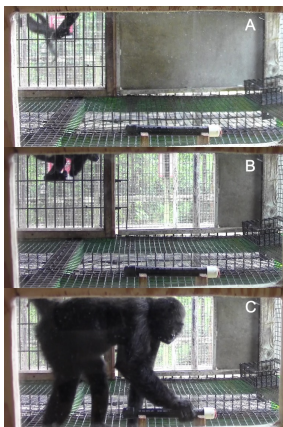
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BACKGROUND:

- **Second-order planning** is selecting a grasp based on what the individual intends to do with an object.
- The **morphological constraint hypothesis** proposes species with *less* dexterity use second-order planning *more* consistently (i.e., more radial grips).
- If motor planning is related to dexterity, spider monkeys should show **high rates of radial grip use** because they have a **low digital dexterity rating**.

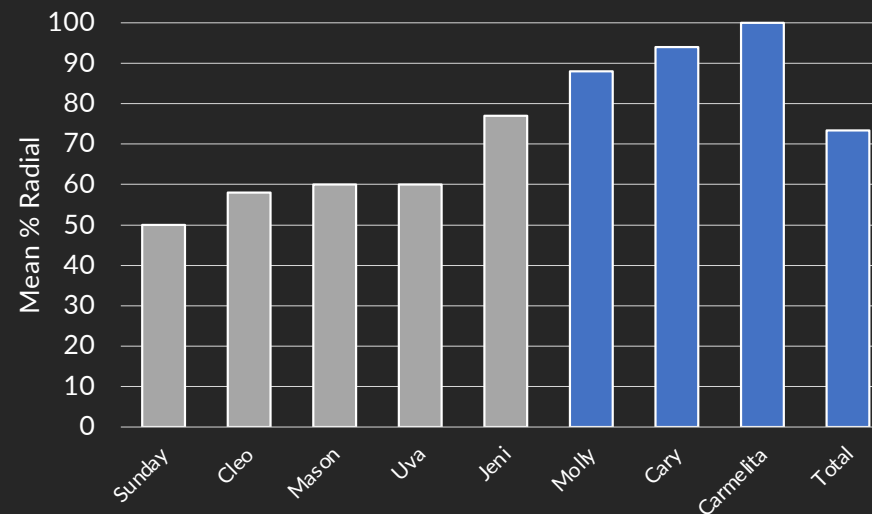
METHODS:

- Tested 8 Colombian spider monkeys housed at a local wildlife park using an **elevated dowel task**.
- Data were collected across 7 sessions until monkeys had completed 10 left and 10 right baited trials.

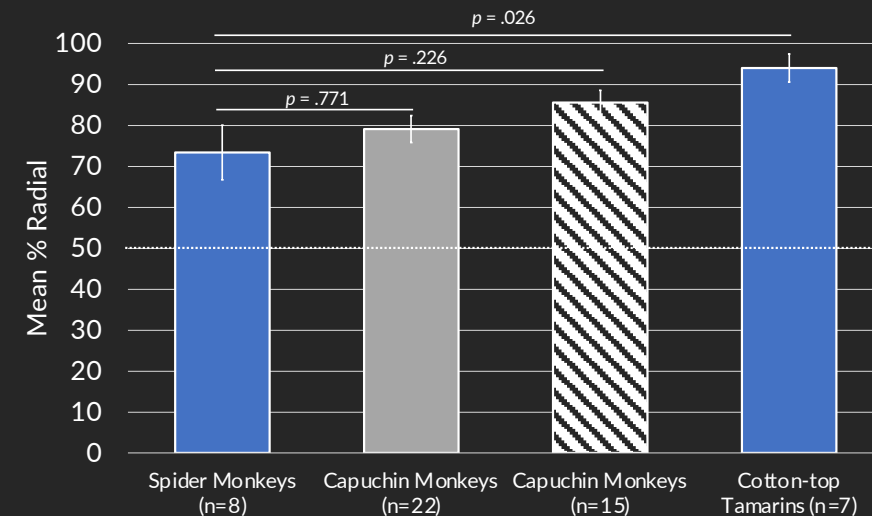


The image shows a spider monkey participating in the elevated dowel task and the progression through one trial. (A) Dowel is placed on the apparatus. (B) The door to the testing area is opened. (C) Spider monkey participates.

Spider monkeys defied expectations about second-order planning.



Cross-species comparisons **challenged our hypothesis**. Spider monkeys differed from cotton-top tamarins rather than capuchins.



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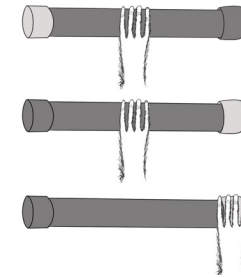
One-way ANOVA ($F(3,48) = 3.195, p = .032$) with Tukey post hoc test.

Solid color denotes captive species.
Hatched pattern denotes wild species.
Bars denote standard error.
Dashed line denotes chance level.

Digital Dexterity Rating
Spider Monkeys = 4
Capuchin Monkeys = 5
Cotton-top Tamarins = 4

DATA ANALYSIS:

- Hand use was coded as left or right and grip use was coded as **radial, ulnar, under, or goal-end**.



The illustration shows a **right** spider monkey hand and three grasps used to bring the left end of the dowel to the mouth: a radial grasp (top) where the radial bone faced the baited end; an ulnar grasp (middle) where the ulnar bone faced the baited end; and a goal-end grip (bottom) where the hand directly grasped the baited end. Under grasp not shown.

- The **percentage of radial grips** relative to all other grips was used as the dependent variable to compare with prior studies in platyrrhine species.

RESULTS:

- The percentage of radial grips used varied from **50% to 100%** with a mean of **73.38 ± 18.91%**.
- A one-sample t-test found that the **radial grip was the group strategy**, $t(7) = 3.497, p = .010$.
- Binomial tests revealed some individual monkeys were not consistent in radial grip use (**5 of 8**).

DISCUSSION:

- Findings **challenge** the morphological constraint hypothesis, suggesting dexterity should not solely be defined by the ability to execute a precision grip.
- Despite the lack of a thumb, the **ability to separate one digit from the rest of the hand** has important implications for motor planning in spider monkeys.



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