ManyPrimates:
Establishing an Infrastructure for Collaboration in Primate Cognition Research

Elizabeth Warren and Drew Altschul on behalf of “ManyPrimates”

SPRG @ The Burn

11/05/2019

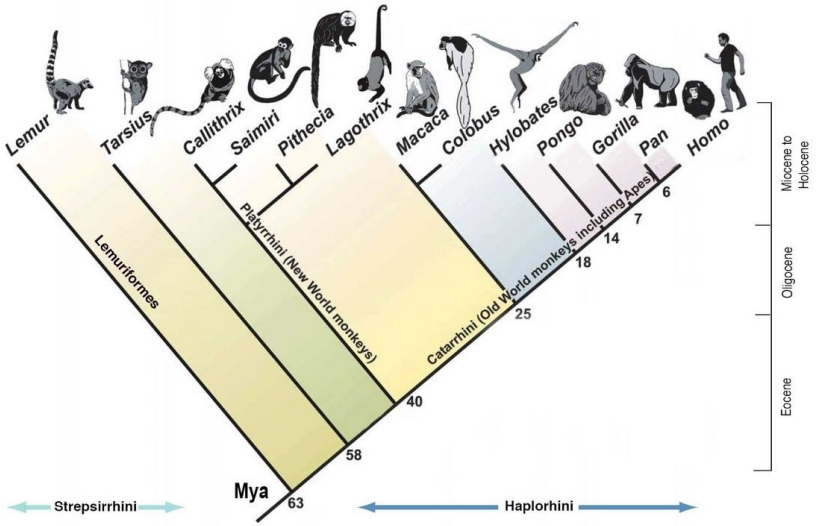
ManyPrimates contributors

Matthias Allritz, Drew Altschul, Michael Beran, Manuel Bohn, Josep Call, Shona Duguid, Crystal Egelkamp, Claudia Fichtel, Julia Fischer, Molly Flessert, Daniela Fuchs, Daniel Hanus, Daniel Haun, Lou Haux, R. Adriana Hernandez-Aguilar, Esther Herrmann, Lydia Hopper, Marine Joly, Fumihiro Kano, Stefanie Keupp, Alicia Melis, Alba Motes-Rodrigo, Steve Ross, Alejandro Sánchez-Amaro, Yutaro Sato, Vanessa Schmitt, Amanda Seed, Ruiting Song, Christoph Völter, Bridget Waller, Elizabeth Warren

Challenges to primate cognition research

Important questions are under-studied due to lack of infrastructure:

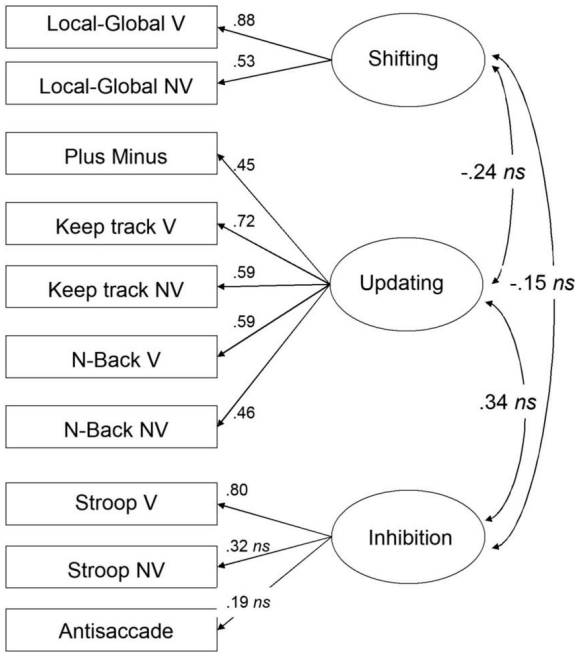
- How does cognition evolve?



Challenges to primate cognition research

Important questions are under-studied due to lack of infrastructure:

- How does cognition evolve?
- How is cognition structured?



Challenges to primate cognition research

Important questions are under-studied due to lack of infrastructure:

- How does cognition evolve?
- How is cognition structured?
- How does cognition develop?

Challenges to primate cognition research

Answering these questions needs:

- Large and diverse samples
- Pooling of resources across labs
- Infrastructure to support studies

ManyPrimates

Network to connect researchers, plan and conduct collaborative studies

Collaboratively deciding on research agenda

Open to all interested in primate cognition

Inspired by:

- Open Science Collaboration // ManyLabs // ManyBabies

Pilot study

Study the phylogeny of a fundamental cognitive ability:

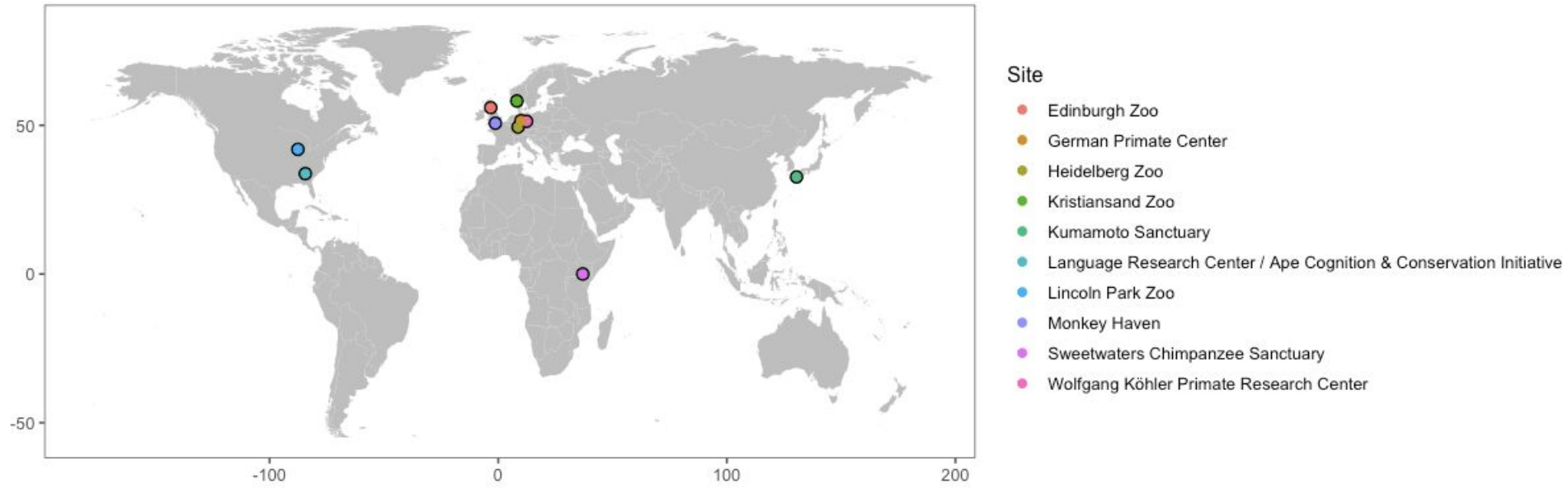
Short-term memory

Build basic infrastructure for future projects

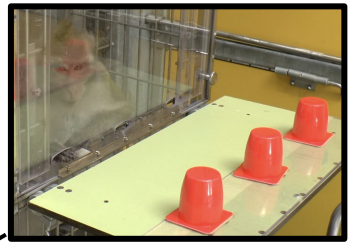
Timeline

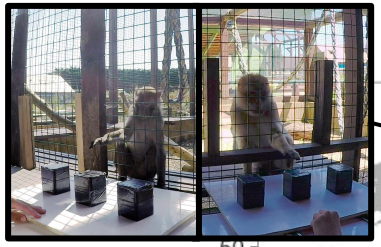
December ‘17:	Initial contact
January ‘18:	Decision on topic for pilot study
February ‘18:	Pre-registration of design and analysis
March - July ‘18:	Data collection
August - February ‘19:	Data analysis and writing
March ‘19:	Manuscript submitted to PLOS One

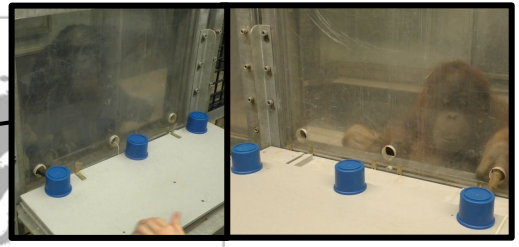
Data collection sites

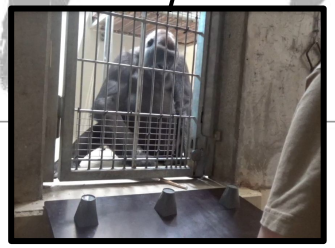


Design









50

-100

200

Design

Rhesus Macaque - Medium Delay

Chimpanzee - Medium Delay

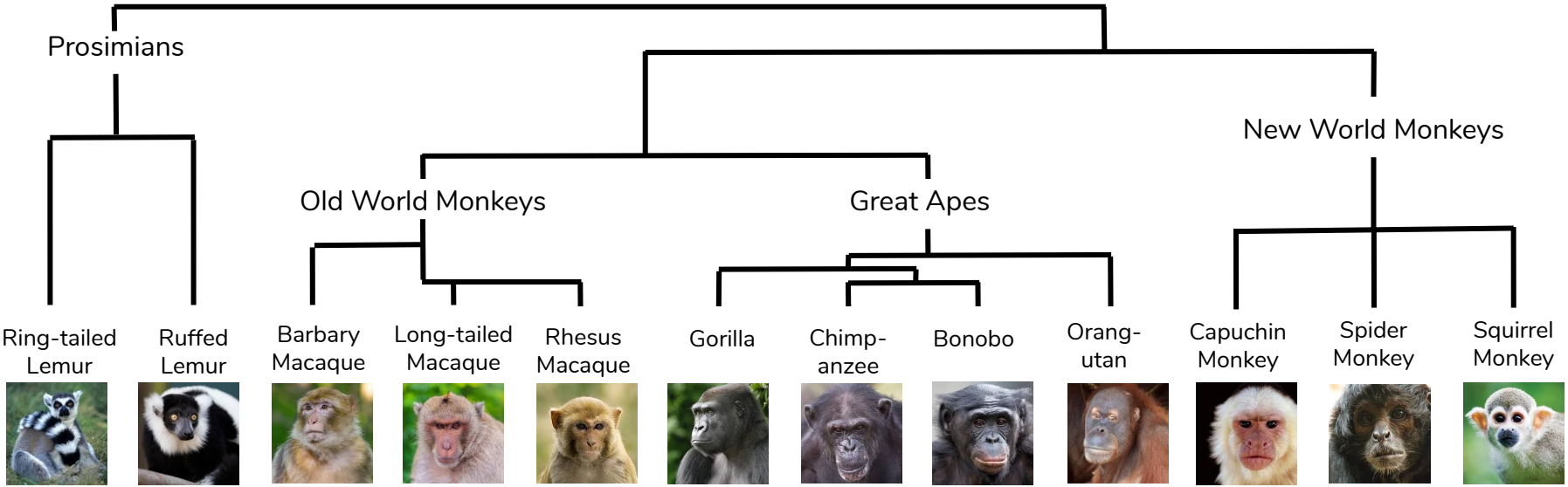
Capuchin Monkey - Medium Delay

Barbary Macaque - Medium Delay

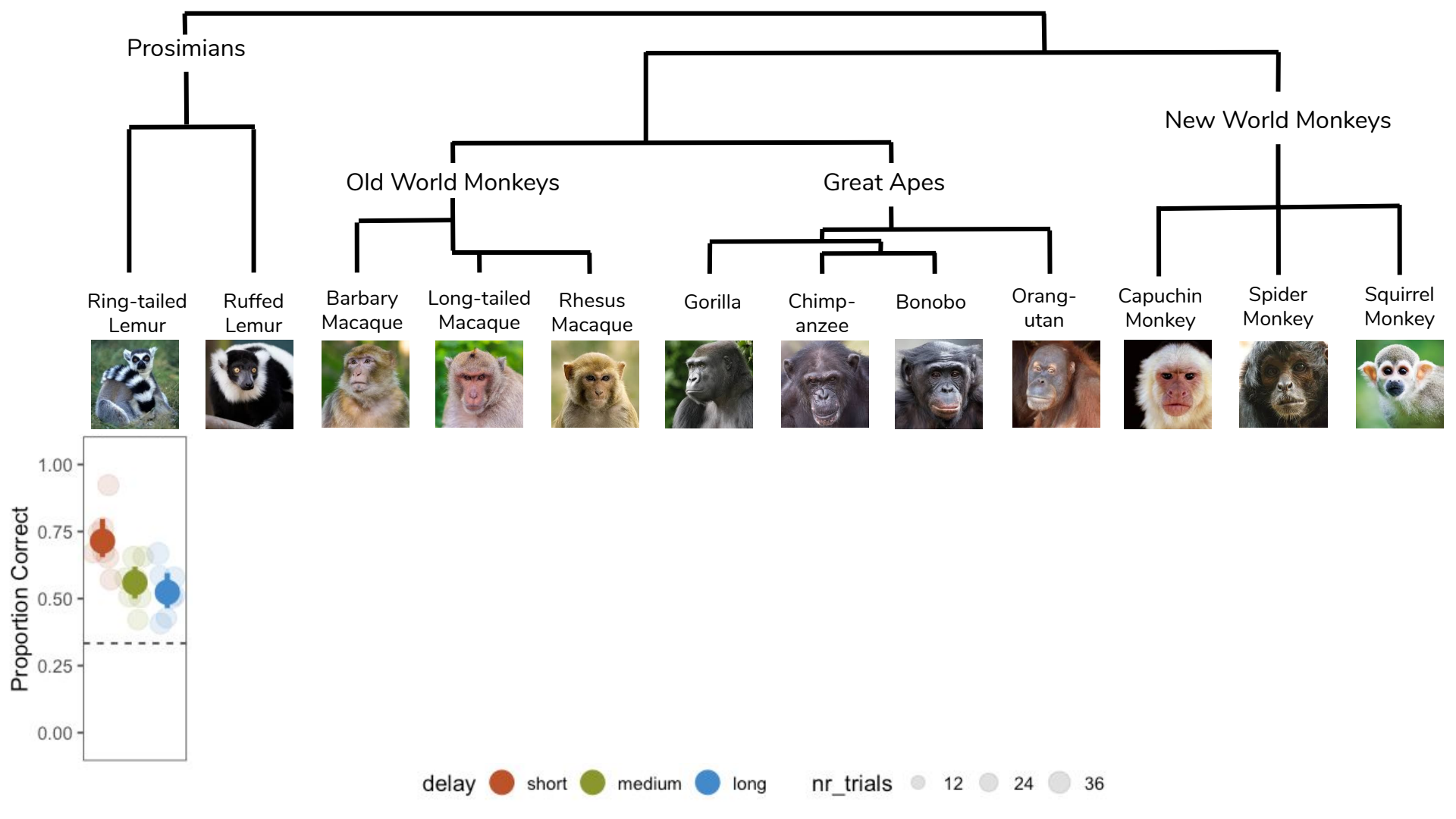
Squirrel Monkey - Short Delay

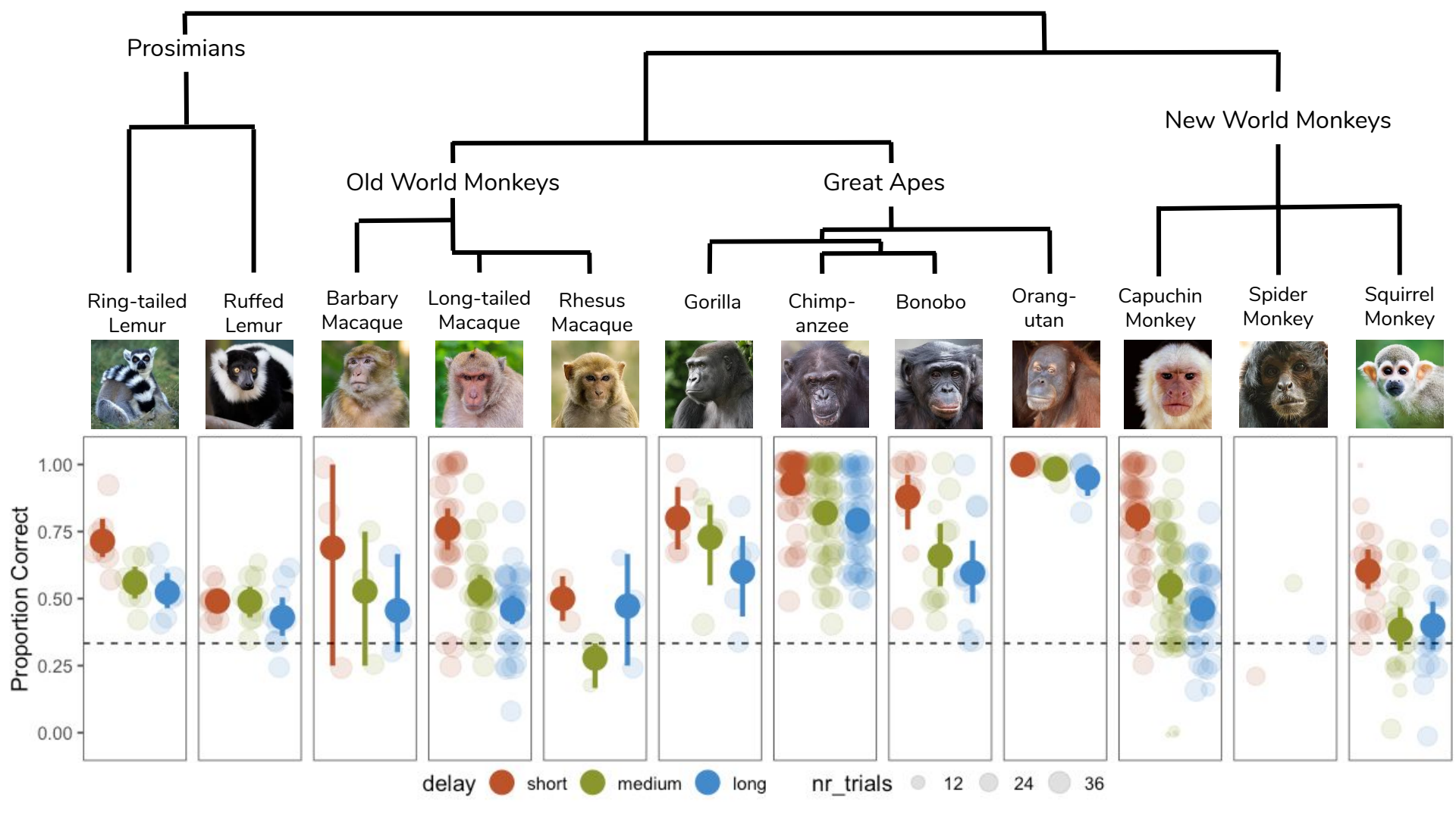
Sample

Total Species	**12**
Total Sites	**11**
Total N	**176**

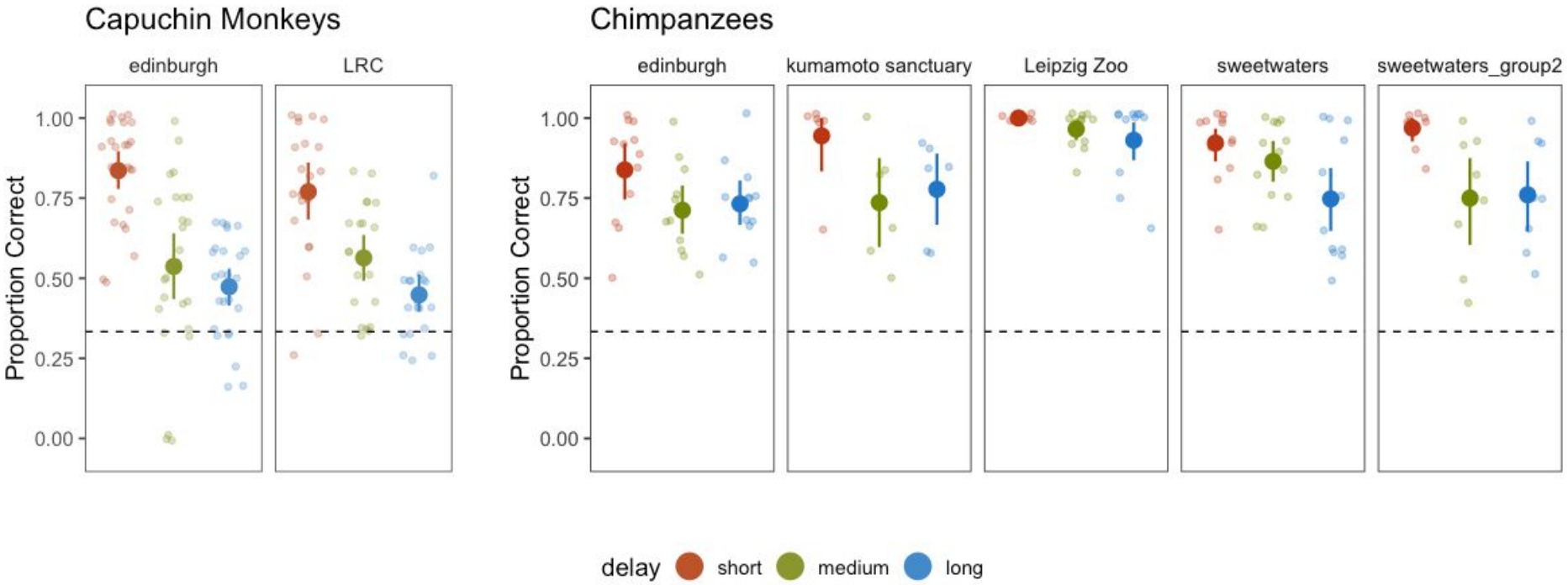


	Ring-tailed Lemur	Ruffed Lemur	Barbary Macaque	Long-tailed Macaque	Rhesus Macaque	Gorilla	Chimp-anzee	Bonobo	Orang-utan	Capuchin Monkey	Spider Monkey	Squirrel Monkey
N	9	7	3	17	3	5	51	11	5	46	1	18
Sites	2	1	1	1	1	2	5	2	1	2	1	1

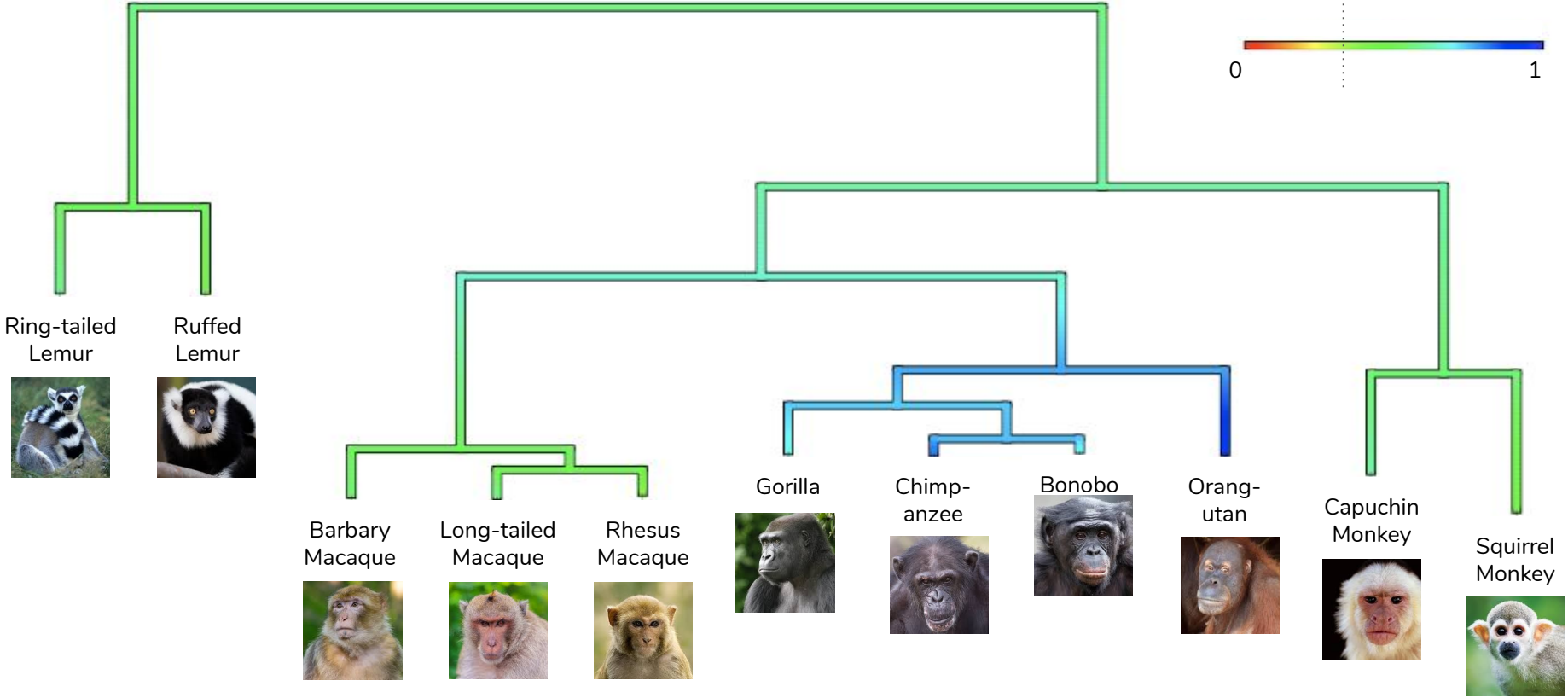

Prosimians
Old World Monkeys
Great Apes
New World Monkeys
Ring-tailed Lemur
Ruffed Lemur
Barbary Macaque
Long-tailed Macaque
Rhesus Macaque
Gorilla
Chimp-anzee
Bonobo
Orang-utan
Capuchin Monkey
Spider Monkey
Squirrel Monkey
Proportion Correct
1.00
0.75
0.50
0.25
0.00
delay
short
medium
long
nr_trials
12
24
36


Prosimians
Old World Monkeys
Great Apes
New World Monkeys
Ring-tailed Lemur
Ruffed Lemur
Barbary Macaque
Long-tailed Macaque
Rhesus Macaque
Gorilla
Chimp-anzee
Bonobo
Orang-utan
Capuchin Monkey
Spider Monkey
Squirrel Monkey
Proportion Correct
1.00
0.75
0.50
0.25
0.00
delay
short
medium
long
nr_trials
12
24
36

Variation across sites



Phylogenetic analysis



Contributions

Study planning

- Generating ideas // designing studies // coordination

Data collection

- Data collection // coding & reliability

Analysis and publication

- Data analysis // writing // public outreach

Outlook

- Spread the word and get more people involved
- Continue with short-term memory study
    - Currently working on pre-registration for ManyPrimates 1
- Collect ideas for future studies
- Further diversification (e.g. including non-captive samples)

Acknowledgements

Cog Etho Lab (DPZ): to Lukas Schad and Carolin Kade

Seed, Call, Völter: RZSS Edinburgh Zoo

Joly, Waller: to Charlotte Gurney-Read and the Monkey Haven, Isle of Wight

Beran, Flessert: Language Research Center and ACCI (especially Amanda Epping)

Sánchez-Amaro, Hanus: WKPRC Leipzig Zoo

Hernandez-Aguilar, Motes-Rodrigo: Dyreparken Kristiansand (especially Helene Axelsen and Tanya Michin)

Herrmann, Melis, Duguid, Haux: Sweetwaters Chimpanzee Sanctuary

Thank you!

ManyPrimates website:

https://github.com/ManyPrimates/mp_pilot

Code and data:

https://github.com/ManyPrimates/mp_pilot

Preprint:

https://psyarxiv.com/3xu7q/

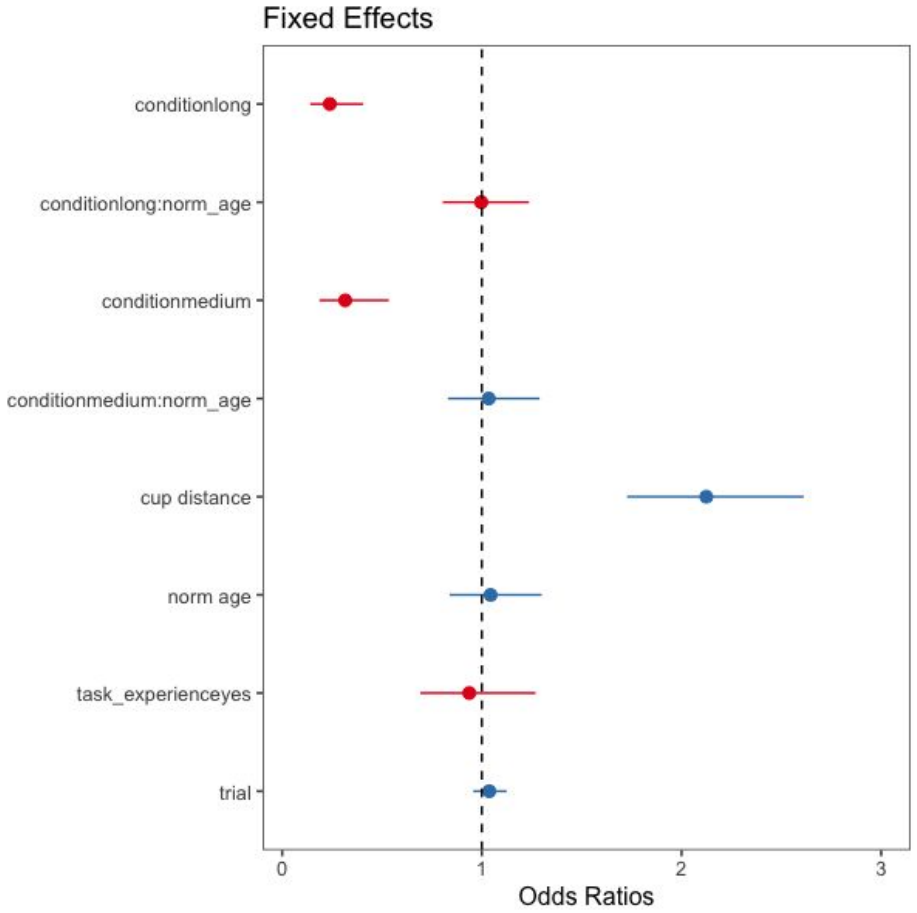
Results

Generalized linear mixed model:

```
correct ~ condition * age +

     task_experience + cup_distance +
          board_size + trial +

     (1 + condition + trial | site/subject) +
          (1 + condition | species)
```



Results

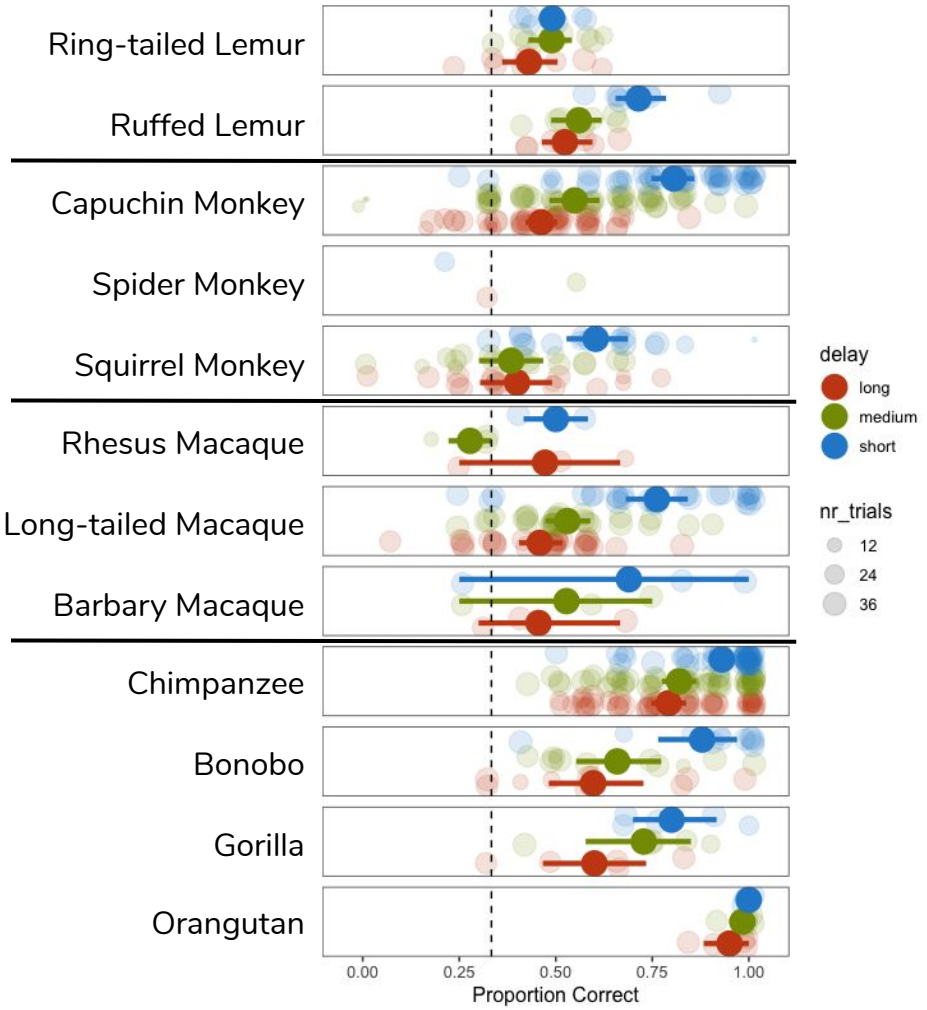
Generalized linear mixed model:

```
correct ~ condition * age +

      task_experience + cup_distance +
           board_size + trial +
```

β_{medium} = -1.153, p > .0001

β_{long} = -1.433, p > .0001



Results

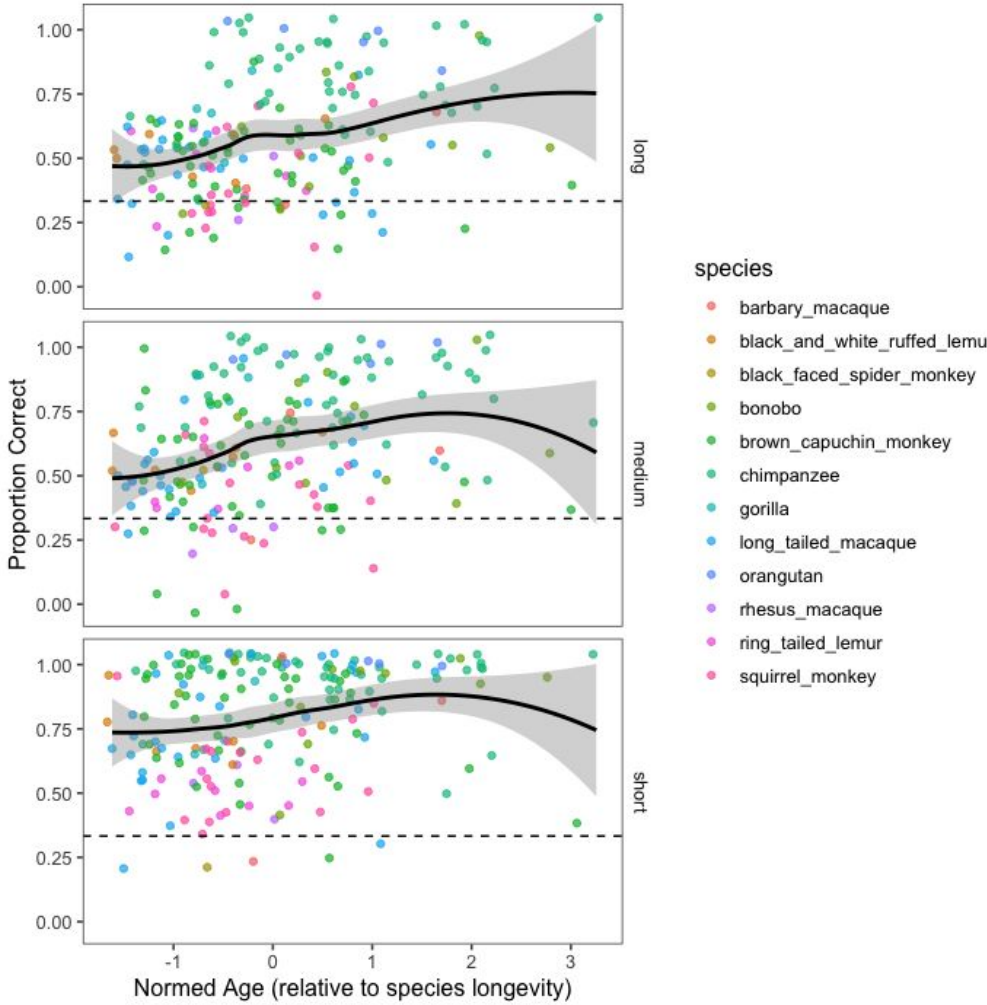
Generalized linear mixed model:

```
correct ~ condition * age +

      task_experience + cup_distance +
           board_size + trial
```

$\beta_{\text{medium*age}}$ = 0.034, p = .76

$\beta_{\text{long* age}}$ = -0.003, p = .98



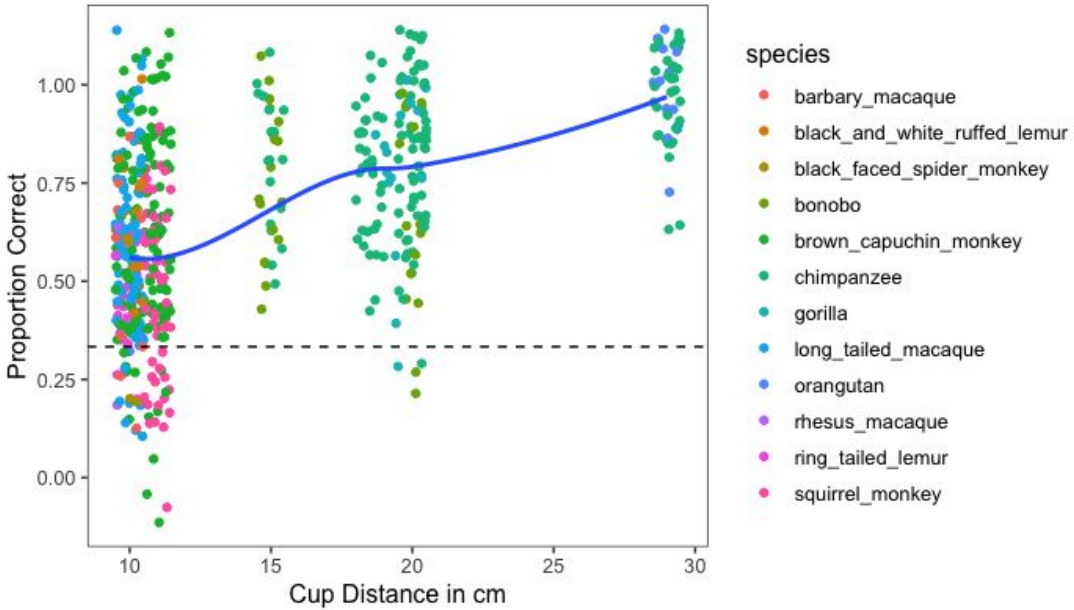
Results

Generalized linear mixed model:

```
correct ~ condition * age +

     task_experience + cup_distance +
          board_size + trial +
```

β_{medium} = 0.753, CI [:], p > .0001



Phylogenetic analysis

Based on data averaged across conditions

Phylogenetic signal (Lambda - λ):

- Do values cluster as expected due to phylogenetic relatedness (range: 0 - 1)
  - Based on performance means
  - Based on phylogenetic t-tests (updated through comparison to chance level)

Recreation of ancestral state

- Estimate likely performance level of common ancestor

Phylogenetic analysis

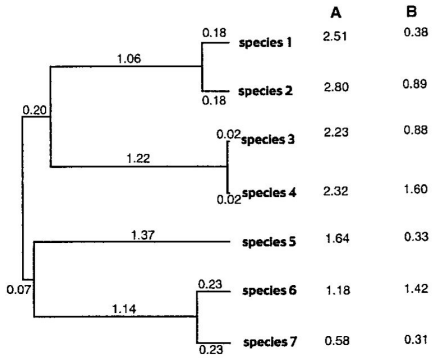
Based on data averaged across conditions

Phylogenetic signal (Lambda - λ):

- Base λ: 0.74, $p = .26$
- Updated λ: 0.79, $p = .02$

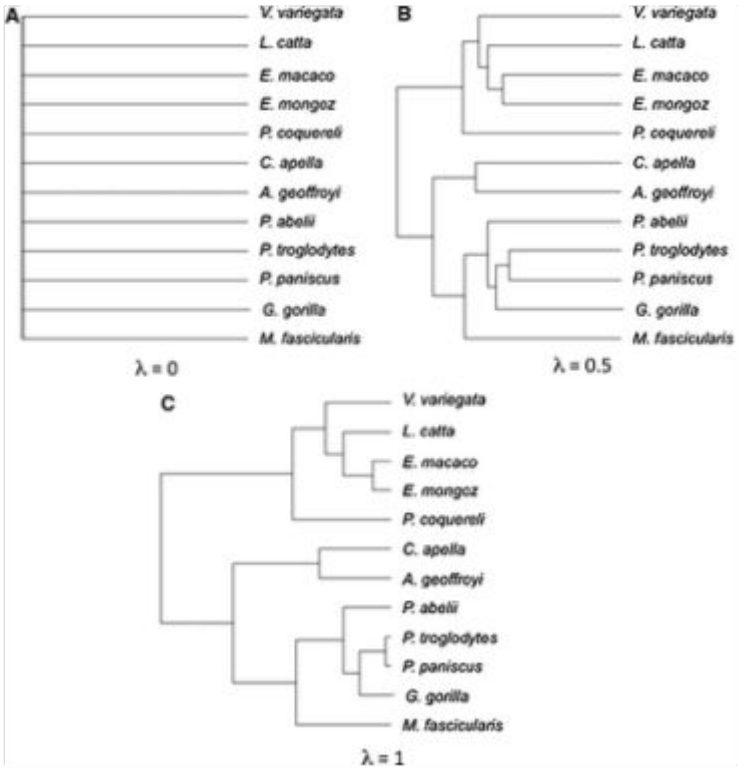
More about λ

(a)

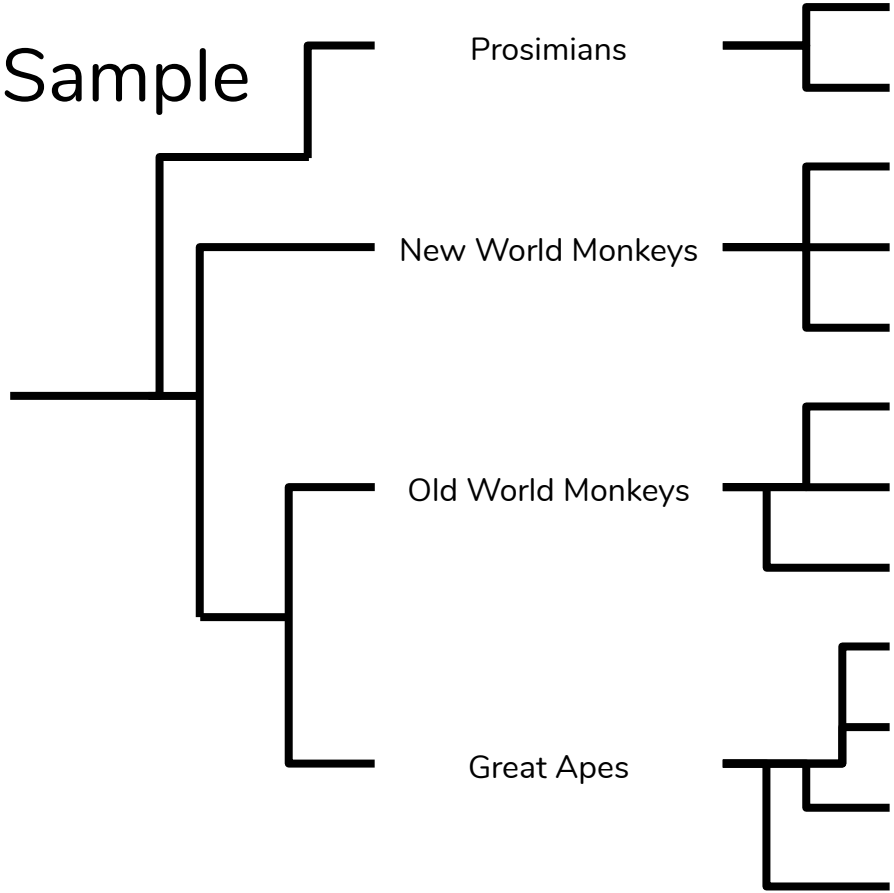


(b)

	species 1	species 2	species 3	species 4	species 5	species 6	species 7
species 1	1.44	1.26	0.20	0.20	0	0	0
species 2	1.26	1.44	0.20	0.20	0	0	0
species 3	0.20	0.20	1.44	1.42	0	0	0
species 4	0.20	0.20	1.44	1.44	0	0	0
species 5	0	0	0	0	1.44	0.07	0.07
species 6	0	0	0	0	0.07	1.44	1.21
species 7	0	0	0	0	0.07	1.21	1.44

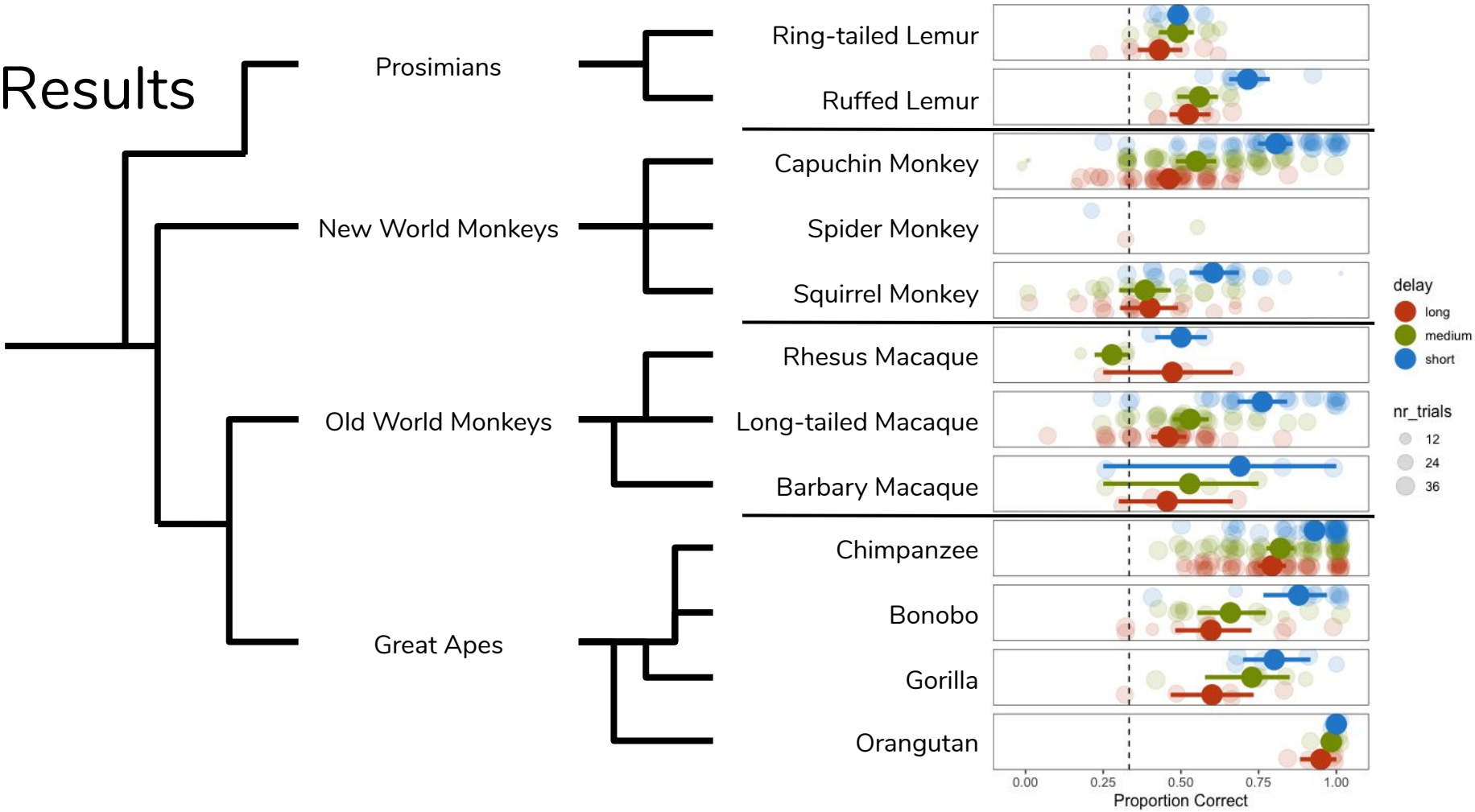


Sample

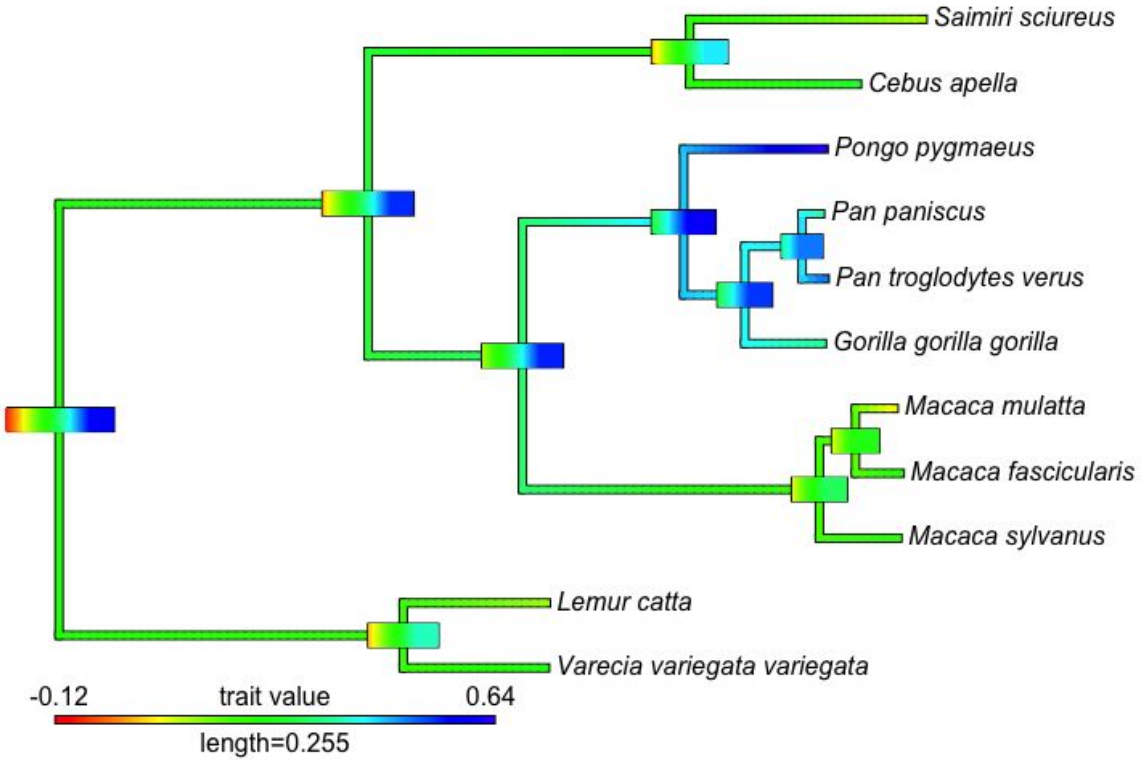


Species	N	Sites
Ring-tailed Lemur	9	2
Ruffed Lemur	7	1
Capuchin Monkey	46	2
Spider Monkey	1	1
Squirrel Monkey	18	1
Rhesus Macaque	3	1
Long-tailed Macaque	28	1
Barbary Macaque	3	1
Chimpanzee	51	5
Bonobo	11	2
Gorilla	5	2
Orangutan	5	1
	187	

Results


Prosimians
New World Monkeys
Old World Monkeys
Great Apes
Ring-tailed Lemur
Ruffed Lemur
Capuchin Monkey
Spider Monkey
Squirrel Monkey
Rhesus Macaque
Long-tailed Macaque
Barbary Macaque
Chimpanzee
Bonobo
Gorilla
Orangutan
0.00
0.25
0.50
0.75
1.00
Proportion Correct
delay
long
medium
short
nr_trials
12
24
36

Phylogenetic analysis



ManyPrimates

Open for people without direct access to primates

- Organize / support studies
- Contribute to design, analysis and writing
- ECR especially encouraged to join!

Follow open science practises

- Pre-register methods and analysis
- Sharing data and code
- Publish open access

Challenges

Adjustment of test layout to site/species specific needs

- Statistical covariation: Species not a privileged variable

→ *Solution*: Phylogenetic analysis

Ad-hoc decisions (gaps in pre-registration)

→ *Solution*: Pilot data collection / Thinking hard in advance!