

ManyPrimates: Establishing an Infrastructure for Collaboration in Primate Cognition Research

Manuel Bohn (Stanford/Leipzig) on behalf of “ManyPrimates”

ManyPrimates meeting @IPS:

August 23rd (today), 7pm in room 13 (here)

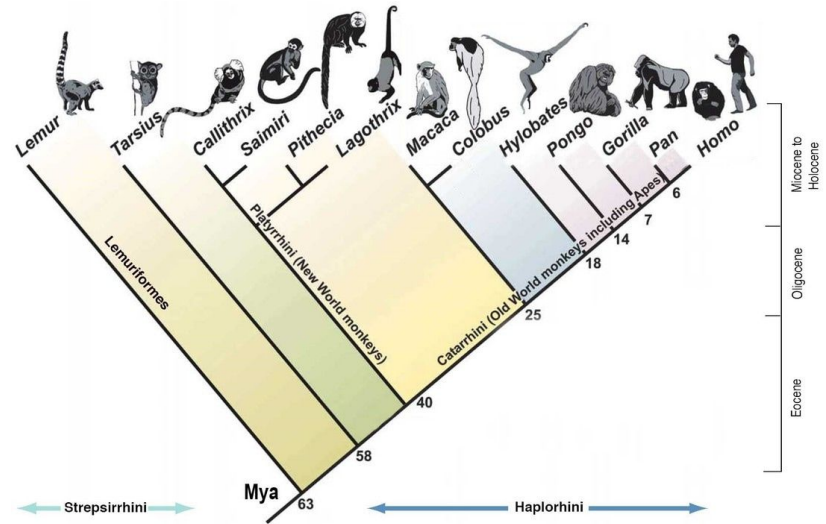
ManyPrimates contributors

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:

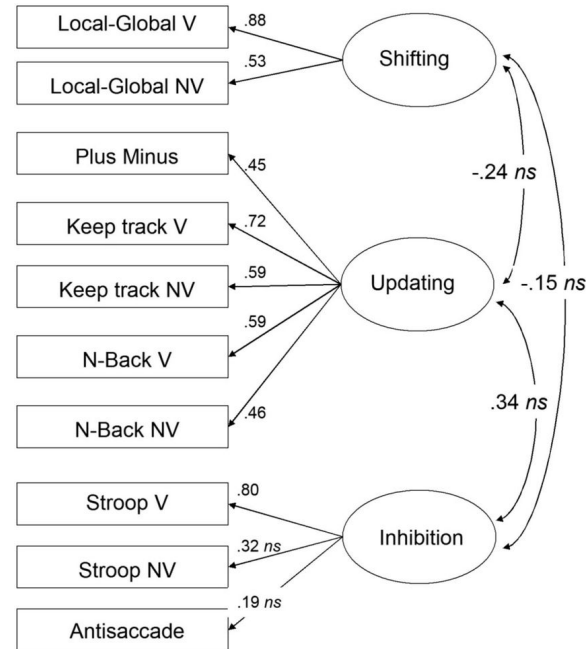
- How does cognition evolve?



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:

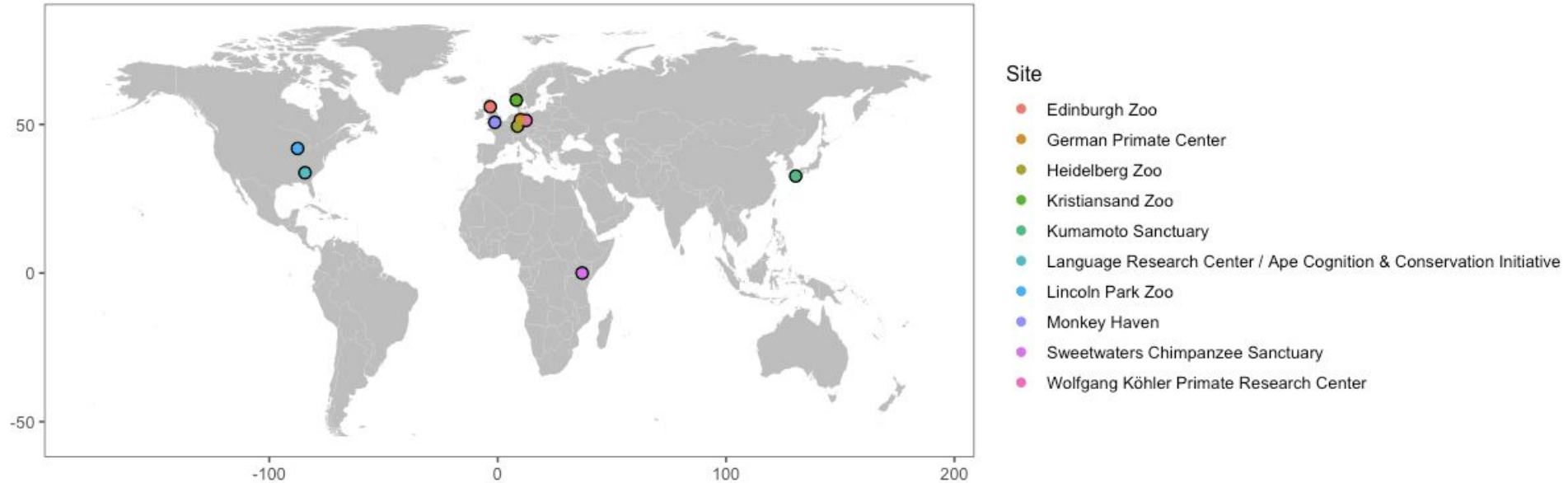
Short-term memory

Build basic infrastructure for future projects

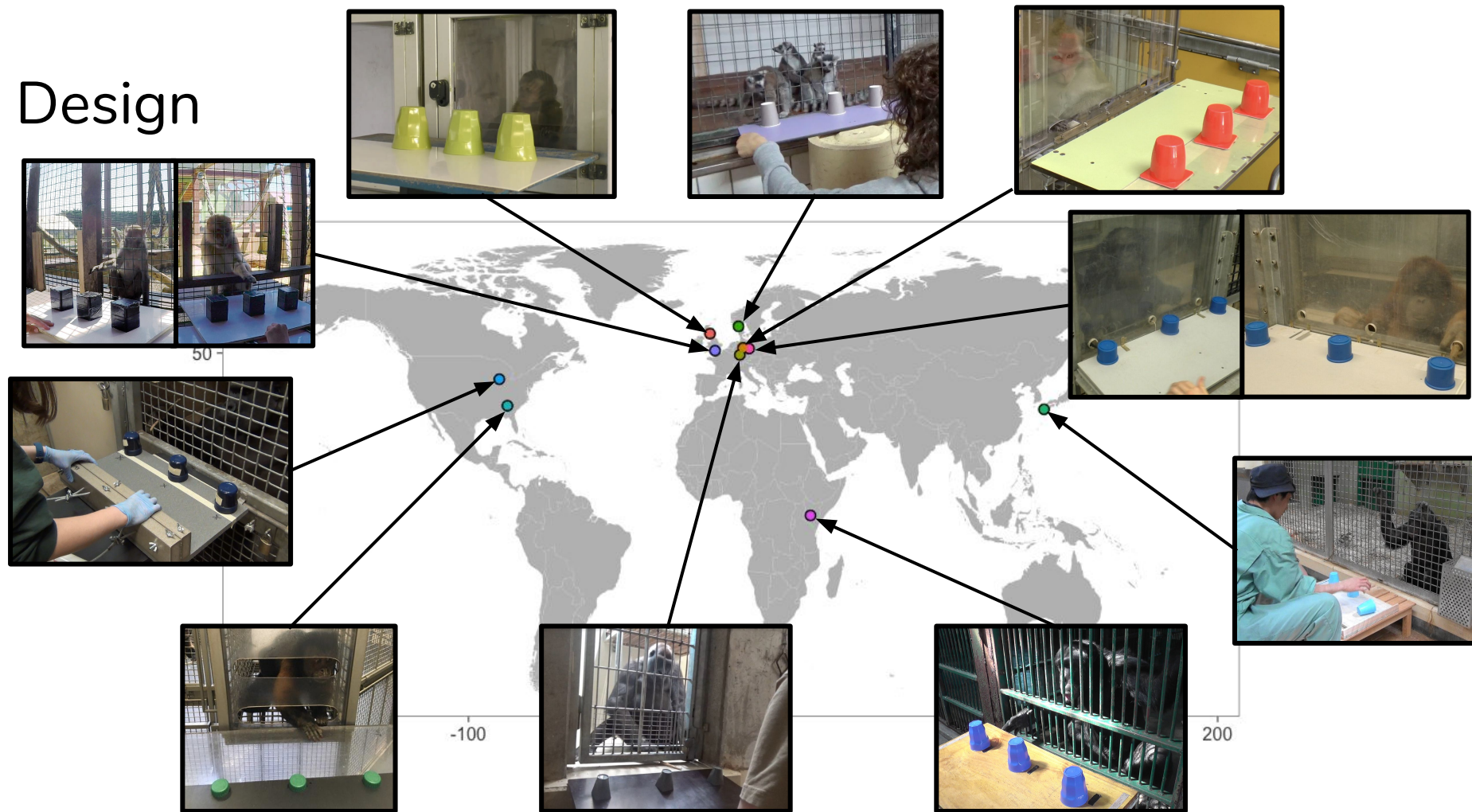
Timeline

Dec 17:	Initial contact
Jan 18:	Decision on topic for pilot study
Feb 18:	Pre-registration of design and analysis
Mar - July 18:	Data collection
Ongoing :	Data analysis and writing

Data collection sites



Design

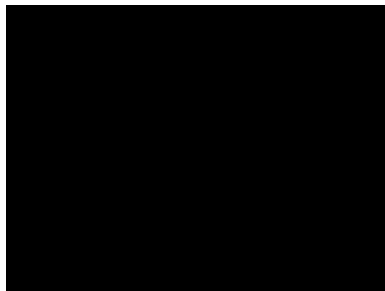


Design

Rhesus Macaque - Medium Delay



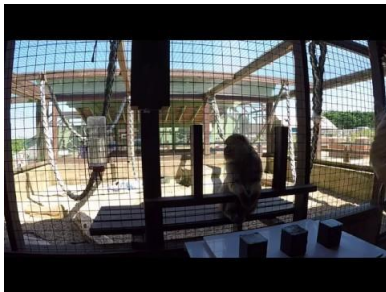
Chimpanzee - Medium Delay



Capuchin Monkey - Medium Delay



Barbary Macaque - Medium Delay

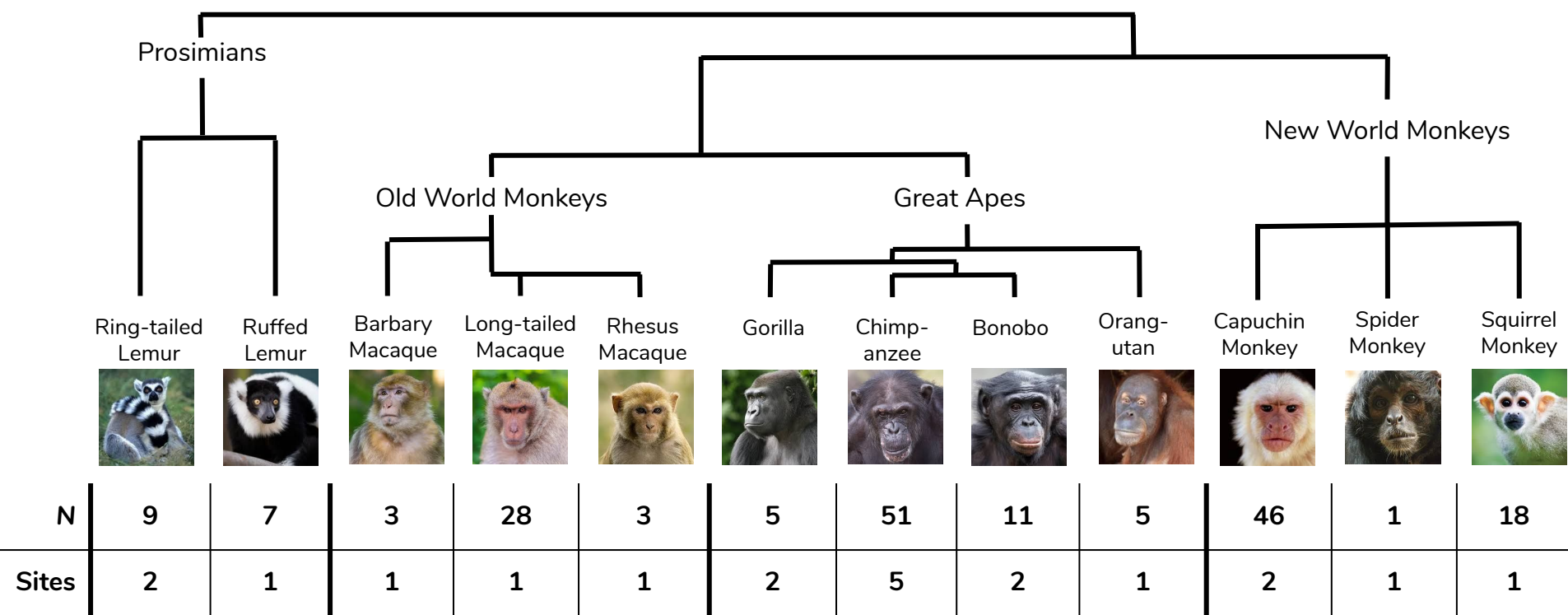


Squirrel Monkey - Short Delay



Sample

Total Species	12
Total Sites	13
Total N	187



Prosimians

New World Monkeys

Old World Monkeys

Great Apes

Ring-tailed
Lemur

Ruffed
Lemur

Barbary
Macaque

Long-tailed
Macaque

Rhesus
Macaque

Gorilla

Chimp-
anzee

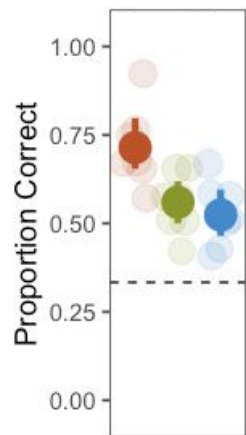
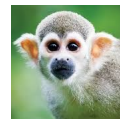
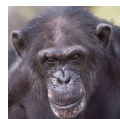
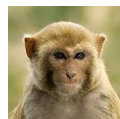
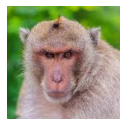
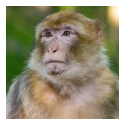
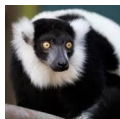
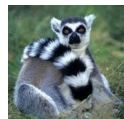
Bonobo

Orang-
utan

Capuchin
Monkey

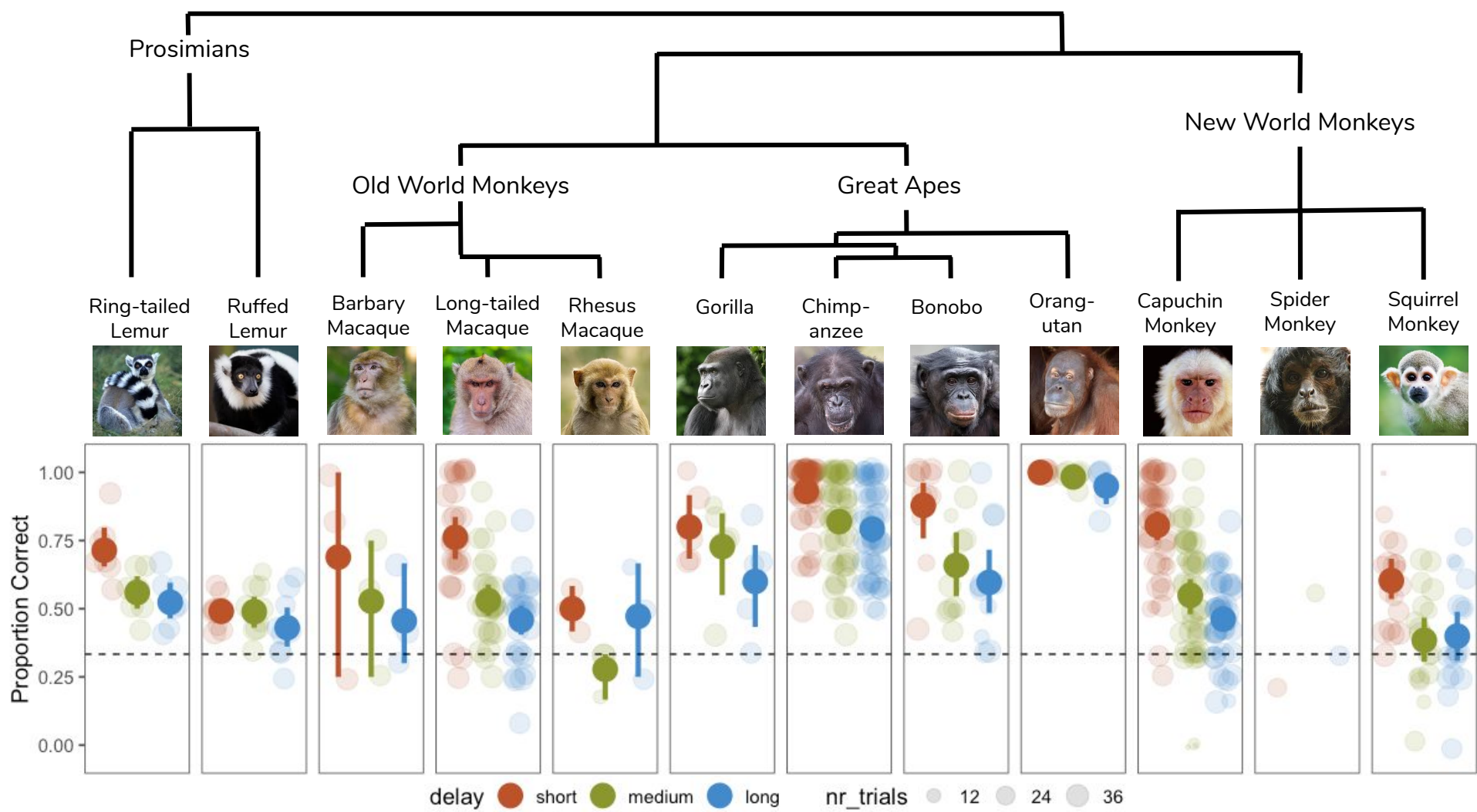
Spider
Monkey

Squirrel
Monkey



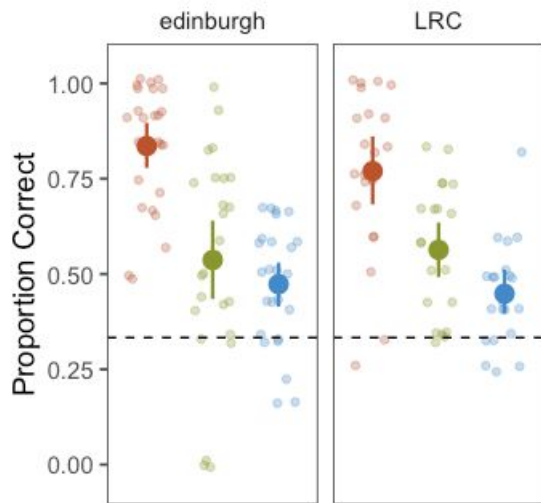
delay ● short ● medium ● long

nr_trials ● 12 ● 24 ● 36

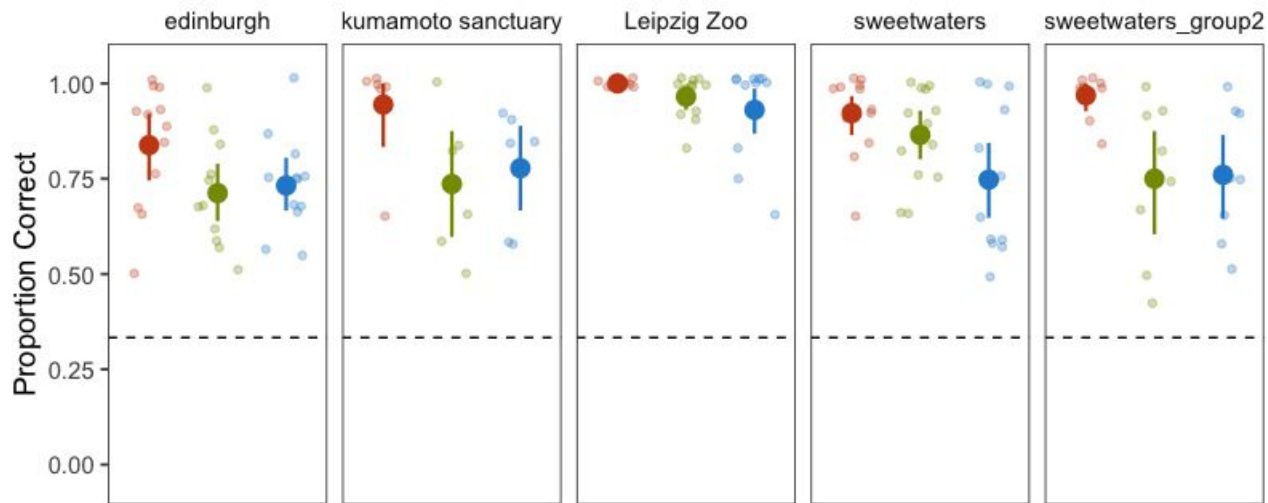


Variation across sites

Capuchin Monkeys

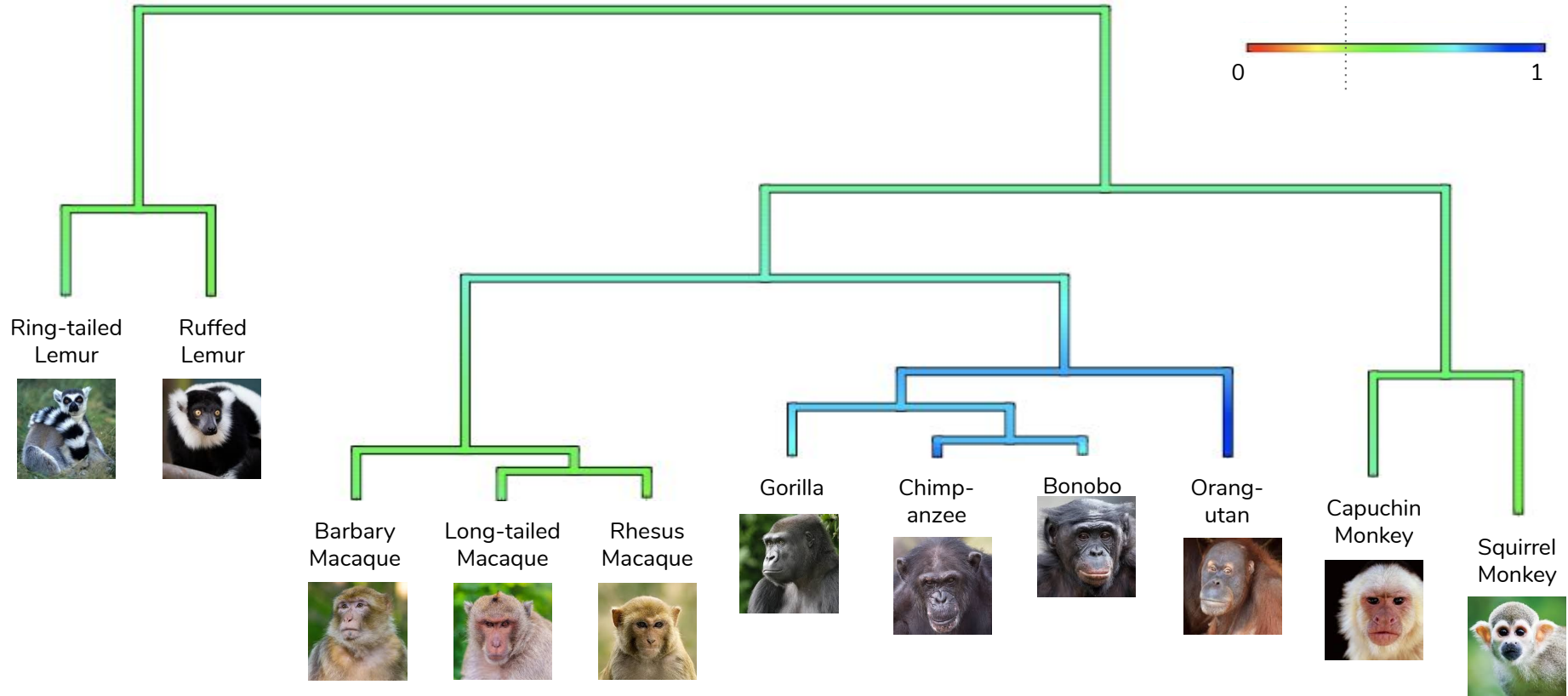


Chimpanzees



delay short medium long

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
- Collect ideas for future studies
- Further diversification (e.g. including non-captive samples)

Thank you!

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ManyPrimates website:

<https://sites.google.com/view/manyprimates>

Code and data:

https://github.com/manuelbohn/ManyPrimates_pilot

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

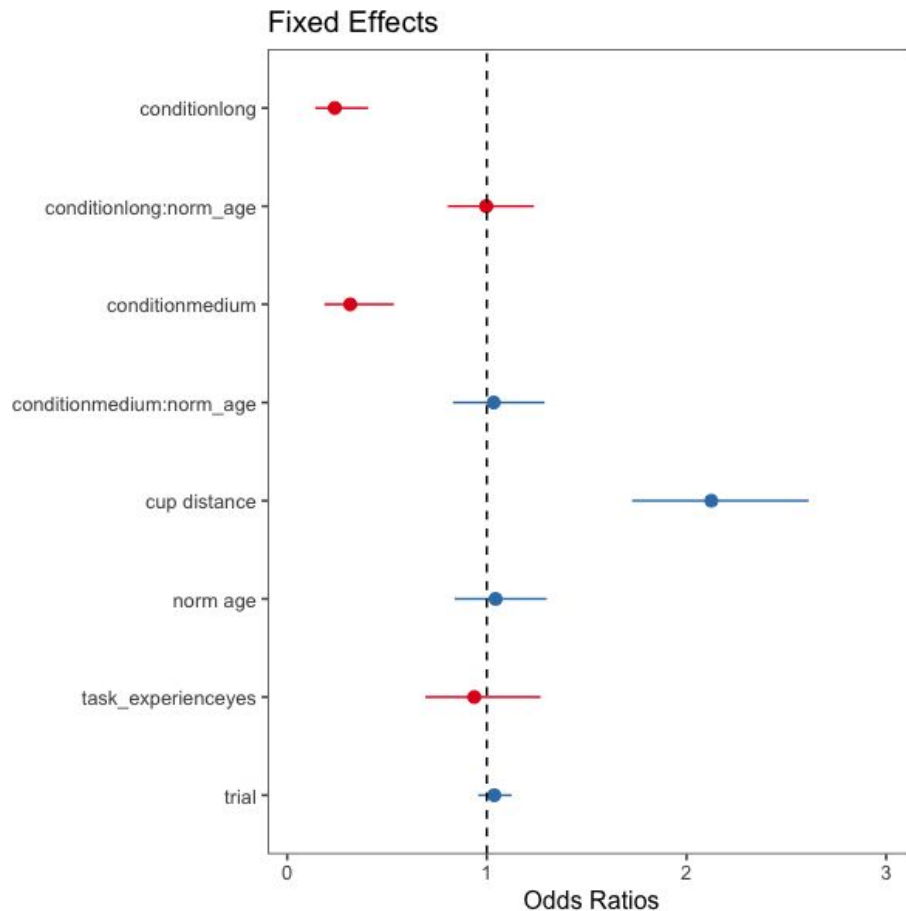
Results

Generalized linear mixed model:

```
correct ~ condition * age +
```

```
  task_experience + cup_distance +  
    board_size + trial +
```

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



Results

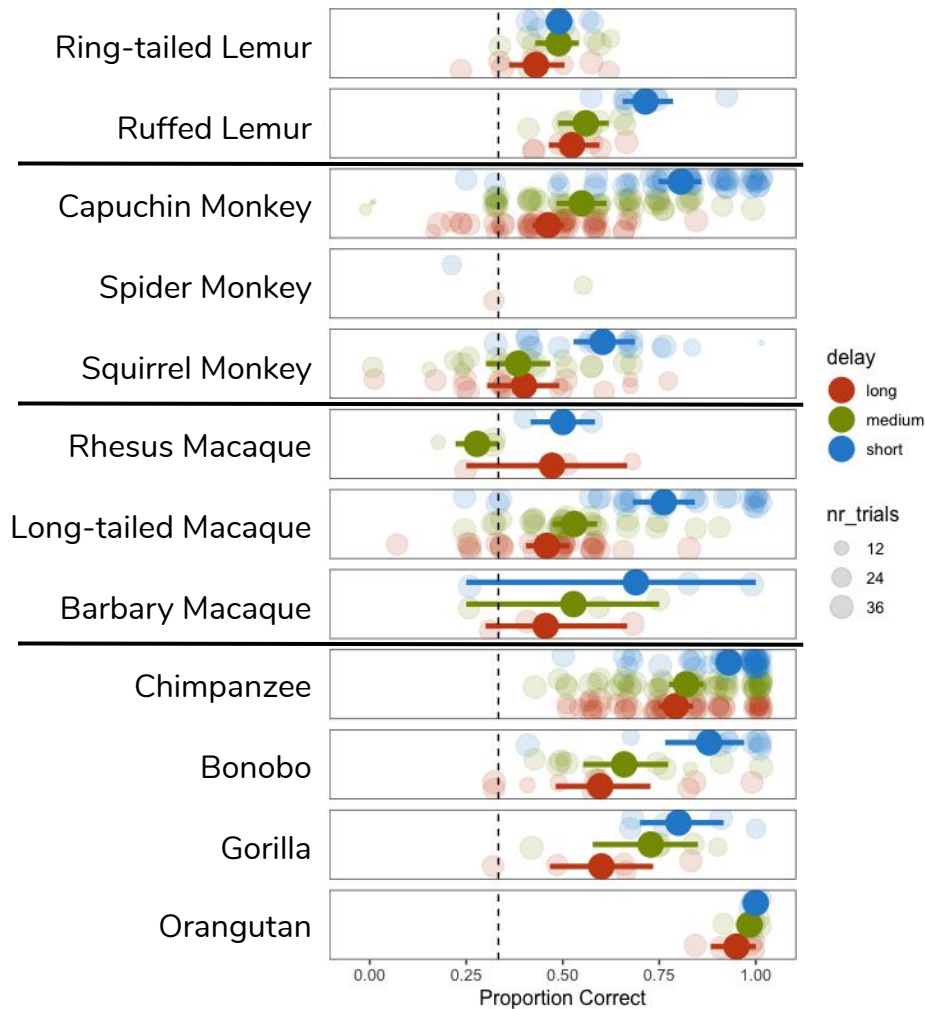
Generalized linear mixed model:

```
correct ~ condition * age +
```

```
task_experience + cup_distance +  
board_size + trial +
```

$$\beta_{\text{medium}} = -1.153, p > .0001$$

$$\beta_{\text{long}} = -1.433, p > .0001$$



Results

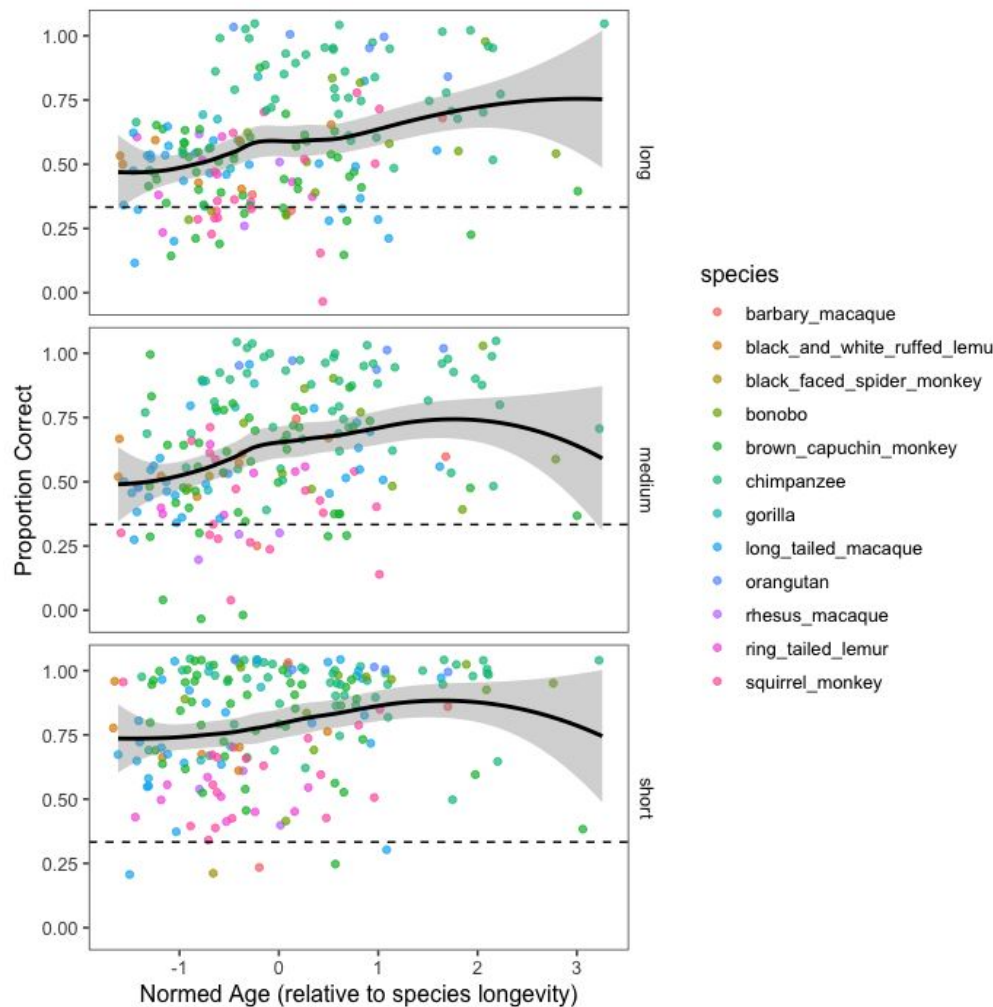
Generalized linear mixed model:

```
correct ~ condition * age +
```

```
  task_experience + cup_distance +  
    board_size + trial
```

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

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



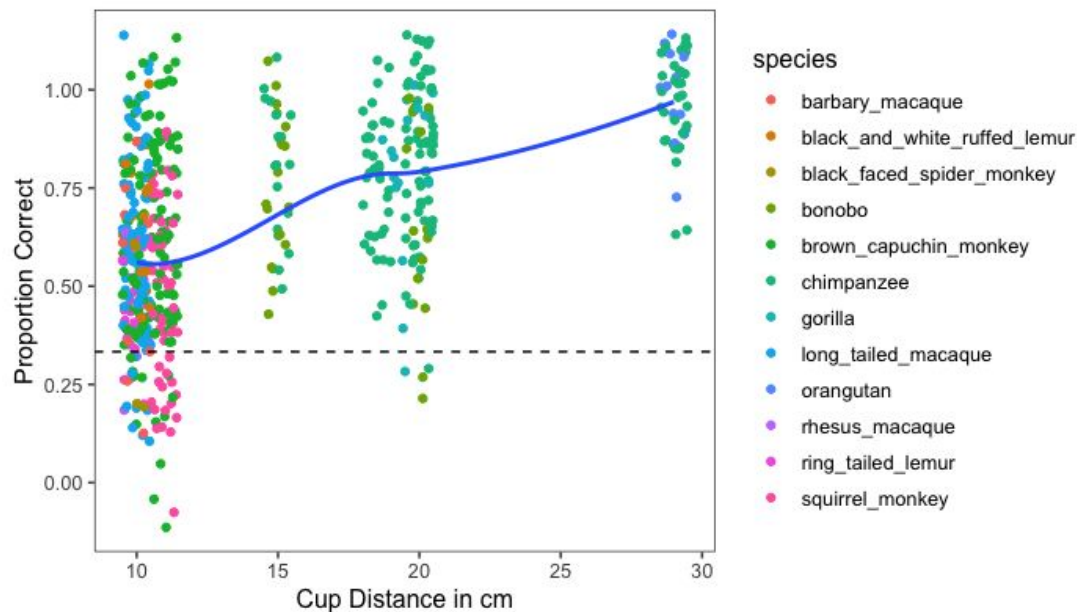
Results

Generalized linear mixed model:

```
correct ~ condition * age +
```

```
    task_experience + cup_distance +  
    board_size + trial +
```

$\beta_{\text{medium}} = 0.753$, 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

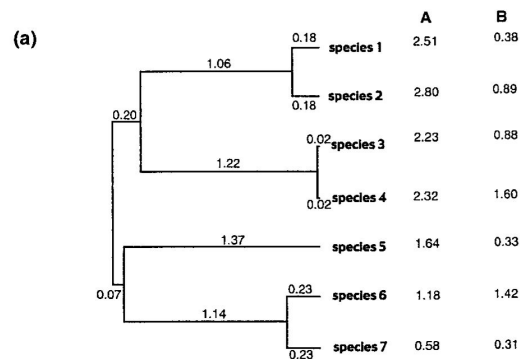
Phylogenetic analysis

Based on data averaged across conditions

Phylogenetic signal (Lambda - λ):

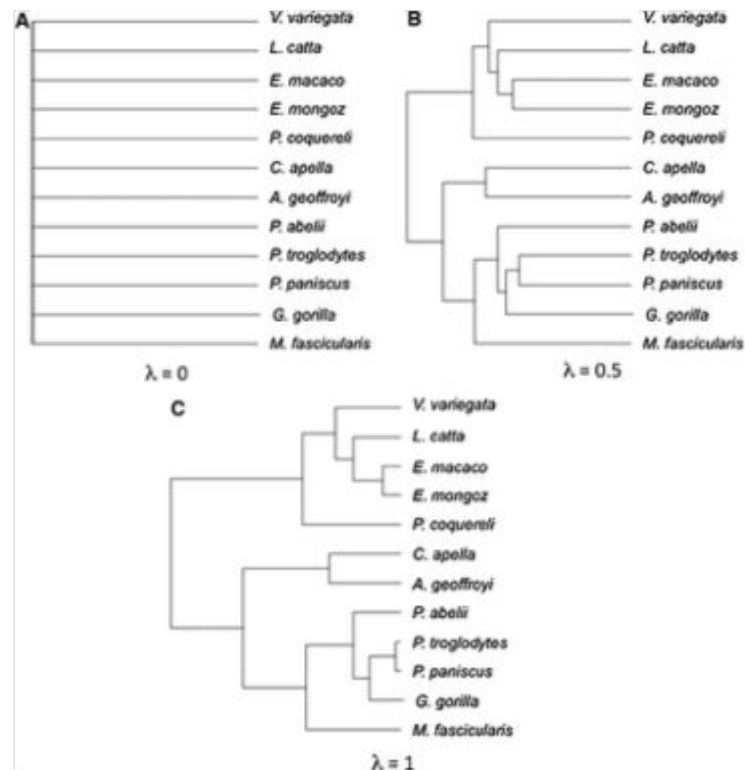
- Base λ : 0.74, $p = .26$
- Updated λ : 0.79, $p = .02$

More about λ

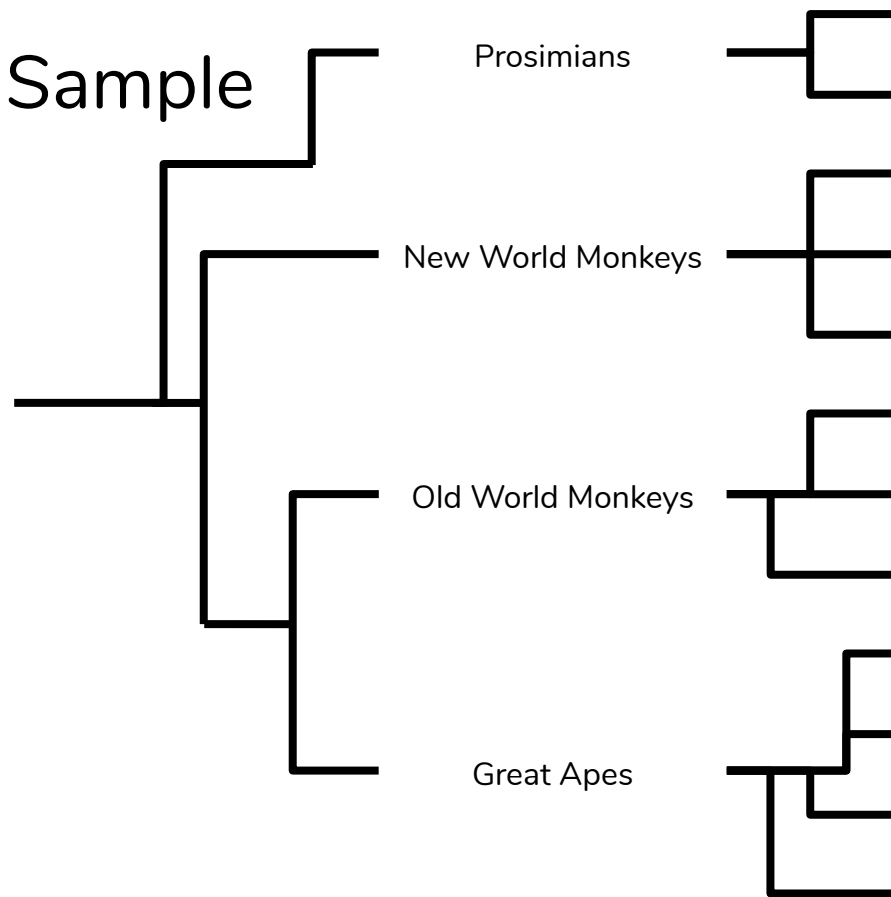


(b)

	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

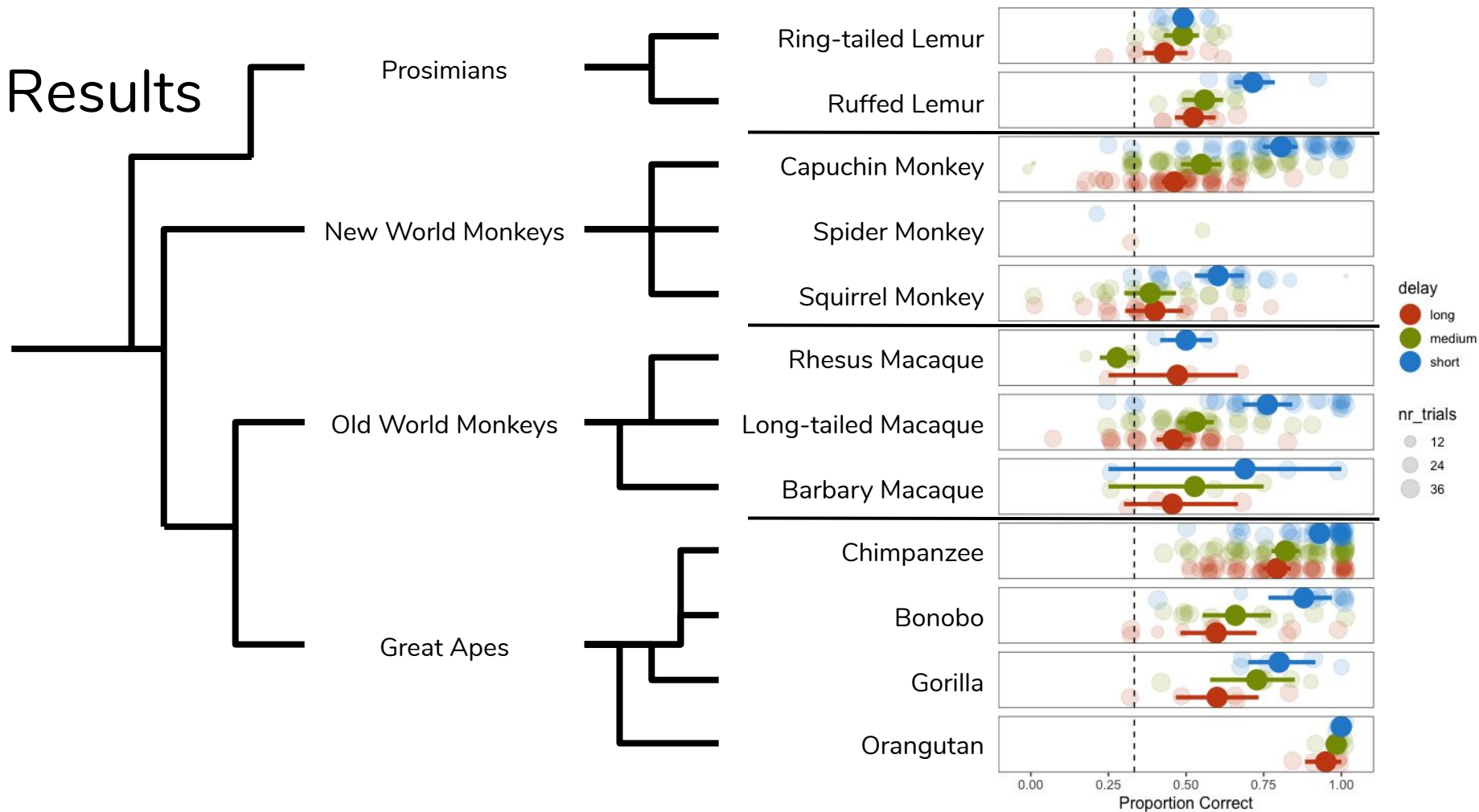


Sample

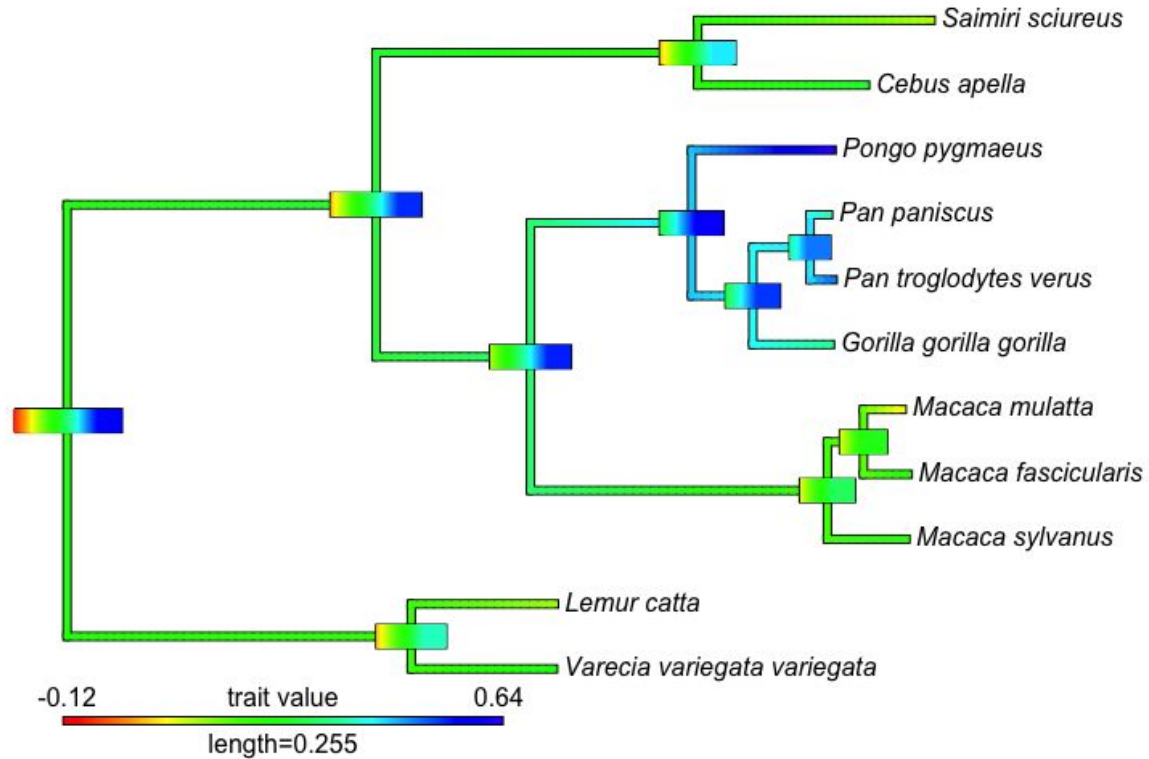


Species	N	Sites
Ring-tailed Lemur	9	2
Ruffed Lemur	7	1
Capuchin Monkey	46	2
Spider Monkey	1	1
Squirrel Monkey	18	1
Rhesus Macaque	3	1
Long-tailed Macaque	28	1
Barbary Macaque	3	1
Chimpanzee	51	5
Bonobo	11	2
Gorilla	5	2
Orangutan	5	1

Results



Phylogenetic analysis



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!

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