

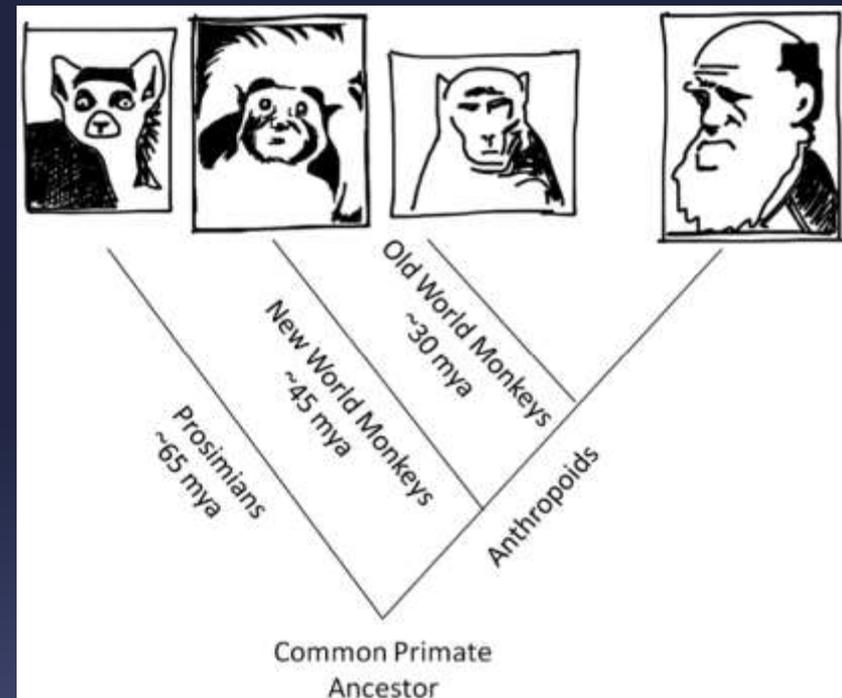
Understanding how
obstacles affect tool-use:
experiments on cotton-top
tamarins, *Saguinus oedipus*
Oedipus

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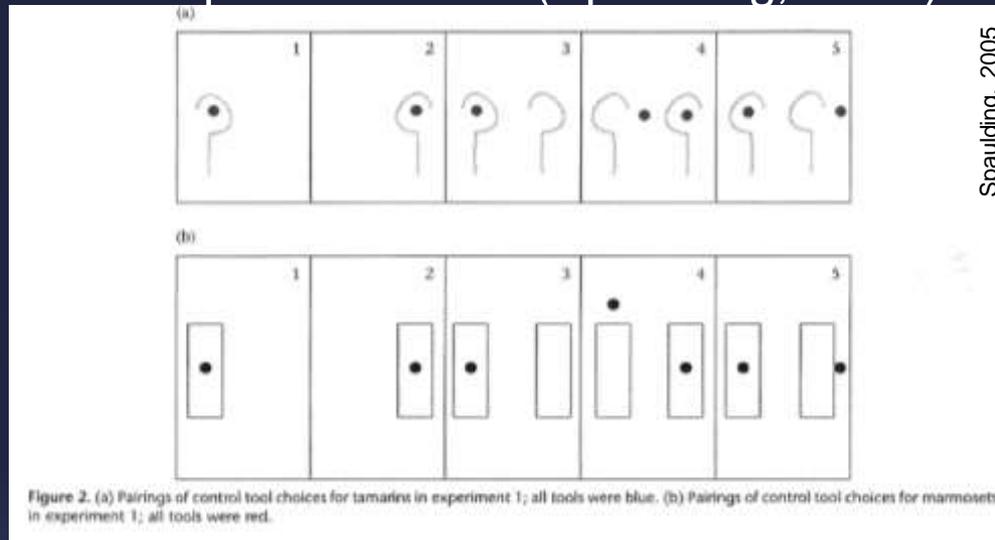
Rationale

- A New World monkey species
- Common ancestor to humans
- Small cooperative breeding species
- Rare family structure and cognitive abilities



Tools

- Individual uses an object in relation to another object, in a situation with ample motivation (Spaulding, 2005)



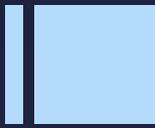
- Once thought to be a characteristic limited to humans because it requires a sophisticated level of intelligence (Tomasello, 1997)
- Non-human primates are capable of using tools in order to accomplish tasks (Brewer, 1990)

Cognition involving tool-use tasks

- (Morell, 2008) To understand concepts & complete tasks primates require:
 - An in depth thought process
 - Understanding of surroundings
- Develops from non-functional behaviors (Leca, 2008)
 - Form of object play

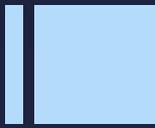
Spatial cognition of primates

- How to understand one's spatial layout? (Tolman, 1932)
 - Adapt behavior in spatial situations (Tomasello, 1997)
 - Cognitive maps help to fill in gaps (Tomasello, 1997)
- Primates' mental representation of objects when not visible and the movements of objects in manipulative space were evaluated (Piaget, 1954)
 - spatial memory and cognitive mapping skills



General tool-use studies

- Chimpanzees are capable of making different types of tools for different purposes (Brewer, 1990)
- Through a tool-use study, tufted capuchin monkeys revealed the ability of self-control (Evans, 2006)

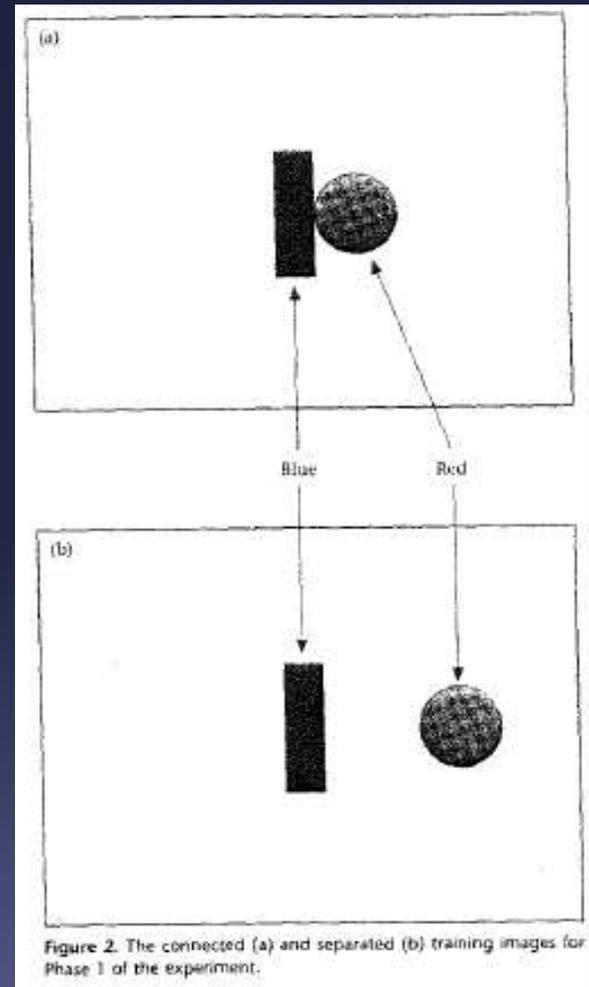


Tamarins using tools in wild setting

- Free-ranging golden lion tamarins observed using tools in setting equivalent to wild
- Captive tamarins' behavior matched wild tamarins behavior possibly due to:
 - Complexity of free-ranging environment
 - Social transmission
 - Suggest link between extractive foraging and tool-use

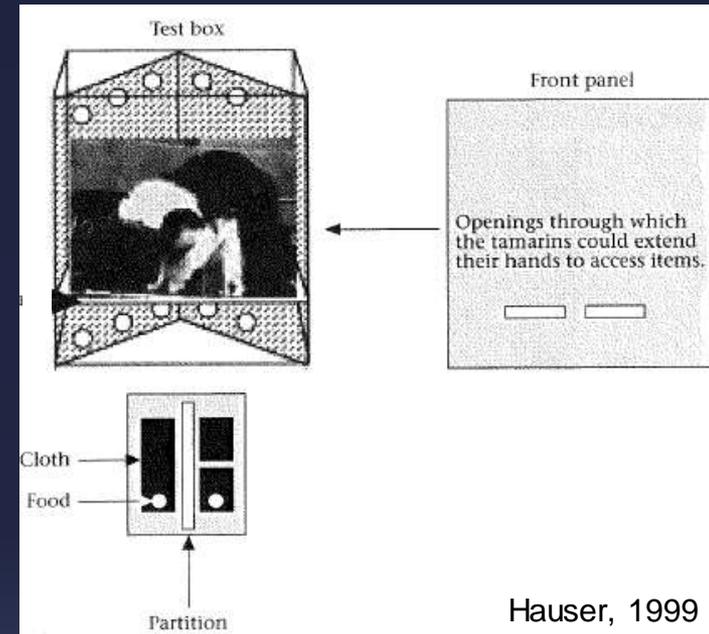
Tool-use Studies with cotton-top tamarins

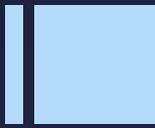
- Understand properties of objects (Kralik, 2002)
- Understanding properties of solid objects (Santos, 2006)
- Represent absent objects & figure out locations when objects are seen being moved or not (Neiworth, 2003)



Tool-use Studies with cotton-top tamarins

- Able to understand the relevant and irrelevant features of a problem in a means-end task (Hauser, 1999)
 - Mechanism that deciphers between relevant and irrelevant (Spaulding, 2005)
- With little training cotton-top tamarins can understand how tools are connected to one another (Santos, 2005)





Research Question

- Are cotton-top tamarins, by recognizing the relevant features of a problem and understanding how obstacles affect their performance, capable of using tools successfully?

Hypotheses

- H1: The tamarins are capable of pulling the cane and attaining the raisin, understanding that pulling on the cane results in a reward.
- H2: The tamarins consistently pull the correct cane in each trial, after the obstacle changes sides, providing evidence that they understand that when the obstacle changes sides, the side with the obstacle still results in not attaining the food.
- H0: The tamarins will not be able to attain the raisin by using the tool and understanding the effect of the obstacle on the problem.

Methods: subjects

- Nine cotton-top tamarin monkeys at FSU
 - Five females; four males
 - 7 – 17 years old
- Had previous tool-use exposure
- Training (six days; two-five trials daily)
 - Apparatus with single cane; no obstacle



Methods: Set-up

- Designed to assess tamarins' ability to understand obstacles in problems involving tool-use
 - Observed subjects while they attempted each situation
- Six trials per session
- Used *Stat trek*: online random sequence generator



Methods: procedure

- Tester authorized to enter cage wheeled a cart with the apparatus inside and then set up the apparatus appropriately for each trial
 - Second tester (me) recorded time it took for monkey to complete a trial
- After 5 minutes of failing to attempt trial subjects timed out
 - Timing out twice in a row, testing was ended with the pair for session



Hole Condition



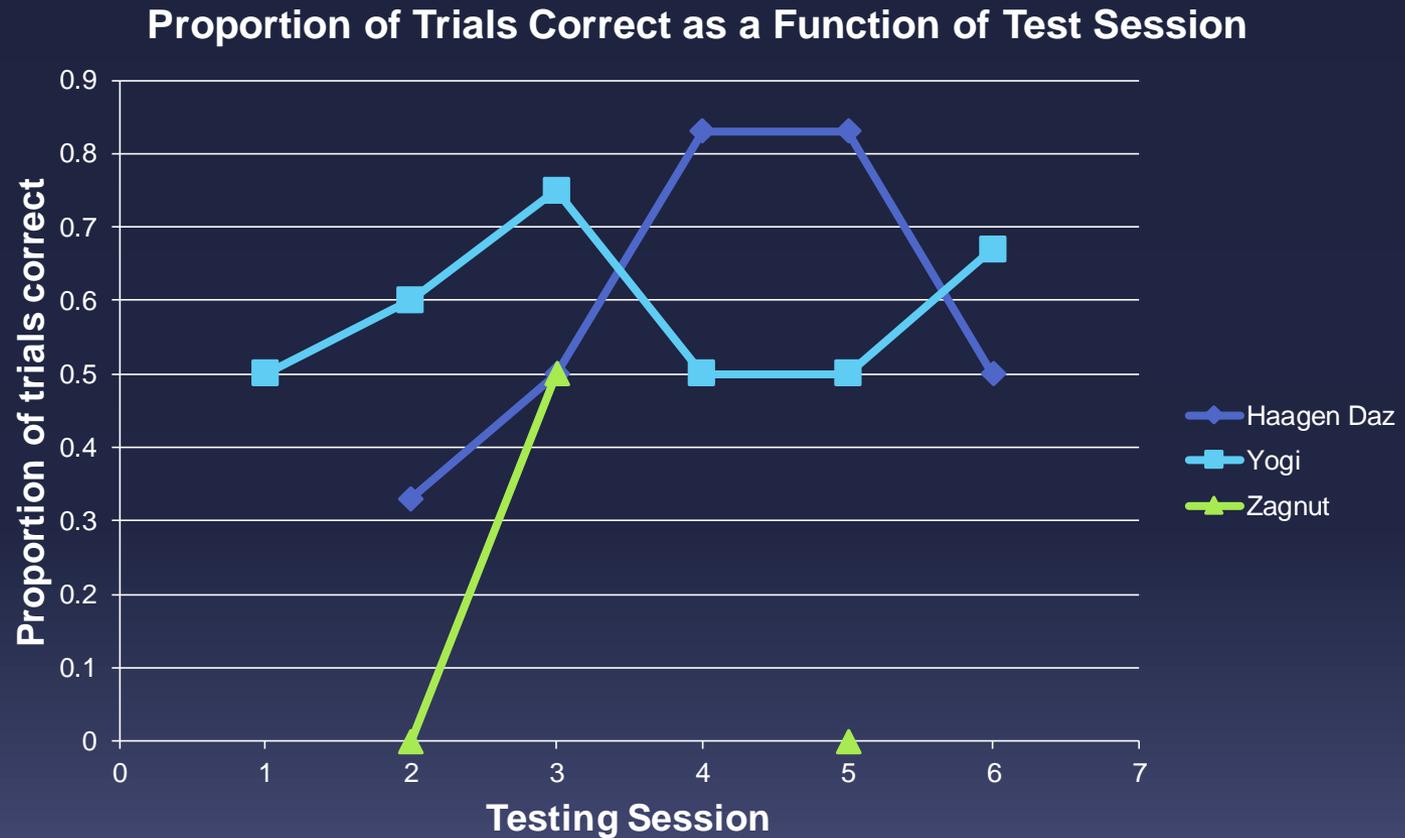
Tested for 3 days, once a day

Stopper Condition



Tested for 5 days, once a day

Results – Hole Condition

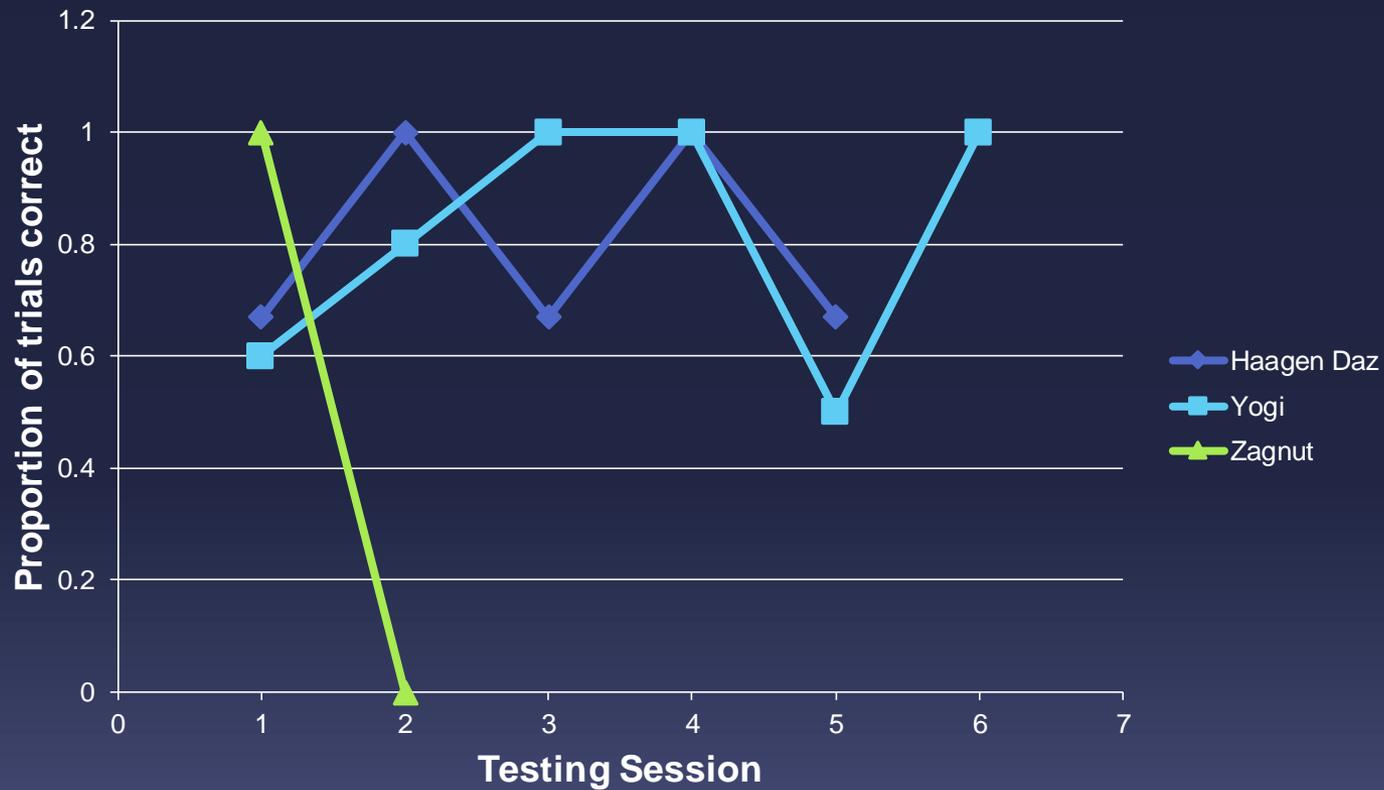


P-value > 0.05

Haagen Daz: $p = 0.08$
Yogi: $p = 0.08$
Zagnut: $p = 0.16$

Results – Stopper Condition

Proportion of Trials Correct as a Function of Test Session

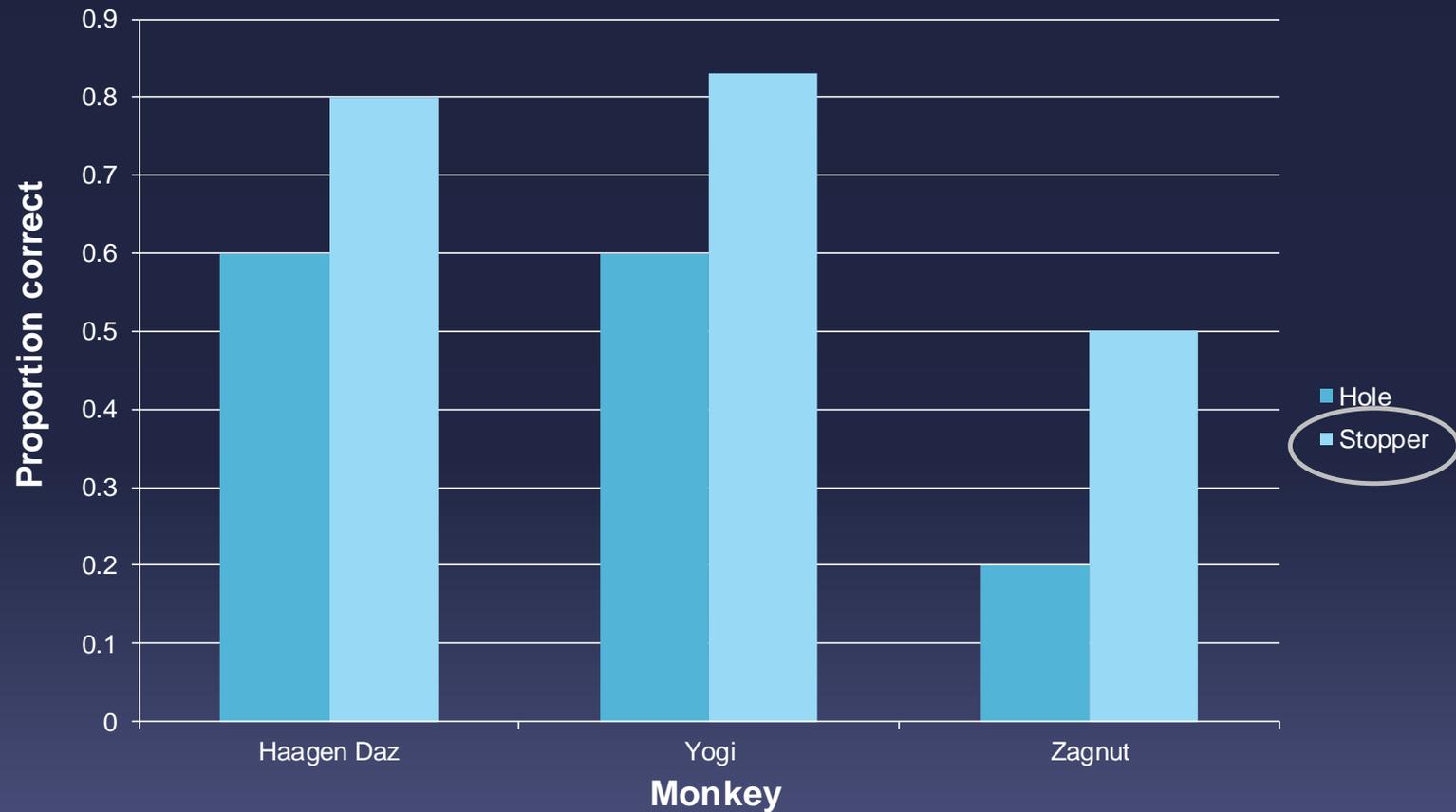


P-value < 0.05

Haagen Daz: $p = 0.0006$
Yogi: $p = 0.0001$
Zagnui: $p = 0.05$ } Confirming both hypotheses

Results

Comparing proportion of responses correct in both conditions



Discussion

- Two monkeys in Stopper condition confirmed both hypotheses
- Behavioral characteristics affected results
- Potential competition



Limitations

- Lack of participation
- Time constraint
- Competition between pairs



- Limited data

Future Research

- Larger sample size
- Longer time period
- Testing subjects individually



- Collect larger amount of data

Conclusions

- Results confirm Hauser's 1999 and 2005 tool-use study
 - Cotton-top tamarins are able to solve tasks involving tool-use
- Can use past knowledge to solve a new problem (Piaget, 1954)
 - Cognitive maps (Tomasello, 1997)
- Results influenced by environment (housed in pairs) (Stoinski, 2001)
- Only in the Stopper condition could two subjects understand the concept of what role an obstacle plays in solving a problem using tools

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Major Findings

- Cotton-top tamarins are able to solve tasks involving tool-use
- Cotton-top tamarin can understand how certain obstacles affect tool-use but not others
- Only in the Stopper condition could two of the subjects understand the concept of what role an obstacle plays in solving a problem using tools
- Questions?