

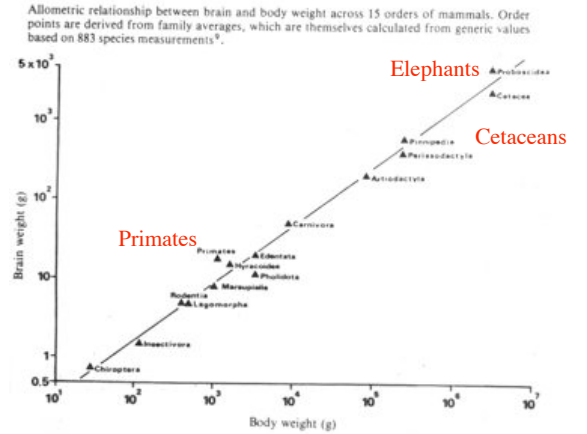
ANBI 159: Biological and cultural perspectives on intelligence

Lecture 5: Animal learning

GOT THROUGH AI CUPS ON WEDNESDAY

<http://weber.ucsd.edu/~jmoore/courses/>

EQs for mammalian Orders



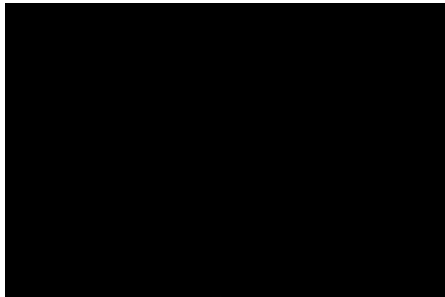
The comparative method

Who wants to know “how smart is a tortoise”?

(what would that mean?)

but “are tortoises smarter than turtles”??

Comparative method is formalization of this, founded on idea that by looking for correlates of variation, one can discover what that variation is “for”.



The comparative method

BUT: correlation is not causation!

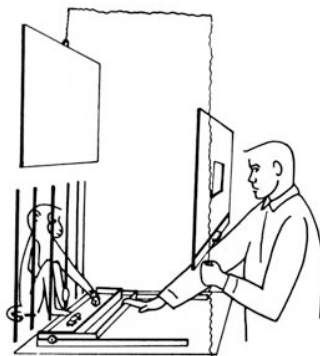
eg: number of buildings on UCSD campus and global temperature

Presence of milk in refrigerator and absence of elephants in the kitchen

So can’t stop with discovery of possible pattern. MUST ask, *does hypothesized cause generate specific, testable predictions?*

Testing procedure

So: you make some kind of test and then carefully trained scientists give the test to a bunch of individuals of every species we’re curious about, and then we rank their performance -- right?



Testing procedure

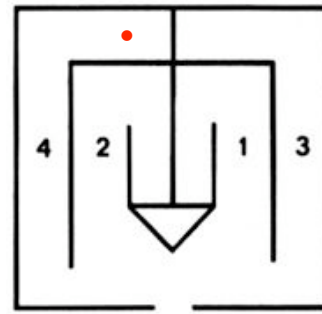
Well, you can...

But are all animals equally suited for the test? Back to that tortoise... Many tests are based on what humans do; who is testing whom at top?



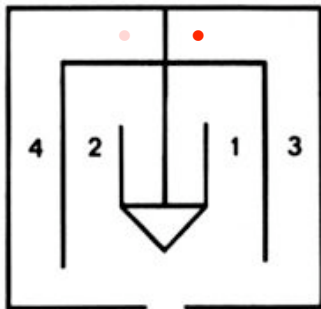
Rats do well at mazes because they are adapted to living in burrows. Squirrels do well at memory tests because they are adapted to hide and find nuts.

We need a “species fair” intelligence test.



Reversal paradigm

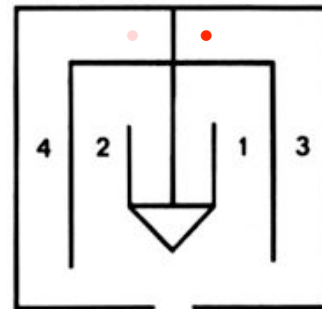
Teach a very simple task (“food is to the left”) until subject is doing as well as it can.



Reversal paradigm

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Then switch the reward to the opposite, and wait until the subject reaches the same level of performance.

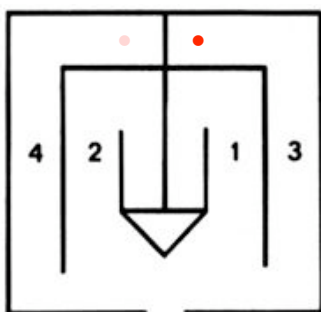
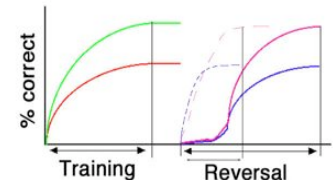


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Training : Reversal



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It seems reasonable but e.g. have had some overlap between high-scoring rats and low-scoring undergrads.

Are You Smarter Than a Chimpanzee?
 By Brandon Kim | December 03, 2007 | 2:25:30 PM | Categories: Animals, Behavior, Evolution

If the existential malaise of yet another Monday hasn't already got you down, here's something more: chimpanzees are probably better than you at math.

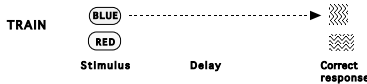
Well, not all math -- let's see Bonzo do quadratics -- but at basic numerical memory. And while you shouldn't trade your Texas Instruments TI-89 for a chimp just yet, Kyoto University cognitive scientist Tetsuro Matsuzawa thinks you should change your conception of human.

In a study due to be published tomorrow in *Current Biology*, Matsuzawa showed a computer screen grid of nine numbers to six chimpanzees, all trained to recognize the ascending nature of arabic numerals, and nine college students. When subjects touched one number, the others disappeared. Then they had to touch the squares in the order of the numbers that used to be there.

When the original numbers remained on-screen for seven-tenths of a second, the college kids fared as well as Ayumu, the most prodigious of the chimps. Both had a success rate of 80 percent. But when the numbers flashed for just four-tenths of a second or less, Ayumu's success rate stayed the same, while the others plummeted to 40 percent. Even with six months of training, three students still couldn't beat Ayumu.

... and don't forget
There is no agreed-upon general 'intelligence test'.
Let's test you against Ayumu...

Studying animal learning: operant conditioning



Chimpanzee Ai on 1st day training; in room with keyboard, one lit key. When wanders close, buzzer sounds, food drops. Once staying near keyboard, only gets buzzer when focus on lit key. In 10 minutes, she's pressing key & getting food like a pro.

THEN, start e.g. showing stimulus, offering pair choices, only when touches 'correct' key get food -- "match to sample". THEN, can start asking questions about *what* she's learning, and how.

Match to sample

Ai (1991) 1m 55s

Now to let a chimpanzee make a monkey of you ...

Ayumu (son of Ai, colleague of Tetsuro Matsuzawa at Kyoto University), learning to 'count'. Touch circle, numeral comes on; touch numeral, get buzzer (reinforcer) and then treat.



Has some trouble learning 1, 2 (vs 2,1)

SHOWTIME: Now, as soon as Ayumu touches "1", all the other numerals are blanked out. See if you can do it.



Distractible pupils are a problem ...

... well, if human.

So - formal tests don't *seem* to work well, and EQs also yielded counterintuitive results...

Look at some more examples of behavior.

The grey text is summary, for website; can ignore it if you're seeing the video!

Scene from the movie "Link", in which orangutan in suit & bow tie greets visitor, carries her bags (after turning off tape recorder that is apparently playing language lessons) and shows her to her room.



The standard view of "intelligent animals"...
How smart *is* this orang-utan, based on this??

Link 1m 30s

Cebus monkey playing a video game (using joystick to follow moving onscreen cross); grimaces, looks totally "in to it". Voiceover notes performance comparable to human.



Watch the monkey's expressions.

Monkey in the Mirror 30s

Young raven confronted with new problem -- meat tied to string suspended from branch -- "figures out" how to pull the string up using claws to hold it after each beak pull.



This seems "intelligent" but is it "insight" or rapid learning?

Note Heinrich's comment that bird doesn't fly away after learning that the meat is attached. Is that the only possible explanation?

Animal Einsteins 2m 41s

Rhesus monkeys at Cayo Santiago Island:
• 2 researchers put 2 or 3 apple slices into container; rhesus immediately goes to one with 3 -- since no reason for monkey to expect problem, suggests they spontaneously count.
• Using "magical stage", provoke longer stare from rhesus following 'impossible' event (sees 2 limes go behind a screen, but only one there when screen lifted) -- similar to 3-month human infant.



There are *many* methodological similarities between studies of children and nonhumans.

Animal Einsteins 4m 30s

Wild chimpanzees (Guinea) crack nuts using stone hammer/anvil; one observation using 3rd stone to prop anvil to make it horizontal -- "meta-tool use".



Then lab at Kyoto, where Matsuzawa hands Ai children's stackable cups, she spontaneously stacks them up. When finishes, she spontaneously hands stack to Matsuzawa and turns, he scratches her

**So, in the end, is this "intelligent"??
Does that question make sense?**

back. No 'instructions' on what to do with cups (though he praised her when she correctly stacked a cup).

Ai (1991) 3m 44s