

INTRODUCTION & MEASURING ANIMAL BEHAVIOR



Photo courtesy: USDA



What is behavior?

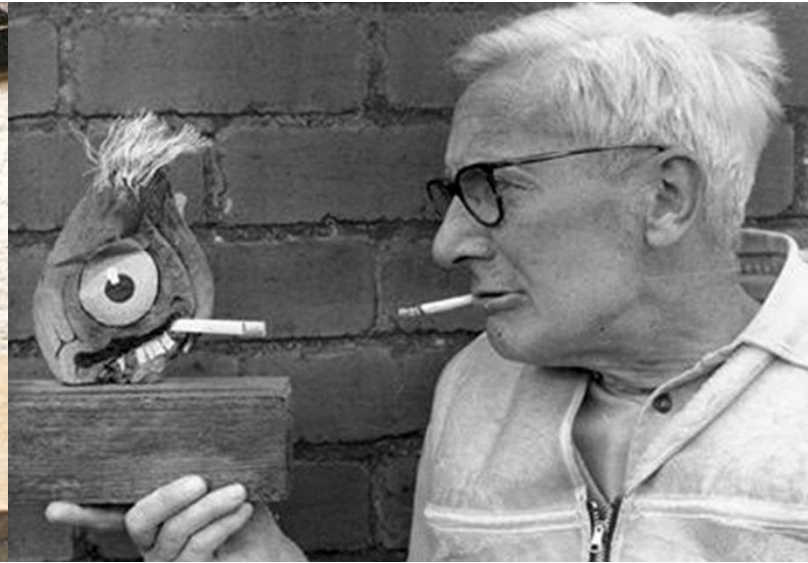
- “Aggregate of responses to internal and external stimuli”
- Dictionary.com

**“The action, reaction, or functioning of a system, under normal or specified circumstances”
- Collins English Dictionary**

**“The response of an individual, group, or species to its environment”
- Merriam-Webster**



People



- Konrad Lorenz, Nikolaas Tinbergen, Karl von Frisch; 1973 Nobel Prize in Physiology or Medicine
- Temple Grandin



Fields and Terms in Animal Behavior

- Ethology (the science of animal behavior)
- Physiology and behavior
- Brain mechanisms of behavior (Neuroethology)
- Evolution of behavior
- Descriptions of behaviors (the Ethogram)
- Development of behavior (ontology)
- Applied animal behavior
- Psychology



The “why” of behavior:

Tinbergen’s 4 questions:

- Function -- What is the function of the behavior? (evolutionary adaptation)
- Phylogeny (evolutionary development)
- Mechanism/causation
- Ontogeny (development)

Example: Dog barking

- Function: communication within and between animals
- Phylogeny: barking developed as a way to socialize, warn, call others, etc.
- Mechanisms: which part of the brain causes barking
- Development: how does barking develop from puppy to adult?



Animal behavior and human significance

Benefits of understanding animal behavior:

- Child development and care
- Language analogues
- Early warning of environmental damage
- Population management
- Developments in domestic animal welfare
- Production industry efficiency
- Making better pet owners
(better for the animal and the human)



Image courtesy: <http://www2.gsu.edu/~wwwlrc/3476.html>



Proximate importance of behavioral observation

- Understand the effects of disease, stress, etc.
- Understand social organization
- Improve management techniques
- Improve animal welfare
- Understand companion animal behavior to improve care

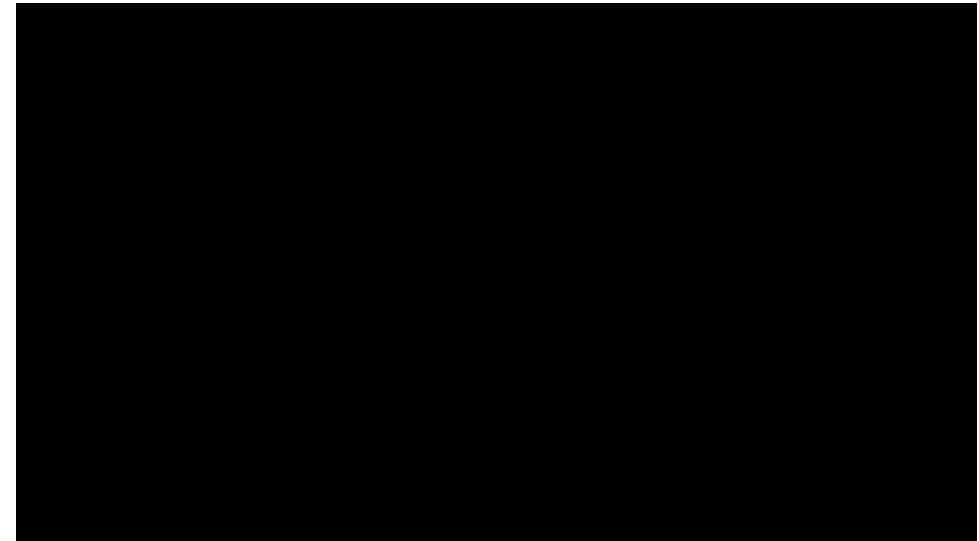


Photo courtesy: www.colostate.edu



Where to begin?

- You will likely have an animal or topic of interest that helps when choosing a subject.
- May need to narrow options down from a generalized population.
 - Use of cows as a representative model of ruminants.
- Questions typically originate from observations.
- You should be familiar with your species of choice before beginning study.
 - Behaviors that would be bizarre in one species may be completely normal for another species.



Getting to know your species

- Read up on the topic.
- May need to conduct an initial survey of a population
 - Recognition of patterns
 - Help formulate the hypothesis
- By knowing what is normal, you can decide how specific/generalized your observations need to be to answer the question.



Designing the observation study: animals

- 1) How many animals should be observed?
 - Unless you are focusing on a very small, specific subset of a population, it is typically ideal to observe as many animals as possible.
 - Ideally you should be able to identify individual animals.
 - Make sure the number you plan to observe will give you statistically sound results



OR



Designing the observation study: approaches

Focal approach

- Focus on a single individual
 - Pre-determined characteristic
 - Randomly chosen
- Describe behaviors in sequence
- Determine the duration of the behavior

Survey approach

- Watch many individuals at the same time
- Count the number of individuals engaged in each behavior
- More generalized idea of population behavior



Designing the observation study: behaviors

- 2) How should behaviors be described?
 - Develop a comprehensive catalog from the initial study.
 - Give each behavior a term and a description.
 - Differentiate between the actual behavior and its perceived function.
 - Quantify behaviors
 - Distance moved
 - Time spent eating
 - Consider adding subjective scores of qualitative behaviors
 - Note the context in which the behavior occurred.



I'm worried, stay away



I like you



Designing the observation study: behaviors

Individual Behaviors

- Also referred to as an “event”.
- Refers to each behavior as its own unique occurrence
 - Walking, jumping, running
 - Best summarized as number of events per time period.

Grouped Behaviors

- Also referred to as a “state”.
- Refers to a collection of similar behaviors
 - Walking, jumping and running = locomotion
 - Best summarized as duration of behavior.



Designing the observation study: making observations



- Is live observation or video-recording better?
 - Things to consider:
 - Time constraints
 - Will your presence affect the animal's behavior?
 - Availability of a power source
 - Availability of personnel



Summarizing the results: the ethogram

- Catalog of behaviors.
- May cover one class of behaviors
 - Vocalization = whining, barking, growling, etc.
- May cover a wide range of behaviors.

Behavior	Description
Head in food/water dish	Cat is actively eating or drinking; or, cat is showing significant interest in food or water
Sitting or Lying – not touching	Cat is sitting or lying with no body part in direct contact of other individual.
Sitting or Lying – touching	Cat is sitting or lying with some part of body in direct contact of other individual.
Aggression	Cat is actively engaged in fighting, hissing, or dominance behavior.
In litterbox – not using	Cat is sitting, standing, or lying inside litterbox, but is not actively using it.
Using litterbox	Cat is urinating or defecating inside litterbox.
Grooming self	Cat is grooming own body.
Grooming other	Cat is grooming body of other individual.
Sleeping	Cat is lying in a relaxed state with eyes closed.
Neutral social interaction	Cat is engaged in non-aggressive interaction with other individual, such as nose-touching or rubbing ¹ .
Locomotion	Cat is walking , pacing, running, or climbing.
Play	Cat is engaged in activity for sake of amusement; either alone or with other individual.



Summarizing the results: time budgets

- Percentage of total observation time animal spends in each behavior.
- Easy to derive from raw data.
- May be easier for audience to understand than behavior counts.

DOG BEHAVIORS BY PERIOD					
PER	TRT	SIT	LAY	STAND	MOVE
1	A	28%	62%	7%	3%
2	A	15%	82%	2%	2%
3	A	3%	68%	8%	20%
1	B	25%	67%	5%	3%
2	B	25%	73%	0%	2%
3	B	28%	65%	2%	5%
1	C	3%	92%	0%	5%
2	C	20%	75%	2%	3%
3	C	27%	68%	3%	2%



Summarizing the results: transition matrix

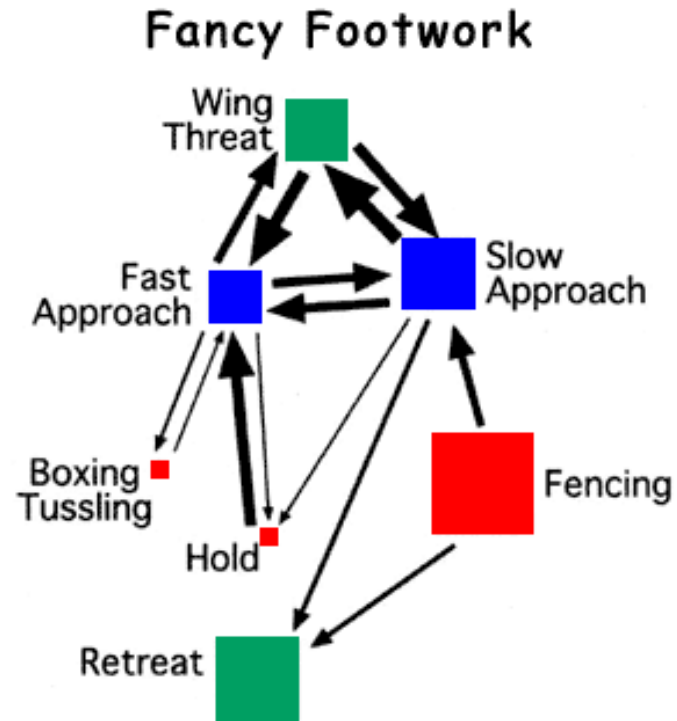
input \ output		A=0			A=1	A=2	A=3	
		lay	sit	stand	walk	trot	canter	gallop
A=0	lay	89.5%	4.4%	5.9%	0.2%	0.0%	0.0%	0.0%
	sit	4.9%	90.9%	1.9%	0.0%	0.4%	2.0%	0.0%
	stand	11.2%	3.5%	83.0%	2.2%	0.1%	0.0%	0.0%
A=1	walk	4.4%	2.3%	0.0%	90.1%	2.7%	0.4%	0.0%
A=2	trot	0.0%	0.0%	0.0%	2.8%	94.8%	2.3%	0.0%
A=3	canter	0.0%	0.0%	0.0%	0.0%	0.3%	72.7%	27.0%
	gallop	0.0%	0.0%	0.0%	0.0%	0.0%	9.9%	90.1%

Figure courtesy: Gerencser et al., 2013

- A transition matrix expresses the probability that behaviors occur in a sequence.
- Allows for easier recognition of behavioral complexes and relationships.
- Rows = preceding behavior,
- Columns = succeeding behavior.



Summarizing the results: flow chart



Ethogram courtesy labworks.hms.harvard.edu/fruitfly/thriller

- Makes visualization of a sequence of events easier.
- Can have different formats to emphasize different points.



Conclusions

- Behavior is a complex field of study.
- It is necessary to understand the organism of interest.
- Experimental design must take into account the goal of the research.
- Method of reporting results should an objective description of the behaviors
- The discussion begins by re-stating the major results and how then agree or not with the literature; then synthesis the findings in an overall conclusion



Image courtesy: www.bbc.com

