

INTRODUCTION & MEASURING ANIMAL BEHAVIOR

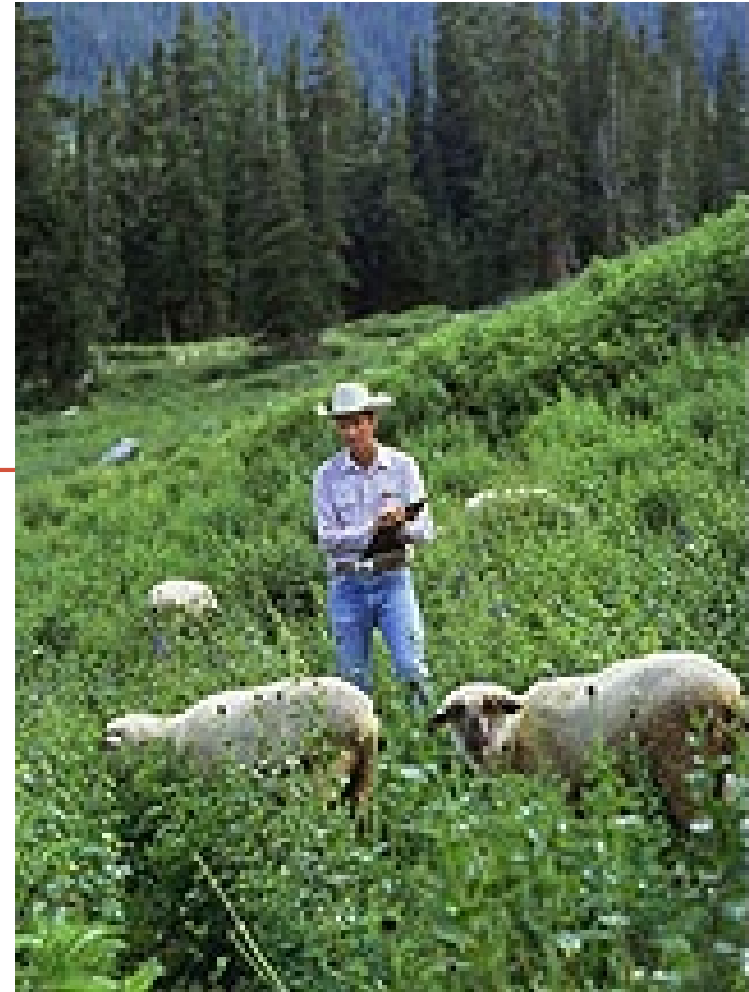


Photo courtesy: USDA



What is behavior?

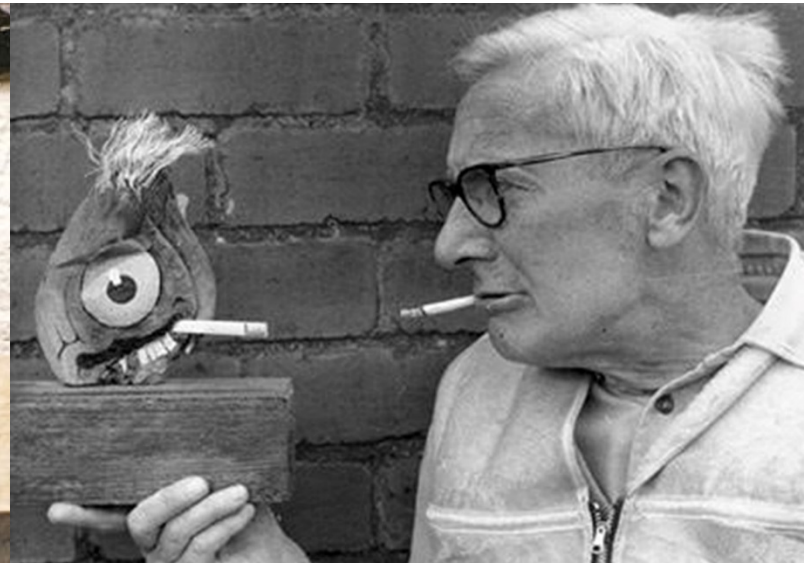
- “Aggregate of responses to internal and external stimuli”
- Dictionary.com

**“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
- Animal welfare science



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; behavior control (better for the animal and the human)
- Animal welfare (farm, companion, zoo, wildlife)
- Behavior and conservation biology (ex., wolf reintroduction)

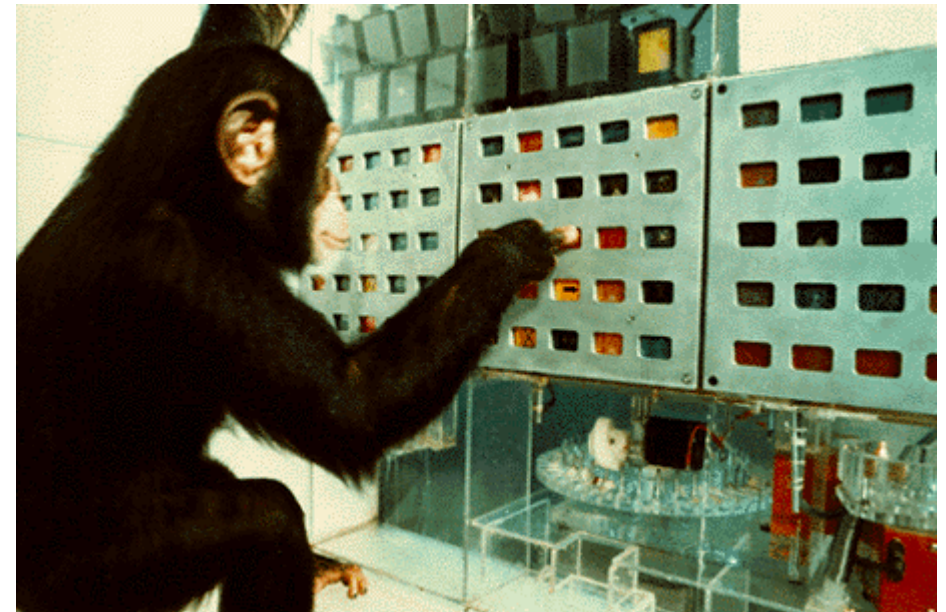


Image courtesy: <http://www2.gsu.edu/~wwwlrc/3476.html>



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



Semester project

- Goal: To completely observe, quantify and report birth and suckling of at least one of these: cattle, swine, sheep.
- Reporting is in the form of data, a written paper with still pictures and an edited video with highlights, and a short oral presentation.
- This is a scientific quantification of behaviors and a narrative of what happened.
- You must relate what you observe to what is published in the scientific literature.



Getting to know your species

- Read the scientific literature and books on your species.
- 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



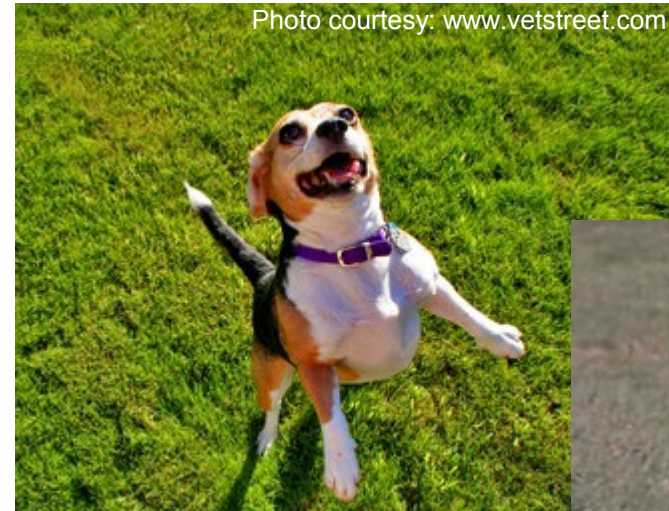
Designing the observation study: behaviors

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

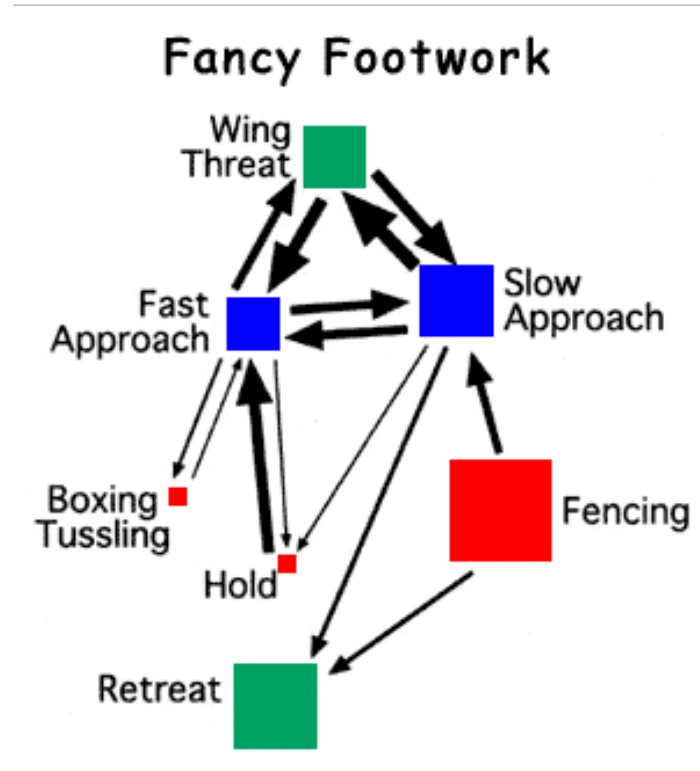
| input \ output | | A=0 | | | A=1 | A=2 | A=3 | |
|----------------|--------|-------|-------|-------|-------|-------|--------|--------|
| | | lay | sit | stand | walk | trot | canter | gallop |
| A=0 | lay | 89.5% | 4.4% | 5.9% | 0.2% | 0.0% | 0.0% | 0.0% |
| | sit | 4.9% | 90.9% | 1.9% | 0.0% | 0.4% | 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

