Chapter 4:
Measuring Behavior

Definition of Measurement

- The process of applying quantitative labels to observed properties of events using a standard set of rules

Researchers Need Measurement

- How scientists operationalize empiricism
  - Without measurement, science is guesswork and opinion
- Applied behavior analysts measure behavior to answer questions
  - Basis for talking about behavior

Practitioners Need Measurement

- To evaluate effects of intervention
  - Before and after treatment
  - During treatment
- To guide decision making
- To prevent mistakes
  - Continue ineffective treatment
  - Discontinue effective treatment

Benefits of Measurement

- Optimize effectiveness
- Verify legitimacy of treatments
- Identify and end use of pseudoscience
- Accountability
- Meet ethical standards

Measurable Dimensions of Behavior

- Dimensions are distinct features that can be measured
- Three fundamental properties
  - Repeatability or countability: behavior can be counted
  - Temporal extent: duration
  - Temporal locus: when behavior occurs

Measures Based on Repeatability

- Count
  - Number of responses emitted during an observation period
- Reported as frequency count
- Measures of count alone do not provide sufficient information for analysis

Measures Based on Repeatability

- Rate/Frequency
  - Ratio of count per observation period
- More meaningful than count alone
- Include counting time for reference
- Rate of correct and incorrect responses helpful in skill development
- Reported as number per standard unit of time

Guidelines for Using Rate

- Take complexity of response into account
- Useful measure for free operants
- Not appropriate for responses within discrete trials
- Not appropriate for continuous behavior over extended period

Measures Based on Repeatability

- Celeration
  - Measure of the change in rate of responding per unit of time
- Reported using Standard Celeration Chart
- Captures behavior acceleration and deceleration

Measures Based on Temporal Extent

- Duration
  - The amount of time a behavior occurs
- Total duration of session
- Duration of each occurrence
- Reported in standard time units
- Count and duration measures provide different pictures of same behavior

Measures Based on Temporal Locus

- Response latency
  - Measure of elapsed time between onset of stimulus and initiation of response
- Typically reported as mean, median, and range

Measures Based on Temporal Locus

- Interresponse time
  - Amount of time that elapses between two consecutive instances of a response class
- Direct measure of temporal locus and related to rate
- Reported as mean, median, and range

Derivative Measures

- Percentage
  - A ratio formed by combining the same dimensional qualities
  - Expresses proportional quantity
- Proportion of correct to incorrect
- Proportion of observation intervals when behavior occurred

Considerations for Using Percentage

- Often misunderstood, used incorrectly
- Most accurate with divisor of 100 or more
- Percentage may be misleading
- Limited use because has no dimensional quantity
- Sets artificial limits on behavior change

Derivative Measures

- Trials-to-criterion
  - Measure of the number of response opportunities needed to achieve a predetermined level of performance
- Other measures can be used to determine trials-to-criterion (e.g., rate)
- Typically calculated *post facto*
- Used to compare effectiveness

Definitional Measures

- Topography
  - The physical form or shape of a behavior
- Measurable dimension
- Malleable by consequences
- Not a fundamental quality of behavior

Definitional Measures

- Magnitude
  - The force or intensity with which a response is emitted
- Important parameter for some response classes
  - E.g., voice volume
- Not a fundamental quality of behavior

Procedures for Measuring Behavior

- Typically involve one or a combination of these three:

1. Event recording
2. Timing
3. Time sampling methods

Event Recording

- Procedures for detecting and recording the number of times a behavior is observed
- Devices include:
  - Wrist counters, digital counters, masking tape, paper clips, etc

Considerations for Event Recording

- Easy to do
- Behavior must have discrete beginning and ending
- Rate must not be too high
- Inappropriate for behaviors with long duration

Timing

- Procedures to measure duration, response latency, and interresponse time
- Duration:
  - computer systems, stopwatch, wall clocks, tape recorder
- Response latency and interresponse time
  - Precise recording of duration between events of interest

Time Sampling

- Variety of methods for observing and recording behavior during intervals or at specific moments in time

- Observation is divided into intervals, presence or absence of behavior recorded for each interval

Time Sampling: Whole-Interval Recording

- Used to measure continuous behavior
- Brief intervals (5-15 seconds)
- At end of interval, record if behavior occurred throughout
- Risk of underestimation
- Reported as percentage of intervals when behavior occurred

Time Sampling: Partial-Interval Recording

- At end of interval record if behavior occurred at any time during interval
- Multiple occurrences scored as one
  - Does not capture duration
- Allows recording of multiple behaviors
- Reported as percentage of intervals when behavior occurred

Time Sampling: Momentary Time Sampling

- Record whether the behavior is occurring at the end of the interval
- Does not require undivided attention
- Misses much behavior
  - Best for continuous behavior
- Reported as percentage of intervals when behavior occurred

Time Sampling: Planned Activity Check

- Variation of momentary time sampling
  - Measures behavior of individuals within a group
- At end of interval, measure number of students engaged in target activity

Guidelines for Time Sampling

- Use a timing device to signal beginning and end of observation
  - Increase accuracy
  - Not distracted by watching a stopwatch
- Record a response for every interval (e.g., yes or no)
  - Prevents losing your place with blank intervals

Time Sampling Artifactual Variability

- Artifact is something that appears to exist because of the way it is examined or measured
- Time sampling provides estimate of actual occurrences
- Different procedures produce different results
- Differences produce variability in data

Measuring Behavior by Permanent Product

- Measuring behavior after it has occurred by measuring its effects on the environment
- *Ex post facto*
- All previous procedures can be applied to permanent product measurement
- Products can be a natural or contrived

Advantages of Permanent Product Recording

- Practitioner free to do other tasks
- Possible measurement of otherwise inaccessible behavior
- More accurate, complete, continuous
- Easier data collection (IOA, treatment integrity)
- Measurement of complex behavior

Determining Appropriate Use

- Is real-time measurement needed?
  - Moment to moment decisions required
- Can behavior be measured by permanent product?
  - Each occurrence must produce same product
  - Product can only be produced by target behavior

Determining Appropriate Use

- Will a contrived product affect the behavior?
  - Reactivity effects
- Cost to obtain and measure the permanent product?
  - Availability, cost and effort of generating the product

Computer-Assisted Measurement

- Data collection and analysis software combined
  - Multiple systems available
  - Sophisticated and easy to use
  - Laptops, hand-held computers, PDAs
- Simultaneous recording of multiple behaviors across multiple dimensions