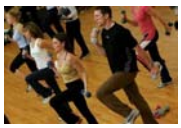
Single Subject Designs

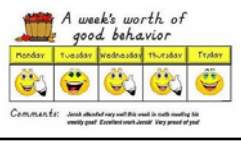
Why Use Single Subject Designs?

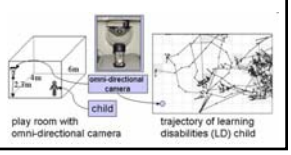
- Useful for applied research
  - Establishing utility of interventions
- Provide useful feedback
  - About progress of an individual intervention program


What is a Single-Subject Design?

- Repeated, systematic measurement of DV
  - Before, during, after manipulation of IV
- DV usually human characteristic
- IV usually involves application of intervention





Characteristics of SSD

- Repeated observation
  - Same behavior measured repeatedly
  - Determines consistency over time
  - Serves as a control for variability
- Consistent observation technique
  - Conditions for data collection
    - Standardized
    - Trained observers
  - Allows meaningful comparisons over time

Characteristics of SSD

- Description of conditions
  - Clear and detailed
  - Strengthens internal & external validity
- Baseline and treatment conditions
  - Baseline
    - Target behavior (DV) observed & recorded
    - **No** intervention/treatment (IV)
  - Treatment
    - Experimental manipulation (IV) is introduced
    - Target behavior (DV) observed & recorded
  - Long enough to achieve stability in DV

Manipulation During Treatment

- Operant
  - Behavior that operates on environment
  - Response that will be strengthened/weakened
- Reinforcement
  - Increases behavior
- Punishment
  - Decreases behavior

Manipulation During Treatment

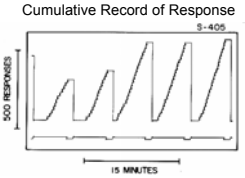
- Operationally define behavior and treatment
- Determine behavioral baseline (A)
  - Measure and record behavior repeatedly
- Introduce treatment (B)
  - Measure and record behavior repeatedly
- Remove treatment (A)
  - Measure and record behavior repeatedly

Observation and Manipulation Phases

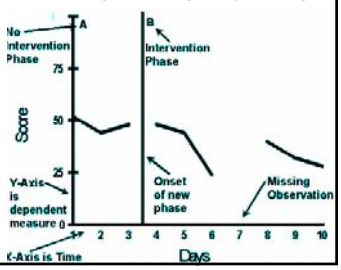
- Length
  - Until behavior is stable and consistent
- Changing phase
  - Treatments introduced, withdrawn or changed
- Measuring the response
  - Most common: rate of response
    - Total frequency of response
    - Time response occurs

Measuring Response

Cumulative Record of Response



Graphing Data in Single Subjects Designs



Types of Single-Subject Designs

- Withdrawal Designs
  - A- B
  - A – B – A
  - A – B – A – B
- Multiple-Baseline Designs
- Alternating-Treatments Designs
- Changing-Criterion Designs

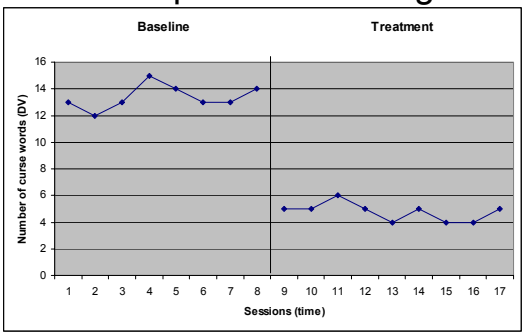
A-B Withdrawal Design

- Used to quickly assess the effects of a treatment
  - Phase 1 (A)
    - Measure baseline response
  - Phase 2 (B)
    - Introduce treatment while measuring response
- Disadvantage
  - Inability to distinguish experimental effect from confounds

Example of A-B Design

- Bob has a habit of cursing at work
  - Co workers complain
- Treatment
  - Pay $5
- "Session" = Work day

Example of A-B Design



A-B-A Withdrawal Designs

- Simplest of single subject designs
- Repeatedly introduces and withdraws treatment
  - Baseline phase (A)
  - Treatment phase (B)
  - Withdrawal phase (A)

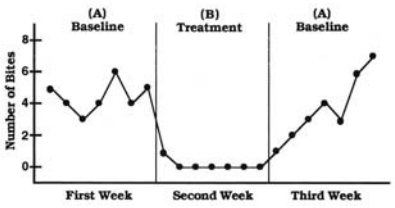
Example of A-B-A Design

- Cat loves to play with the family dog
- Dog not tolerant of cat
  - Captures cat between teeth
  - Painful to cat
- Change dog's behavior
  - Use behavior modification

Example of A-B-A Design

- Instituted sophisticated verbal treatment
  - The "NO! - NO! —BAD DOG!" treatment
- Week 1: Recorded number of times dog bit cat
- Week 2: Every time dog bit cat, instituted treatment while continuing to record behavior
- Week 3: Record behavior without treatment

Example of A-B-A Design



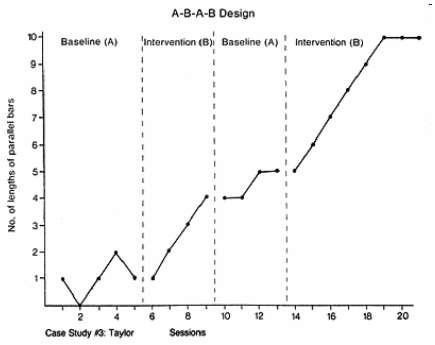
A-B-A Advantages and Disadvantages

- Advantage
  - Withdrawal phase
    - Allows more reliable assessment of intervention effects
    - Confounds
      - Unlikely to co-occur repeatedly with treatment
- Disadvantage
  - Can't use with irreversible treatment effects
  - Ethical concerns with withdrawing treatment
  - Use A-B-A-B designs

Example of A-B-A-B Design

- Taylor (4 yrs old)
  - Partial leg paralysis
  - Lacks upper body strength
- Goal
  - Increase strength and endurance
- Target behavior
  - Ambulate 10 consecutive lengths of parallel bars
  - No rest breaks
  - 3 consecutive days
- Treatment
  - Wheelchair pushups
  - Bar graph monitoring of progress

Example of A-B-A-B Design

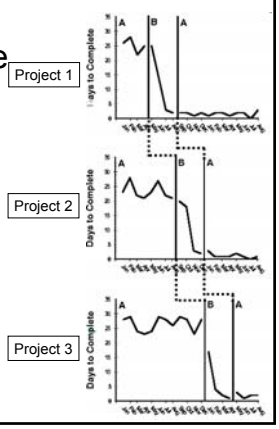


Multiple Baseline Designs

- Evaluation across individuals, settings, or behaviors
- Useful for evaluating interventions
  - Likely to cause enduring change in DV
- Withdrawal designs
  - Use withdrawal phase to control threats to internal validity
- Multiple baseline designs
  - Control by varying length of the baseline

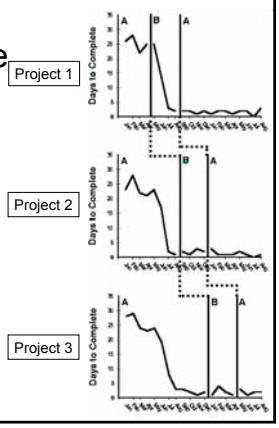
Example 1a of Multiple Baseline

- Intervention
  - Enhancing quality of life in public housing
- Intervention
  - Community organization
- Behavior
  - Time to repair apartments



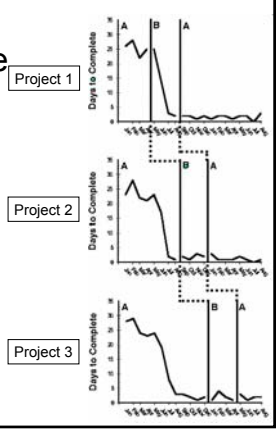
Example 1b of Multiple Baseline

- Threats to internal validity
  - Controlled by multiple baselines
  - 3rd variable problem
    - Show up on all charts simultaneously
- Causal inferences
  - Depend on independent observations across charts



Example 1b of Multiple Baseline

- Explanation for changes across charts
  1. Third variable causes change
  2. Intervention B causes change
     - Observations are not independent

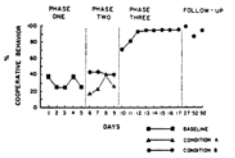


Alternating Treatment Designs

- Useful for evaluating effect of several treatments
  - Same individual
- Different treatments
  - Alternated several times
  - Order randomly determined or counterbalanced
- Each treatment replicated
  - Each time introduced

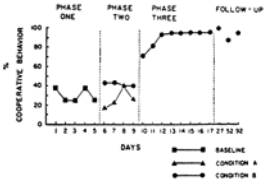
Alternating Treatment Designs

- After baseline
  - Treatments administered
    - Alternating
  - Instructions before each treatment
- Possible confounds
  - Counterbalanced during experiment
- Data plotted separately
  - For each intervention



Example of Alternating Treatment Design

- Treatment A
  - Social reinforcement for cooperating
  - Ignoring uncooperative behavior
- Treatment B
  - Social reinforcement for cooperating
  - Time out for uncooperative
- Treatments alternated during day
  - Morning session
  - Afternoon session

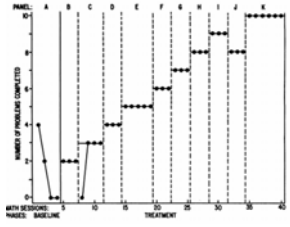


Changing Criterion Design

- Variation of multiple-baseline design
- Useful for incrementally changing target behavior
  - Criteria for target behavior set
  - When criteria met
    - Set new criteria
- Each phase provides baseline for subsequent phases

Example of Changing Criterion Design

- DV = # math problems solved correctly
- Baseline worksheet with 9 division problems
- Criteria set at 2 correct problems solved
- Increased +1
  - 3 consecutive days criteria met



External Validity Issues

- Single subject designs criticized
  - Issues related to external validity
- Behavior analysts
  - Concerned with establishing robustness of a few variables
    - Reinforcement
    - Stimulus control
  - Not concerned about individual differences
- Direct, systematic replication is important

Benefits of Single Subject Design

- Rigorous methodology
  - Identify functional variables.
- See pattern of action of DV
- Make informed statements about:
  - Acquisition
  - Maintenance
  - Generalization

Benefits of Single Subject Design

- Study low incidence populations and behaviors
- Cost effective
  - Evaluate intervention prior to large scale study
- Flexible design is adaptable to situation
- Can be conducted in practice settings
  - Test clinical hypotheses
  - Monitor progress in applied settings

Limitations of Single Subject Design

- Does not answer questions related to external validity very well
  - Not intended for those types of questions
- Data analysis via visual inspection of data
  - Can result in unreliable interpretation
  - No established standards
  - Low agreement among observers

Limitations of Single Subject Design

- Aggregating results across studies
  - No established methods
  - Meta analysis may be useful
    - Important for validating interventions as "evidence-based"
    - Practitioners do not have time/access to primary source material
- Standards for validating interventions as evidence-based
  - Just emerging
    - No consensus among standards

In Class Exercise ABA Design

- Break into groups of 4 – 6 students
  - Each student pairs up with another student
  - Decide who will record behavior and who engage in behavior
- Hypothesis: Exercise increases pulse rate
- Treatment = exercise
  - Operationally define "exercise"
- Behavior = pulse rate
  - Heart beats per minute
    - (# beats in 30 seconds) X 2
- Define exercise – note on sheet
  - Measure & record behavior in 1 minute intervals
  - Baseline, treatment, withdrawal
  - Complete graph for each student engaging in behavior