Experimental Designs vs. Quasi-Experimental Designs

- Experimental Designs include:
  - Random Assignment of Participants to groups (Control and Experimental if possible)
  - Examining effects of an Independent Variable on a Dependent Variable
- Quasi-Experimental Designs include:
  - Assignment of Participants to groups (Control and Experimental if possible)
  - Examining the effects of an Independent Variable on a Dependent Variable
- What is Missing from Quasi-Experimental Designs?

The Answer is ............... RANDOM ASSIGNMENT

So, Quasi-Experimental Designs lack Random Assignment of participants

In turn, this lack of randomization reduces the amount of control a researcher has over variables (do not confuse this type of control with a control group as quasi-experimental designs may use control groups)

Remember, lack of control leads to threats to Internal Validity
Why Use Quasi-Experimental Designs?

- Quasi-Experimental Designs emerged from the need to conduct applied research in settings where randomization and control were difficult or impossible to achieve
  - Programs such as DARE (Drug Abuse Resistance Education), and MADD (Mothers Against Drunk Driving)
  - You cannot make someone join or leave one of these programs
  - Single Classrooms where a teacher wants to test a new technique
  - One class does not represent a good sample of all classrooms in the United States
  - Research where an entire group needs to receive the same treatment
  - Patients on a ward in severe psychiatric institution

Program Evaluation

- Quasi-Experimental Design is used extensively in Program Evaluation
- Program Evaluation is research on programs that are proposed and implemented to achieve some positive effect on individuals
  - People with disabilities
  - Students
  - Employees
  - Entire Communities

  Basically, they are used to determine if programs are achieving a desired outcome

Other Types of Quasi-Experimental Designs

- One Group Posttest Only Design
- One Group Pretest-Posttest Design
- Nonequivalent Control Group Design
- Interrupted Time Series Design
- Control Series Design
- Single Case Experimental Designs
  - Reversal Design
  - Multiple Baseline Design
One Group Posttest Only Design

- X (IV) O (DV)
- Also called a "one shot case study"
- Example: This class, and this class only, attends a 2 hour lecture on Validity and then immediately takes a test to gauge Validity knowledge
- What is wrong with this design?
  - No comparison group
  - Does not account for what the class knew prior to the Validity lecture
  - Major threats to Internal Validity

One Group Pretest-Posttest Design

- O (DV) X (IV) O (DV)
- Does contain a comparison to look at the effects of the IV on the DV
- Example: This class, and this class only, takes a Validity knowledge test on a Monday. The next Monday, this class attends a 2 hour lecture on Validity. On the third Monday, this class takes a test to gauge Validity knowledge
- Although this design includes a comparison (pretest to posttest), it does not account for several alternative explanations as to why the students scored the way they did on the posttest (DV)
  - History
  - Maturation
  - Testing
  - Instrument Decay
  - Regression Towards the Mean

Nonequivalent Control Group Design

- The Nonequivalent Control Group Design employs a separate control group BUT the participants in the two conditions are not equal
- Differences between groups are called **selection differences**
- Example: The Experimental Group consists of people in this class and the Control Group consists of people in a class from counselor education. What are the differences?
Nonequivalent Control Group Design Cont.

Nonequivalent Control Group Pretest-Posttest Design
- Experimental Group: O X O
- Control Group: O O
- This is probably the most useful quasi-experimental design
  - Allows for a comparison between groups pre and post
- Remember though that this is not a perfect design as the groups were not equal to begin with!
  - One group is from this class and the other is from counselor education. Remember that selection differences cause problems.

Interrupted Time Series Design
- The Interrupted Time Series design examines data before and after an intervention has taken place to see if the intervention truly had an effect
- Example: In November of 2003, due to a tremendous rise in traffic accidents on 34th Street, the City decided to lower the speed limit to 25 miles per hour. One month after the speed limit reduction, accidents were reduced by 10%. The question is, did the reduction in the speed limit reduce the accident rate?
- Let's look at the data!

Interrupted Time Series Design Cont.

![Graph showing traffic accidents per month]

- Nov-03: 30 accidents
- Dec-03: 26 accidents

Traffic Accidents per month
Interrupted Time Series Design Cont.

- Well, it looks like the data proves it! The reduction in the speed limit really reduced traffic accidents.
- "BUT WAIT!" says one bright student from the research class (insert name here). "We should do an interrupted time series design study to see if the accident rate has dropped in the past. Also, what will the accident rate look like 6 months from now?"
- Let's look at the data!

Interrupted Time Series Design Cont.

As you can see, the number of accidents went up and down prior to the Speed limit reduction and also went up and down after the speed limit intervention.

The Interrupted Time Series Design allows us to see these changes even if they take place over great periods of time.
### Control Series Design

- Control Series Designs improves upon the Interrupted Times series design as it adds a control group.
- Example: Along with our accidents on 34th Street study, let's look at data of accidents on Archer Road over time since the speed limit on that street was *not* lowered.

### Single Case Experimental Designs

- Single Case Experimental Designs were developed from a need to assess the effect of an experimental manipulation on a single research participant.
- Also called single subject designs, single case designs, and single participant designs.

### Single Case Experimental Designs Cont.

**Purpose of Single-Subject/System Designs**

- Used to monitor and evaluate participants’ responses to the interventions with which they address participants’ target problems. The strategy is to intensively study one participant system at a time (Grinnell, 1993).
### Single Case Experimental Designs Cont.

- With this design, a subject's behavior is measured over time beginning with a baseline period (Beginning). The behavior will continue to be measured after the introduction of an intervention.
- If a change in behavior is observed from the baseline period to after the introduction of a treatment, evidence for effectiveness may be concluded.
- *As with other quasi-experimental designs, there may be many alternative explanations for such change.*

### Single Case Experimental Designs Cont.

For Single Case Experimental Studies, the following Coding System will be used:
- **A**: Baseline Period
- **B**: Treatment Period
- **C**: Second Treatment

### Components of Single-Subject Designs

#### Baseline Measures
- Baseline data are measures of the level of behavior (the DV) as it occurs naturally, before intervention.
- Baseline data serve two functions:
  - Descriptive function
  - Predictive function
### Components of Single-Subject Designs Cont.

#### Baseline Measures
- Baseline should be stable and baseline trends should be taken into account before intervention.
- *A trend in the data* refers to an indication of a distinctive direction in the performance of the behavior.
- *A trend* is defined as three successive data points in the same direction.

#### Baseline Measures
- A baseline may show no trend, an increasing trend, or a decreasing trend.
- The researcher should initiate intervention on an ascending baseline only if the objective is to decrease the behavior.
- In contrast, the researcher should initiate intervention on a descending baseline only if the objective is to increase the behavior.

#### Intervention Measures
- A series of repeated measures of the subject's performance under a treatment or intervention condition.
- The IV (treatment or intervention) is introduced and its effects on the DV (the subject's performance) are monitored.
- *Trends in treatment data* indicate the effectiveness of the treatment and provide the researcher with guidance in determining the need for changes in intervention procedures.
Components of Single-Subject Designs Cont.

Other Components

- Phase: A distinct stage/period of a target behavior (e.g., baseline phase, treatment/intervention phase, withdrawal phase)
- Withdrawal: Termination of the administration of an intervention or treatment.
- Probe: A thorough examination or investigation to the DV (i.e., the target behavior that you want to improve).

Characteristics of Single-Subject/System Designs

- According to Kratochwill and Williams (1988), single-case experimental designs have following five characteristics:
  1. The researcher repeatedly assesses the DV across various phases of the experiment. Data collected prior to, during, and following the intervention allow measurement of changes on the DV.
  2. The researcher should have ability to measure variability on single or multiple dependent measures across time.

Characteristics of Single-Subject/System Designs Cont.

- 3. The researcher usually specifies in great detail the nature of the IV/DV, and the characteristics of the setting, therapist, and participant. Most of these variables are held constant during intervention phases so that functional relationships can be established between the IV and DV.
- 4. This kind of design can rule out major threats to internal validity through replication of the experimental effects.
Characteristics of Single-Subject/System Designs Cont.

- 5. When applying this kind of design, the researcher has some degree of flexibility to change the nature of the design as data are evaluated across time, or to combine design elements to better rule out various threats to internal validity.

Two Major Types of Single-Subject/System Designs

- Depending on the level of sophistication of the research design and the validity and reliability of the data collected under it, studies of participant systems based on single-subject/single-system designs can be used to answer two different types of questions (Grinnell, 1993):
  - 1. Evaluative question: Did the participant system improve during the course of the intervention?
  - 2. Experimental question: Did the participant system improve because of intervention?

Single-System Evaluative Designs

The B Design

- In the B design, systematic assessment of the outcome measure(s) and implementation of the intervention begin simultaneously.
- Repeated measurements are taken while the treatment continues, and at the end of the treatment period the data are depicted on a simple graph.
- Visual inspection of this graph permits one to make inferences as to whether or not the participant's target problem has improved over the treatment period.
- The B design indicates whether the level of the participant's target problem is changing in the desired direction.
Single-System Evaluative Designs

**The AB Design**
- The AB design requires a valid and reliable outcome measure that is amenable to repeated assessment. However, this design calls for assessing the participant system’s target problem several times before the intervention begins.
- There are two phases:
  - In the baseline period (A Phase) fluctuations in the participant system’s target problem are monitored but no attempt is made to effect any changes in the problem – only measuring the target problem.
  - Interventions are carried out in the B Phase, which follows the baseline period.

Single-System Evaluative Designs Cont.

**The Changing Criterion Design**
- This design is used to evaluate a gradual and systematic increase or decrease in the client’s performance level by changing the criterion for reinforcement in a stepwise fashion.
- This design, much like the AB design, also includes two phases.
  - The intervention phase is divided into sub-phases. Each sub-phase requires a closer approximation of the terminal behavior than the previous one. The participant’s performance thus moves gradually from the baseline level to the terminal objective.

Single-System Experimental Designs

- Such designs attempt to control for alternative hypotheses by demonstrating that there is more than one coincidence in which treatment began and then the participant system improved or in which treatment is discontinued and the participant deteriorated.
- The purpose of doing studies based on this kind of design is to determine whether the researcher can appropriately draw the inference that the independent variable (IV) (i.e., the intervention) is the plausible cause of change in the dependent variable (DV) (i.e., the participant system’s outcome).
Single-System Experimental Designs Cont.

- This involves the concept of the internal validity of the design – the extent to which it can demonstrate that any changes in the DV would result from the IV and from no other plausible factors.
- A variety of single-system designs can be used to answer the experimental question in practice and research: Did the participant system improve because of intervention?

<table>
<thead>
<tr>
<th>Single-System Experimental Designs Cont.</th>
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<tbody>
<tr>
<td><strong>The ABAB Design/The Withdrawal Design/The Reversal Design</strong></td>
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<tr>
<td>This design involves the sequential application and withdrawal of an intervention to verify the intervention’s effects on a target behavior.</td>
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<tr>
<td>By repeatedly comparing baseline data to data collected after application of the intervention strategy, the researcher can determine whether a functional relationship exists between the DV and the IV.</td>
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Single-System Experimental Designs Cont.  

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<td>A study using this design is conducted by first employing the evaluative AB design (a baseline period followed by an intervention phase) and then temporarily halting treatment for a second baseline period before the intervention is resumed. (In effect, the ABAB design represents two AB designs in succession.)</td>
</tr>
<tr>
<td>Such designs are only appropriate when the intervention employed has readily removable or temporary effects. Removing treatment interventions in this manner is ethically acceptable only if the participant will not be put at risk.</td>
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**Single-System Experimental Designs Cont.**

**The BAB Design**
- Sometimes it is not feasible to use a baseline period (A Phase) for ethical reasons; the participant’s target problem may be too severe or dangerous to postpone an intervention.
- There may also be pragmatic reasons to avoid using a baseline period; a program to be evaluated may already be operating. In such cases, the BAB design is appropriate.

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**The BAB Design**
- The BAB design records outcome measures repeatedly over time while an existing program in operation or treatment is being applied in the first B Phase (B1).
- Then the existing program or treatment is temporarily removed, and records are kept of the outcome measures. In the B2 Phase, the program or treatment is reinstated and the effects are again observed.

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**The BCBC Design (the Multiple-Component Design)**
- Used to compare the relative effectiveness of two different treatment interventions.
Single-System Experimental Designs Cont.

Multiple Baseline Designs
- Since it may be impossible or unethical to reverse treatment, researchers developed Multiple Baseline Designs.
- Basically, Multiple Baseline Experimental Designs introduce the independent variable (treatment) under different circumstances:
  - Across Subjects
  - Across Behaviors
  - Across Situations
- This variation in administration of the independent variable reduces the threats to internal validity that the reversal design cannot account for.

Single-System Experimental Designs Cont.

Multiple Baseline Designs: Across Subjects
- Across subjects means administering a treatment to different participants at different times.
- Example: Subject X begins Walk-Plus in January, Subject Y begins Walk-Plus in February, and Subject Z begins Walk-Plus in March.
- Since each participant began treatment at a different time, a researcher can rule out negative effects such as chance and history.

Single-System Experimental Designs Cont.

Multiple Baseline Designs: Across Behaviors
- Across behaviors means administering a treatment to participants while they are exhibiting certain behaviors.
- For example, to test a reward system on children, you can give a child a Dollar when they groom themselves, when they eat their veggies, and when they wake up on their own.
### Single-System Experimental Designs Cont.

**Multiple Baseline Designs: Across Situations**
- Across situations means administering a treatment in different settings.
- Using our reward system for children example, you can give a child a reward at school, at home, and at the doctor's office.

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### Single Case Experimental Design Examples

**AB Example**: Subject X can walk 10 steps before falling down at the baseline period. After 1 month of Walk-Plus Treatment, his steps increase to 20.

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### Single Case Experimental Design Examples

**Reversal Design A B A**
- Example: Subject X walks 10 steps before falling down at the baseline period. After 1 month of Walk-Plus Treatment, his steps increase to 20. One month after his Walk-Plus Treatment is discontinued, Subject X is measured again and his steps stay at 20.
- What are some advantages of this design?
## Single Case Experimental Designs Cont.

### Replication of Single Subject Designs
- Single case studies can be further enhanced by adding other subjects
  - Allows you to compare one participant’s score to another’s
  - Allows you to compare group means

## Questions or Comments

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