Experimental Reasoning: Introduction

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Applied Behavior Analysis and Single-subject Experiments

- One of the distinguishing features of ABA is the use of single-subject experiments

- Single-subject experiments are characterized by an experimental, quantitative, and intensive analysis of an individual subject or participant.

- Single-subject research can be contrasted and compared to other research methods.

Case Studies

- Case studies share with single subject experiments the feature of an intensive study of an individual.

- Case studies typically are not quantitative

– Case studies are a type of **descriptive** research, they seek to describe the subject under study.

– Descriptive studies do not seek to compare conditions experimentally.

Group Experiments

- Group experiments share with single-subject studies the feature of making comparisons among conditions.
- They both produce quantitative functions between and among independent and dependent variables.
- Group experiments also share with single-subject studies the attempt to establish experimental control.
- Group studies, however, are concerned with populations of subjects, not the individual.

Populations versus Individuals

- The statistical methods that are used in group experiments compare differences in samples of a population of subjects.
- The assumptions, techniques, and methods of comparison are all based on population parameters.
- **Whereas** the assumptions, techniques, and methods of comparison in single-subject experiments are all based on the individual case.

Group and Single-Subject Experiments

- Group experiments examine functional relations between and among independent and dependent variables for a population of individuals, **whereas**

- Single-subject experiments examine functional relations between and among independent and dependent variables for an individual.

- In ABA the functional relations we examine are between environmental independent variables and the behavior of individuals as dependent variables.

Class Example

- Will Monica increase the number of items she identifies when she is provided with objects that she already asks for, but only when given social reinforcers like: 'that's correct.", "excellent, you know what a ___ is.' etc. ?"

- Dependent Variable:
- Independent Variable:

Teams

- Give an example from a subject matter of interest to you that can be addressed as a single-subject experiment.

- State your interest in terms of an experimental question? Be sure to indicate who the subject is, what the dependent variable(s) is, and what the independent variable(s) is.

All Kinds of Science

- All kinds of scientific research ask about the degree to which the investigation achieves **internal and external validity**.

Internal validity: the extent to which the explanation rather than other influences can be considered to account for the results.

Think: other influences, confounds, plausible alternative explanations, etc.

Think: what do I have to keep constant across the conditions I am comparing in the experiment.

- When addressing internal validity you should list all the Threats to an explanation. A Threat is any legitimate, rival explanation for the results achieved.

– If you haven't controlled for the threats to internal validity, alternative explanations will interfere with the conclusions you can draw from your research.

– What are these **threats**?

– Anything that occurs **in one** condition of your study that is different from **the others.**

Criteria to Check Threats

- **Subjects-Are the participants different across conditions?**
  - **H**istory
  - **M**aturation
  - **A**ttrition
  - **S**election Biases
- **Settings-Are the settings different across conditions?**
- **Measurement-Is measurement different?**
  - **I**nstruments
  - **T**esting
- **Independent Variable (Construct)-Are all the differences between conditions described?**
  - **S**pecial treatment of Control vs. Experimental conditions
  - **D**iffusion

- Historical threats to internal validity are controlled in single-subject research because we use the subject we are interested in studying.
  - Groups studies have to **worry** whether the subjects in one group are from the same population as subjects in another group
  - Single-subject research uses the same subject under all conditions. No **worries**!!

What, Me Worry?

Setting

- Setting variables are controlled by making sure that the setting used is the same in all conditions

- Single Subject designs also typically involve stability of behavior under one condition before another condition is introduced.

- Stability adds confidence that the setting is not changing for the behavior under study.
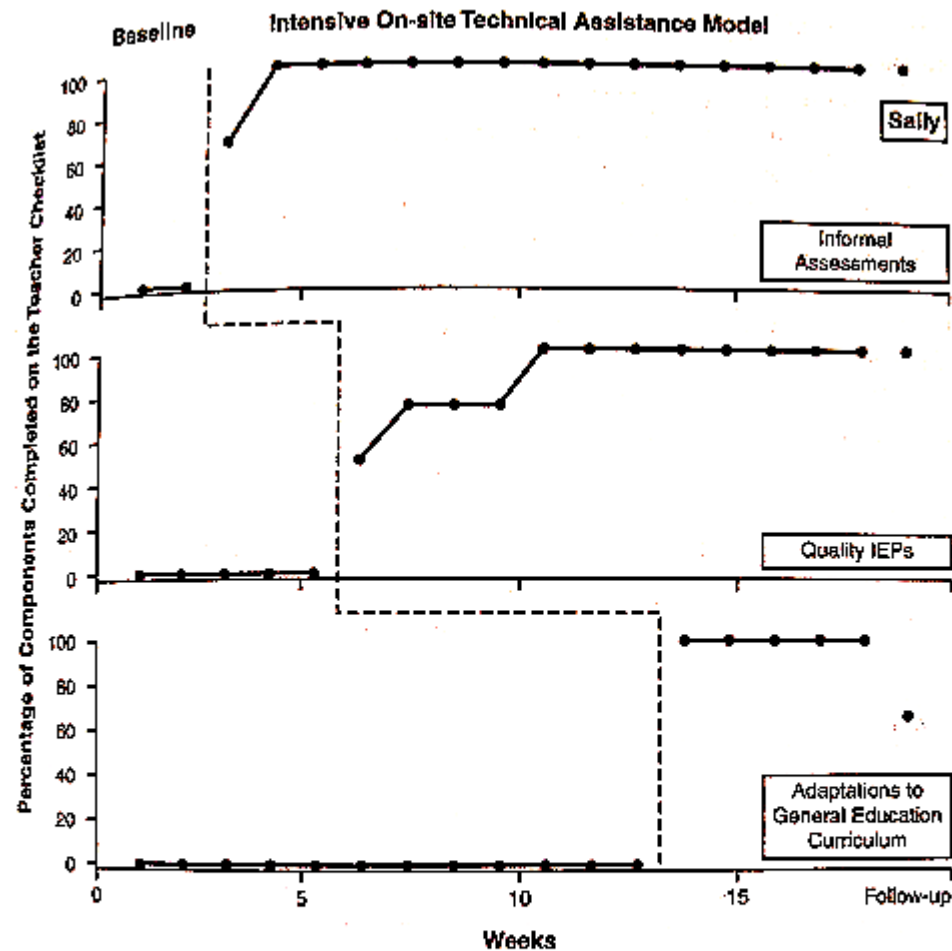
Stable Initial Conditions

FIGURE 11.1 *Example of a multiple-baseline-across-behaviors design.* The dependent variable was the percentage of components correctly completed for each of three teaching skills: (1) informal assessments, (2) quality IEPs, and (3) adaptations to the general education curriculum. The intervention was an intensive on-site technical assistance intervention to improve the teaching practices of a special educator, Sally.

Source: From N. M. Clark, L. S. Cushing, and C. H. Kennedy, "An Intensive On-Site Technical Assistance Model to Promote Inclusive Practices for Students with Severe Disabilities," manuscript submitted for publication.

- Measurement variables are controlled by:
  - precise definitions of how the behavior is measured,
  - measuring the behavior **the same way** in all conditions,
  - assessing stability before making a change in conditions.
  - measuring IOA

- Independent variables threats are managed by:
  – Precisely defining the treatment.
  – Examining change repeatedly.
  – Obtaining measures of treatment integrity.

Monica Example

- Dependent Variable: Number of items she identifies when given objects
- Independent Variable: Social reinforcers
- Subject threats:
- Setting threats:
- Measurement threats:
- Independent Variable threats:

Teams

- Think about confounding variables or threats to internal validity for your example of an experiment. Use the chart of threats and **list possible threats that are specific to your experiment.**

Criteria

- Who is the subject?
- What is the behavior.
- What is initial condition?
- What is treatment?
- Is the behavior measured in the same setting under all conditions?
- Is the behavior measured in the same way under treatment as the initial condition?
- How is treatment different from the initial condition?

External Validity

- ***External validity***: the extent to which the results can be generalized beyond the people, settings, times, measures, and other characteristics of the study.
- **Think:** external generality of results.

External Validity:

- When thinking about external validity you should list all the limits to generalizing beyond the study to other populations, settings, and circumstances.

- It is helpful, therefore, to memorize threats to external validity.

- What are they?
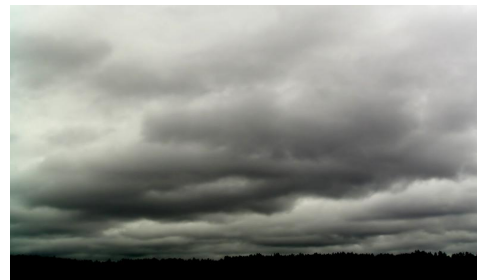
Threats to External Validity

- Subjects
- Settings
- Teachers/Staff
- Measures

Monica Example

- Dependent Variable: Number of items she identifies when given objects
- Independent Variable: Social reinforcers
- Will the study generalize to other subjects?
- To other settings?
- To use with other teachers/staff?
- To other measures of the behavior?

Teams

- How well does your example deal with external validity?
- Return to your example of an experiment and examine the threats to external validity described in the slides.

- All this discussion of external and internal validity leads to the design of experiments that minimize the likelihood that some other plausible, alternative explanation could be derived.

Check this out!
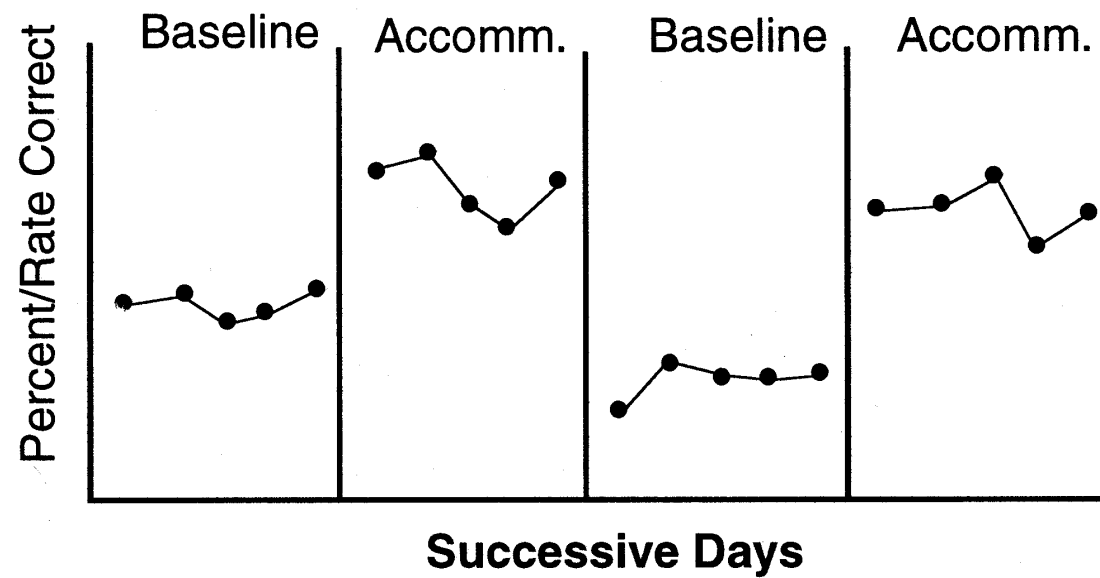
A Single Subject Analysis Starts with a Baseline

- What is a baseline?

Survey says:

- Initial period of observation during which repeated measurement is used to determine whether the target behavior under study is stable or changing.
- What would be a baseline in your study?

Why a baseline?

- Minimize reactivity to observers
- Increase validity, reliability, and accuracy of measurement
- ID relevant/potential events in the setting that vary
- Future comparison to treatment

Experimental Logic

- Prediction

- Verification

- Replication

Experiment =

exposing an individual to two or more conditions while simultaneously minimizing the effects of extraneous variables

Prediction:

- Anticipated outcome of a presently unknown or future measurement
- **Think:**
  - Predict that behavior will change from baseline conditions to treatment conditions.
  - Predict that if the conditions do not change, the behavior will not change
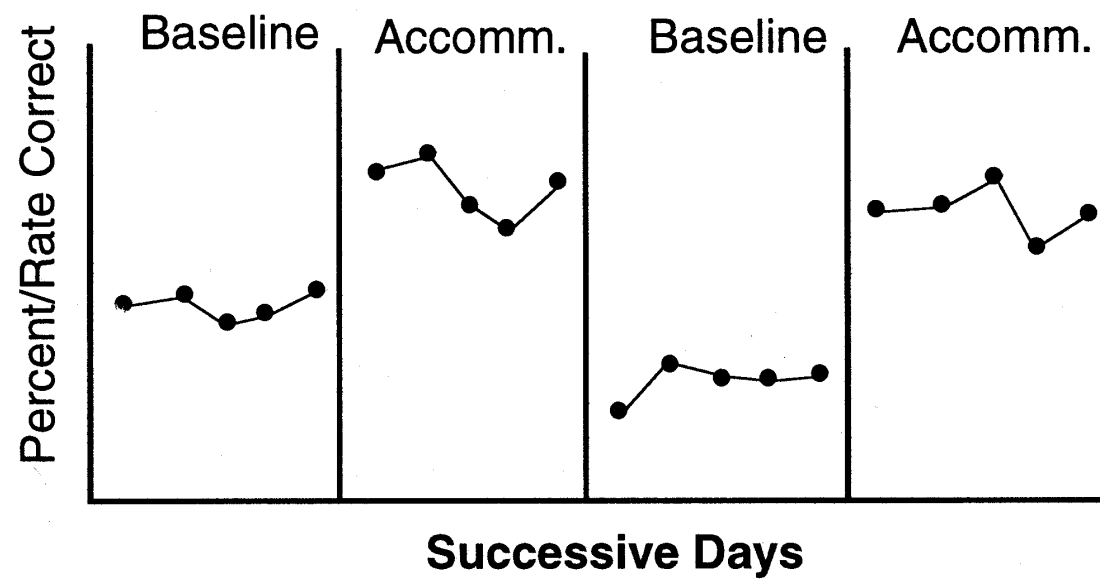
Verification

- Does the behavior change when the conditions change from baseline to treatment?
- **Think:** Did the results verify the prediction that behavior would change from baseline to treatment.

Verification
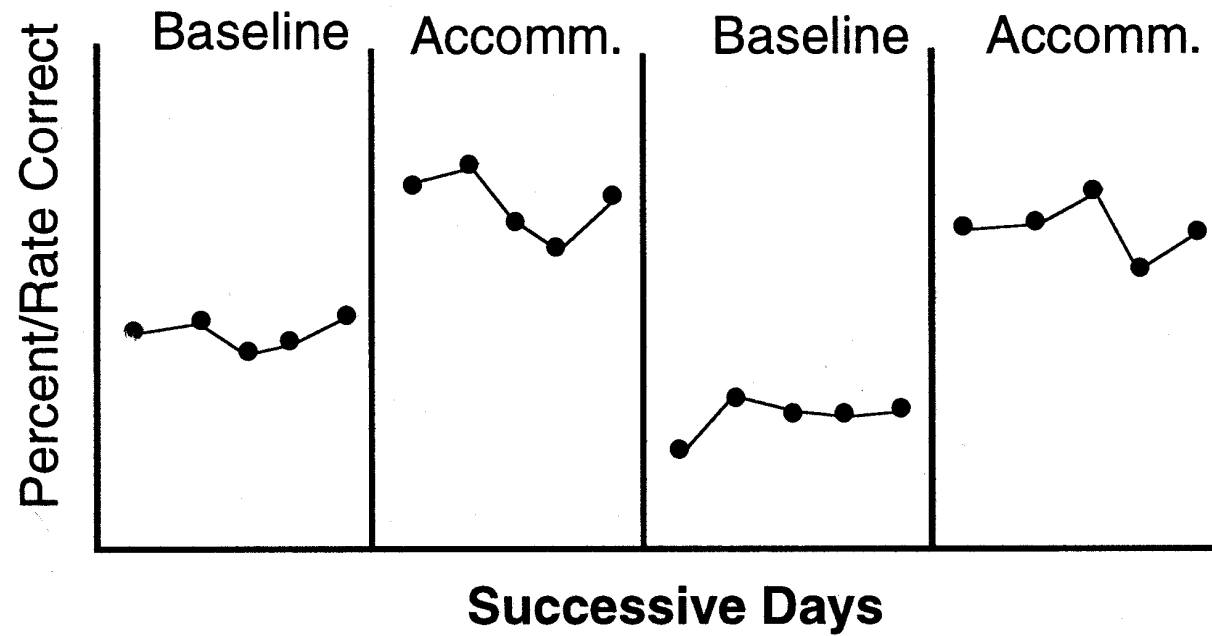
Replication

- Repeating the comparison between baseline and other conditions to test for similar outcomes.

- We check to determine if returning to baseline results in similar behavior as first baseline

- We check to determine if returning to the treatment results in similar behavior as the first treatment

The number of replications…

- Many replications increases our confidence, but the number of replications is governed by questions about ethical/moral/social validity vs. repeating baseline.

Types of Replication

- **Direct Replication**
- **Systematic Replication**
- **Intrasubject replication**
- **Intersubject replication**

Direct Replication

- The researcher makes every effort to duplicate exactly the conditions of an earlier condition or experiment

Systematic Replication

- The researcher purposefully varies one or more aspects of an earlier condition or experiment.

- When a systematic replication successfully reproduces the results of a previous condition it adds to the external validity of the previous study

- Change participants, places, measures, therapists, teachers, etc.

Intrasubject Replication

- If the same subject is used in a replication

EAT VEGETABLES
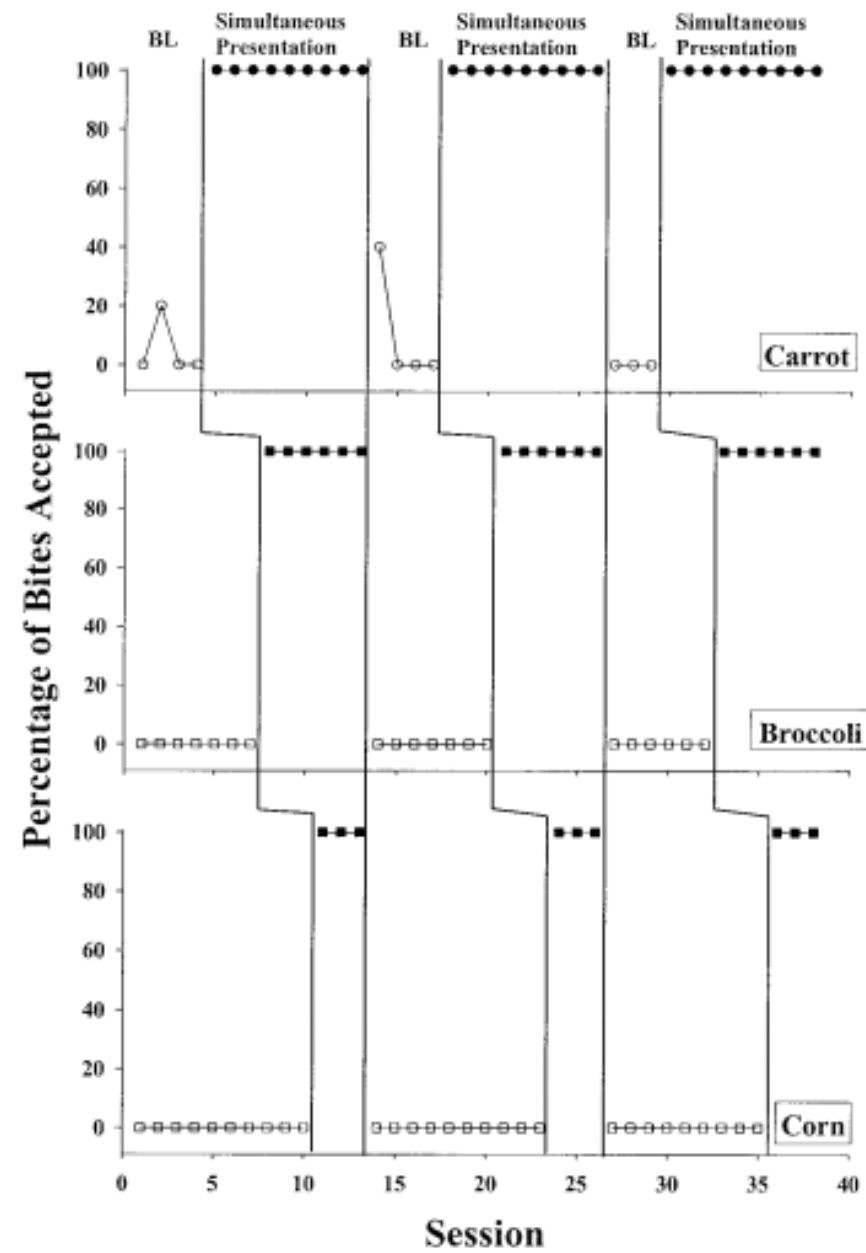
Intersubject Replication

- Maintains every aspect of another condition or experiment except that different subjects are involved
- Is the primary method for determining the extent to which research findings have generality (external validity) across subjects
- Often reported in the same study

- In single-subject research the emphasis on precise definitions, stability, and replication increases our confidence that the experiment will rule out alternative explanations.
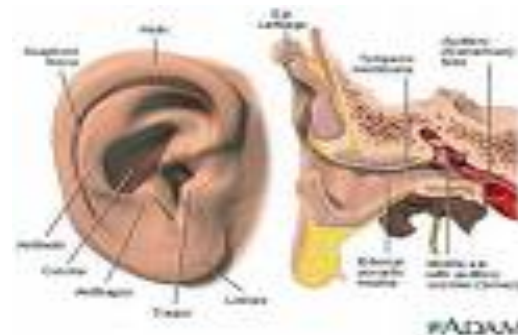
A Single-Subject Rebus

Lots of:

Eliminates:

To:

- Of the many people who invented the methods of applied behavior analysis - Don Baer, Mont Wolf, Todd Risley, and R. Vance Hall were probably the most influential.

- They have a wonderful film where they talk about the logic of single subject designs for clinical problems.

- Watch at www.behavior.org under Continuing Education, On Demand, and search for single subject designs.

Teams

- Return to your experiment and describe both your baseline condition and your treatment condition.
- Say what you predict will happen when you change from the baseline to the treatment condition.
- Say how you will verify your prediction.
- Describe how you will address each of the kinds of replication discussed in the slides.

Teams

- Finish all of the study questions for today with your group
- One person submit one copy of answers with everyone's names and email addresses by **19:00 on October 17.**