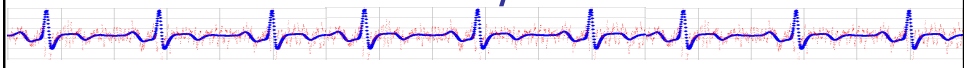
Empirical Research Methods in Information Science

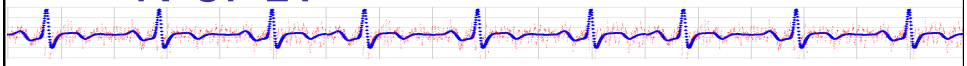
IS 4800 / CS 6350



Lecture 17

Single Subject Designs

How can I generalize from an N of 1?



1. Large number of observations per subject, allowing random error to be characterized and factored out.
2. Rigid control of extraneous factors.
3. Study powerful variables whose influence is typically much greater than error variance.
4. Often study unconscious, universal behavior —e.g., perception & motor control

Single Subject Designs

- Baseline Design
  - Repeat
    - Change IV
    - Sample DV until stable
- Dynamic Design
  - Continuously vary IV & measure DV response
- Discrete Trials Design
  - Repeat
    - Give randomly assigned IV
    - Measure DV

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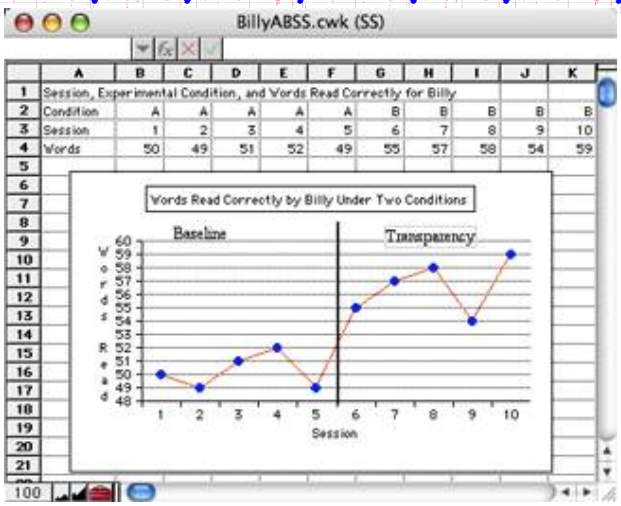
Single Subject Baseline Design A-B



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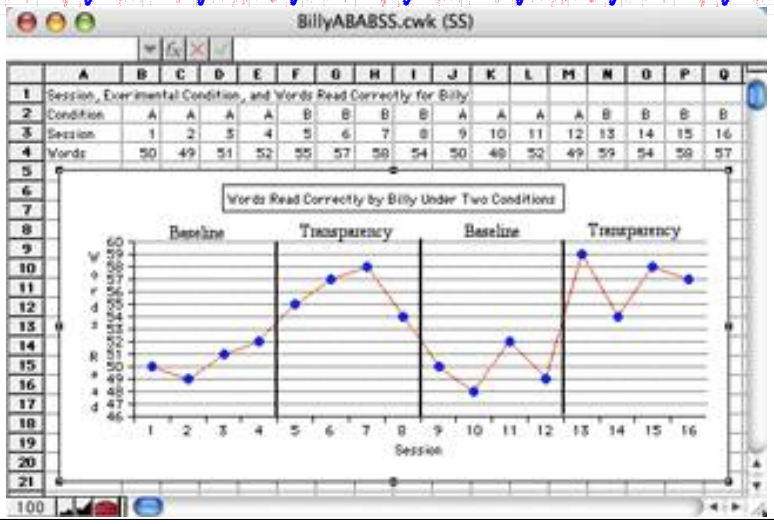
Single Subject Baseline Design A-B-A-B



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Characteristics of the Single-Subject Discrete Trials Design

1. Individual subjects receive each treatment condition of the experiment dozens (perhaps hundreds) of times. Each exposure to a treatment or *trial,* produces one data point for each dependent variable measured.
2. Extraneous variables that might introduce unwanted variability in the dependent variable are tightly controlled

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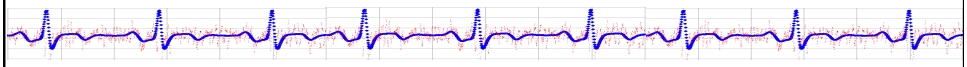

3. If feasible, the order of presenting the treatments is randomized or counterbalanced to control order effects
4. The behavior of individual subjects undergoing the same treatment may be compared to provide intersubject replication

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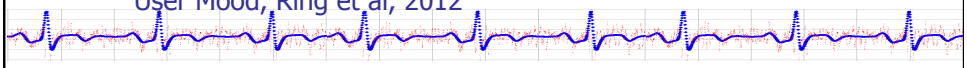
Example Discrete Trials Design

Longitudinal Affective Computing - Virtual Agents that Respond to User Mood, Ring et al, 2012



- N=21 participants interacted with a virtual exercise coach for 2 months (696 samples)
- Each day, their mood was assessed via self-report.
- The coach would randomly say one of:
  - **Favor**: I was wondering if you'd mind doing me a favor and take a walk before our next session.
  - **Request**: Would you take a walk before our next session.
- Walking was assessed via pedometer.

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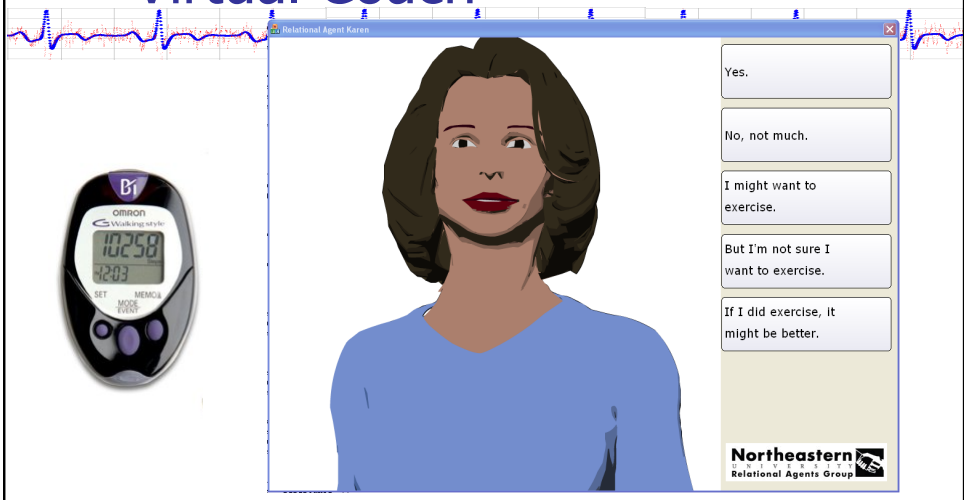
Virtual Coach



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Example Discrete Trials Design

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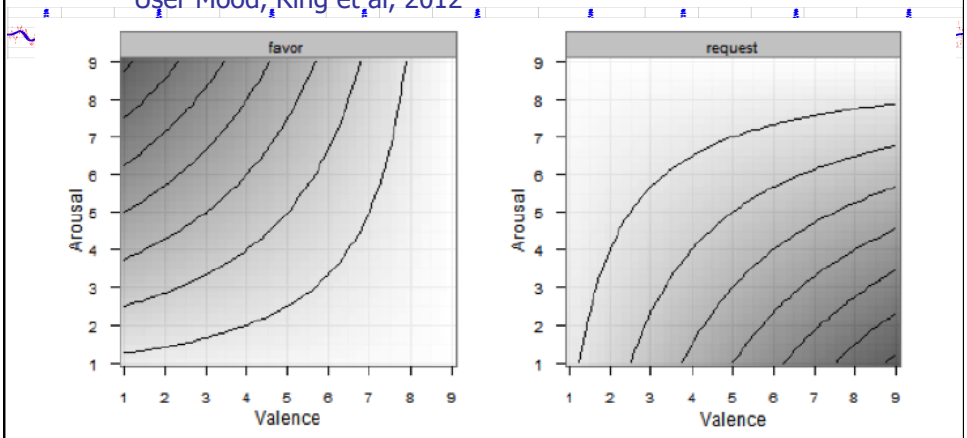
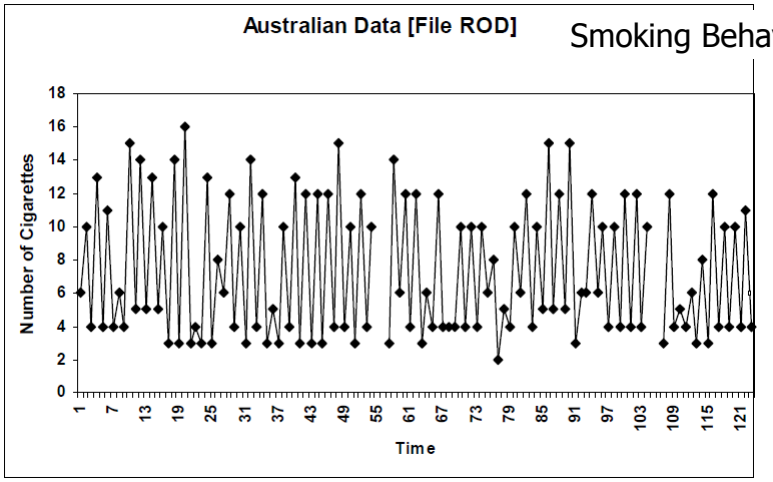


Fig. 1: Change in the number of steps walked based on mood and dialogue manipulation. Darker areas represent where each dialogue had the most positive effect on step count.

Time Series Analysis

Velicer & Fava, 2003



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Why is this science?

Generality?

1. Large number of observations
    1. Average out small error variations
2. Rigid control of extraneous variables
3. Focus on powerful effects

4. Still show inter-subject generality
    1. But usually small N (3-6)

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Advantages of the Single-Subject Approach

- Focus on tightly controlling error variance
- Focus on individual behavior makes identifying and controlling sources of error variance relatively easy
- Focus on individual behavior may reveal subtle effects of an independent variable lost with a group approach
- Causal relationships can be established with very few subjects

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Disadvantages of the Single-Subject Approach

- Making multiple observations is time- consuming and can be tedious
- The single-subject approach is not appropriate for all research questions (e.g., jury decision making)
- Results may be of limited generality
- All variables that can cause error variance cannot be identified and controlled
- Not widely accepted by the research community

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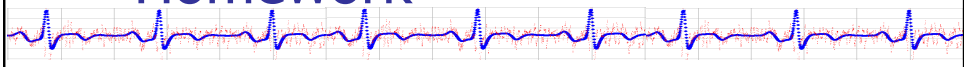
Homework



- Read
  - Within-subjects designs (B&A Ch 10 312-326). The t-test for dependent means.
  - Example (Rigby paper)
- IS4800: start on T2
  - Correlational design
  - Proposal 3/23
  - Presentation 4/3

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