



Single case experimental designs

Bethany Raiff, PhD, BCBA-D

Rowan University

Outline

- Introduce single-case designs (SCDs) to evaluate behavioral data
- Introduce each SCD and discuss advantages and disadvantages
 - Provide examples
- Analysis of SCDs

Single Case Design (SCD)

- Focus on individual subjects
 - aka n-of-1 designs (even though n in a study is > 1)
 - Not the same as a “Case study”
- Common characteristics:
 - Repeated assessment
 - Replication of effects
 - Each case serves as his/her/its own control

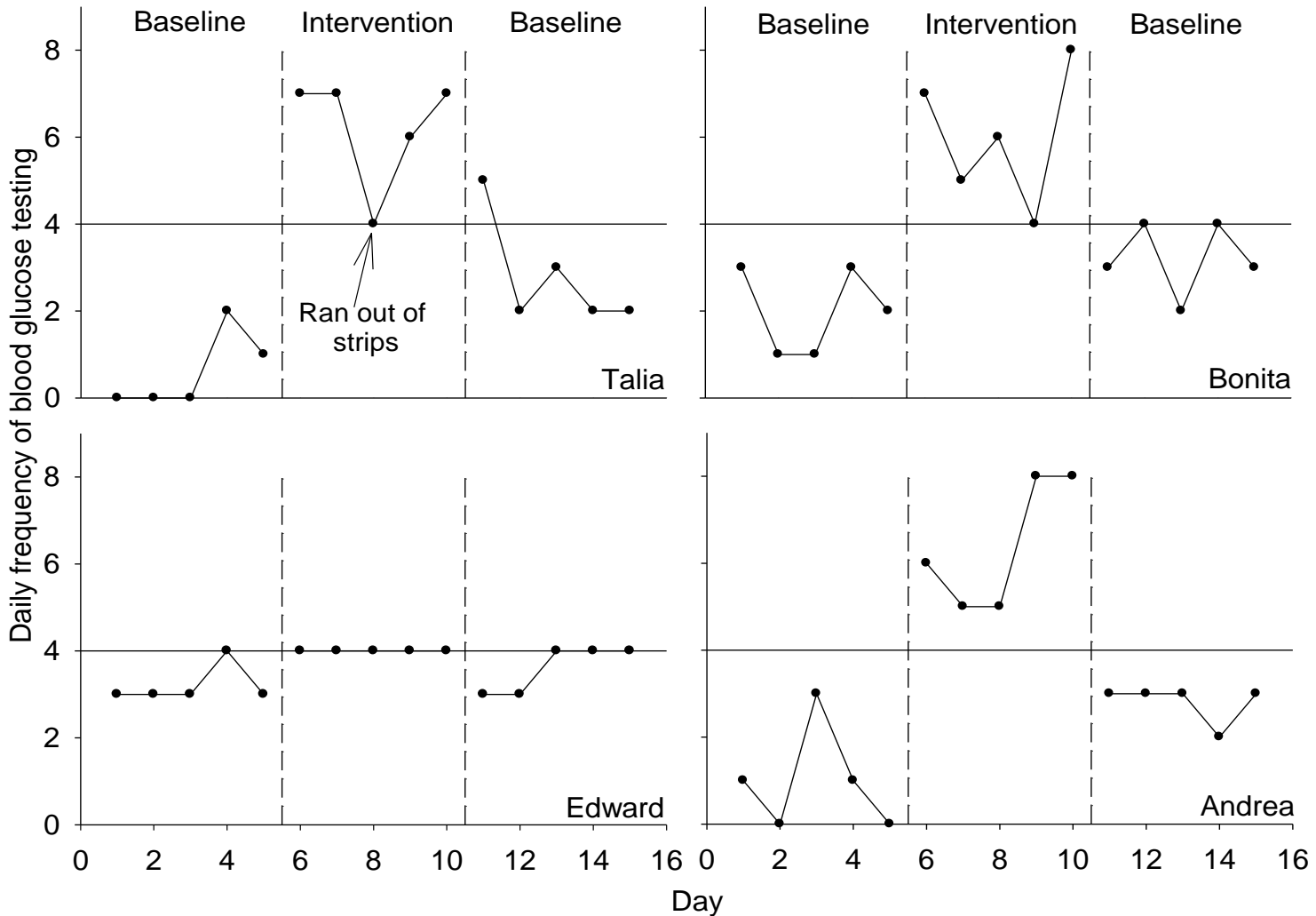
When to use SCDs?

- Able to repeatedly assess behavior/symptoms over time
- Desire to change behavior/symptoms (not merely assess) and establish preliminary efficacy
- When it is unethical to withhold treatment from some participants.
- Can be applied across a range of funding levels

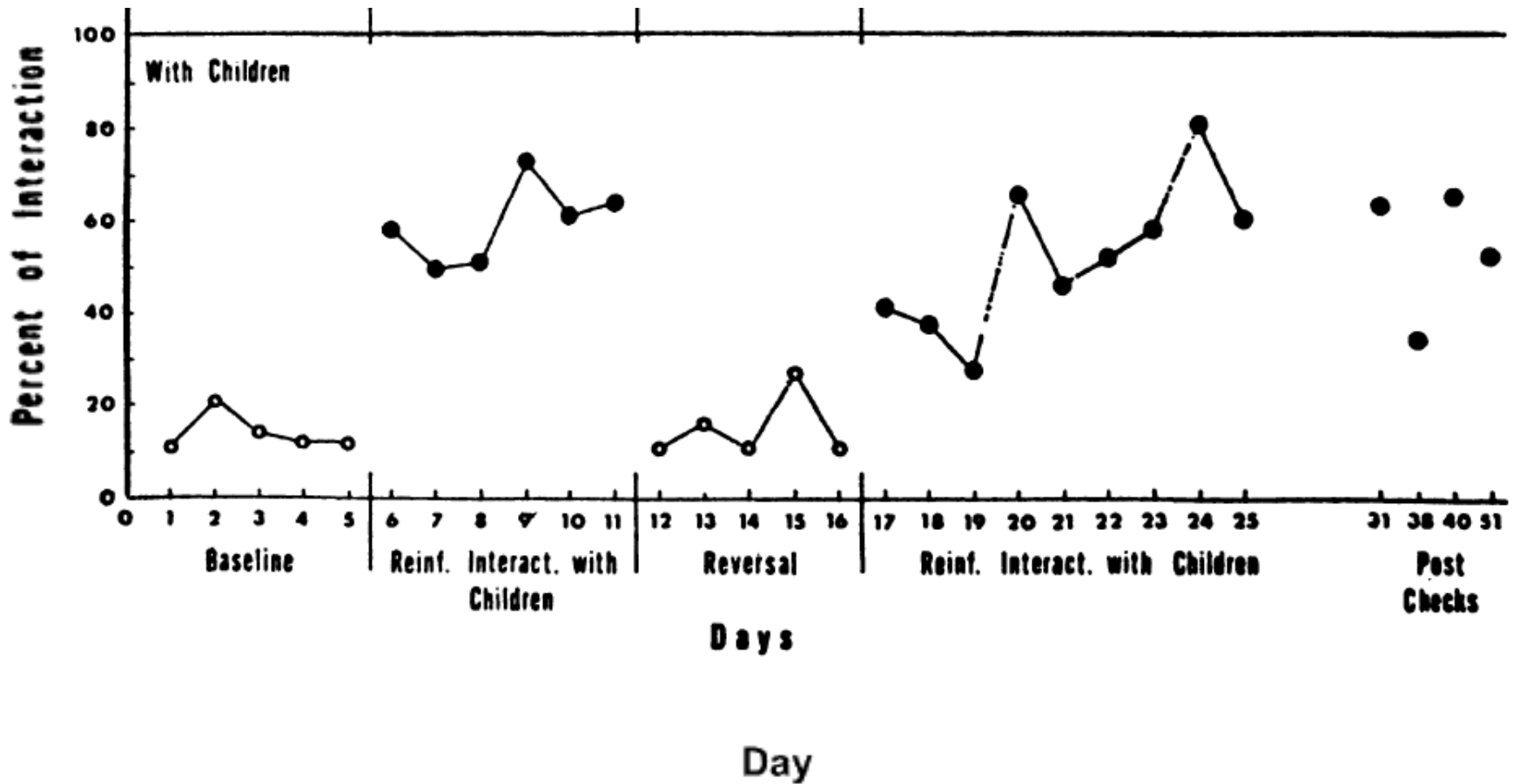
SCDs

- Types of designs
 - Reversal-replication (e.g., ABA, ABAB)
 - Alternating treatments
 - Multiple-baseline
 - Changing criterion
 - Combination

Reversal Design: Increasing blood glucose testing with Internet-based incentives (Raiff & Dallery, 2010)

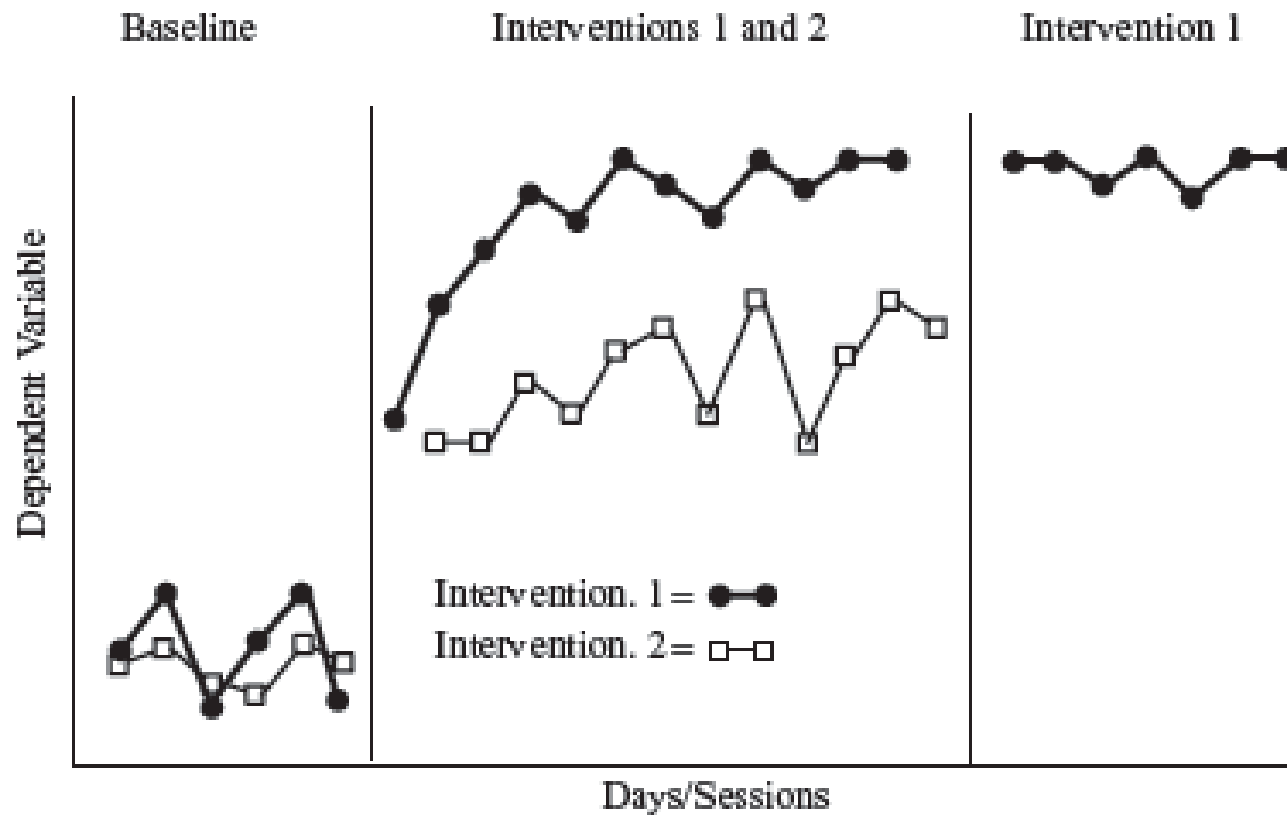


Reversal Design: Increasing peer interactions (Allen et al, 1964)

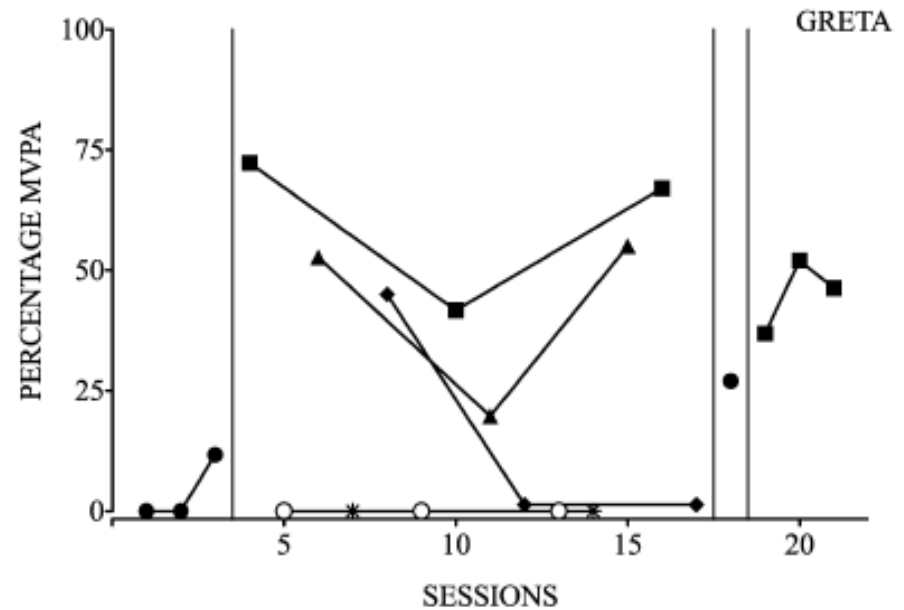
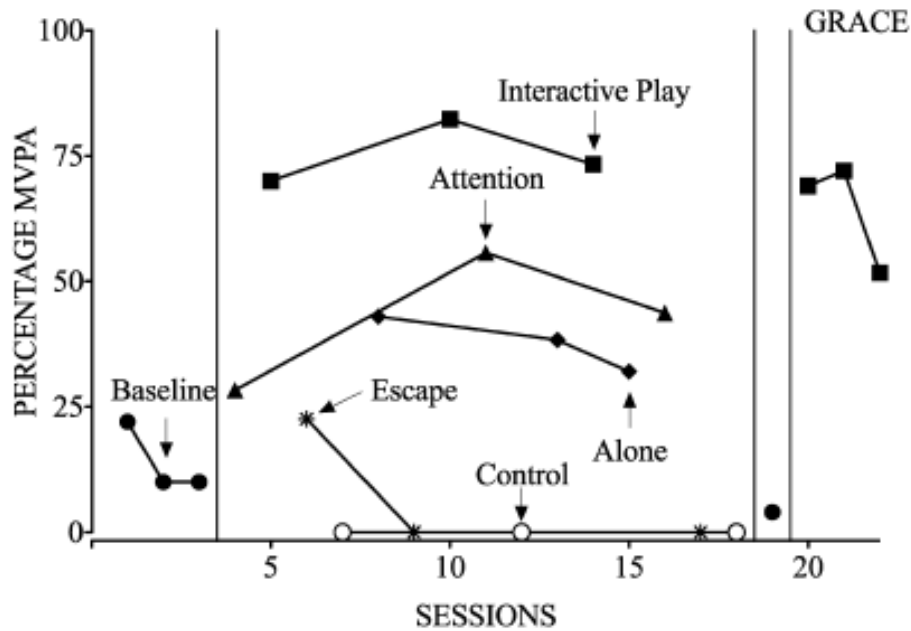


Alternating treatments design

(Kratochwill et al., 2012)



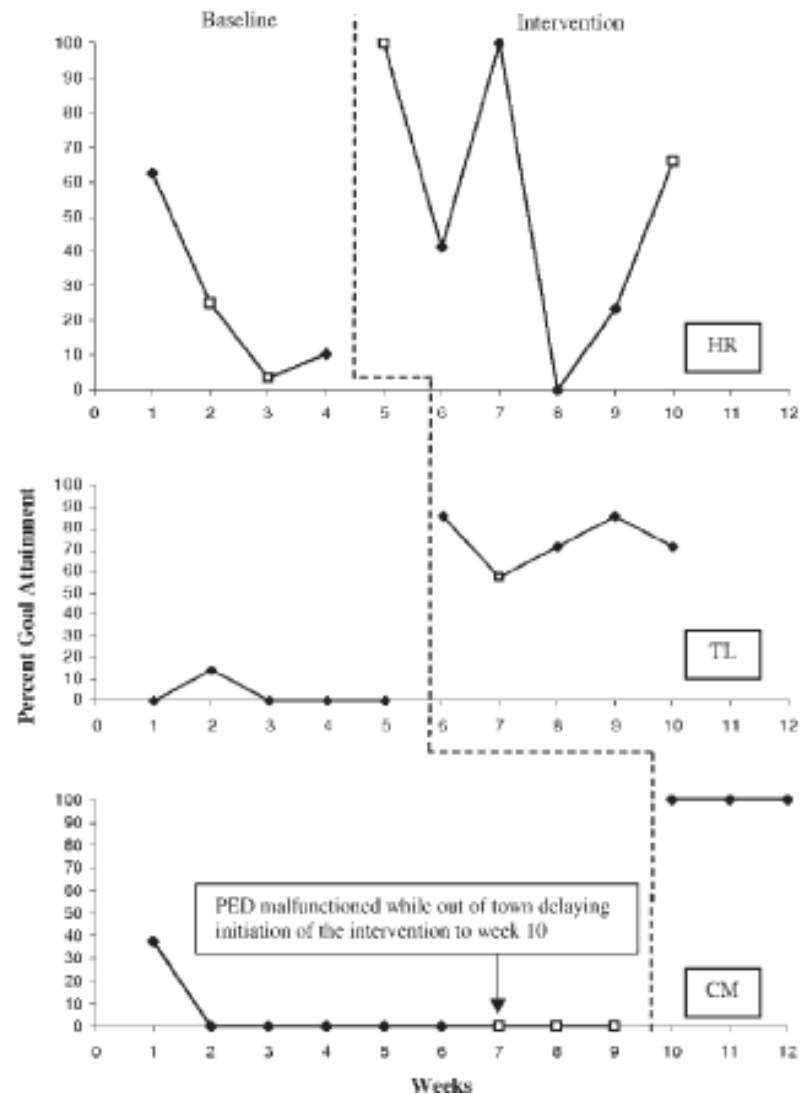
Alternating Treatments: Promoting moderate-to-vigorous activity (Larson et al., 2014)



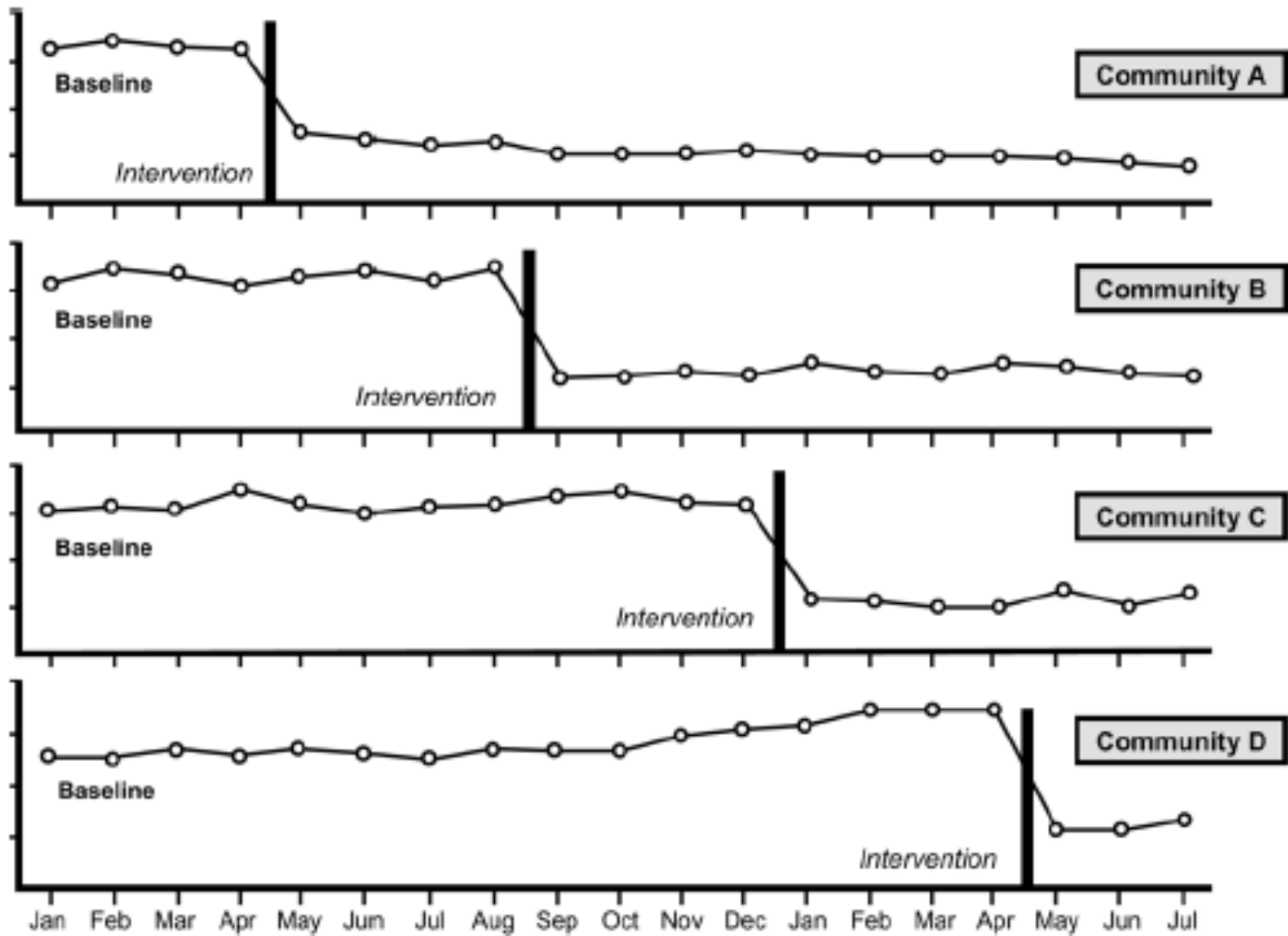
Reversal and Alternating Treatments Designs

- Advantages
 - Within-subject replication
 - Clear demonstration of the effect of the independent variable
 - Flexible (ABA, ABAB, ABACACB, BAB)
- Disadvantages
 - Must remove a treatment to demonstrate experimental control (not always ethical)
 - Risk of carryover and order effects
 - Will not work with irreversible treatments

Multiple-Baseline: Adherence to weight management with personal electronic device (Cushing et al., 2010)

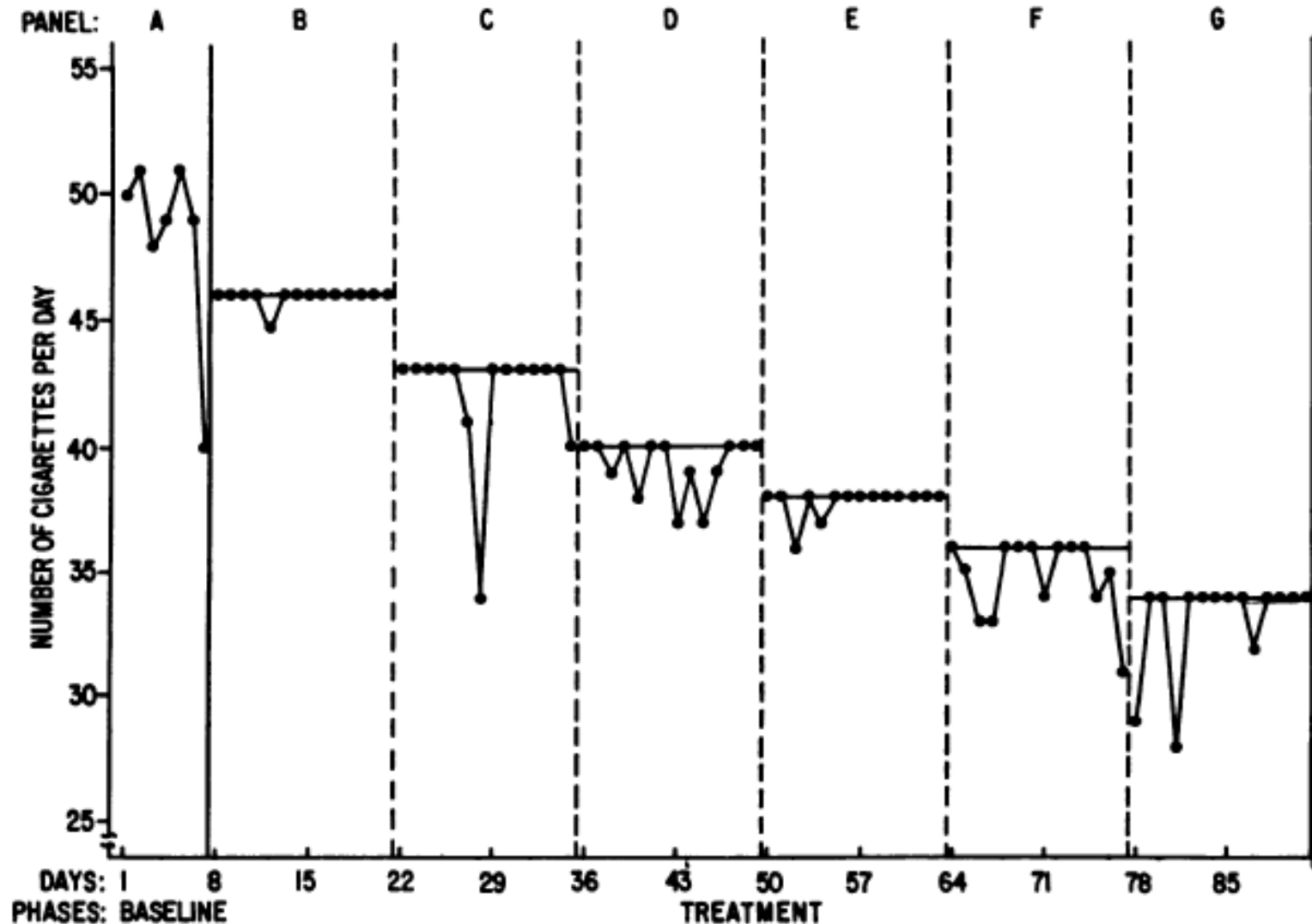


Multiple Baseline: Different communities (Hawkins et al, 2007)

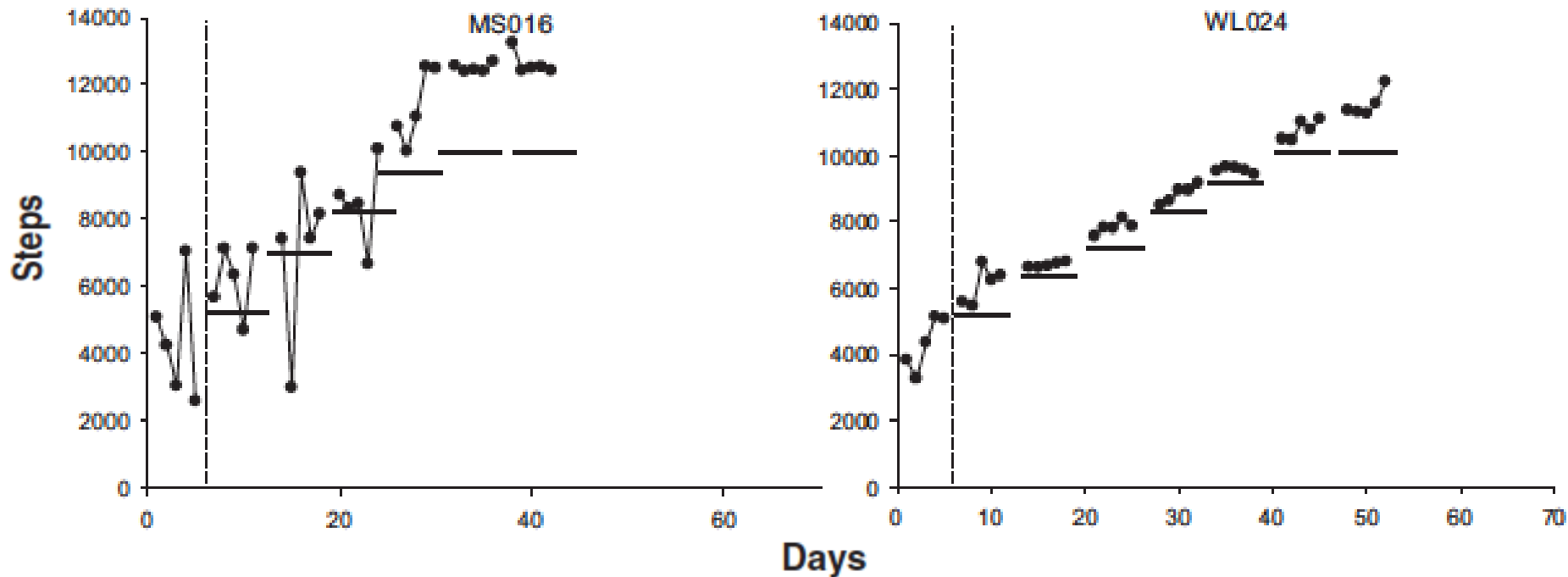


Changing Criterion Design: Decreasing daily smoking

(Hartmann & Hall, 1976)



Changing Criterion: Increasing number of steps taken per day in sedentary adults (Kurti & Dallery, 2013)



Multiple Baseline & Changing Criterion Designs

- Advantages:
 - Do not need to remove an effective treatment
 - Flexible (behavior, settings, participants)
- Disadvantages:
 - Requires quantitative criteria that can be targeted in step-wise fashion (CCD)
 - May need more subjects to convincingly show experimental control

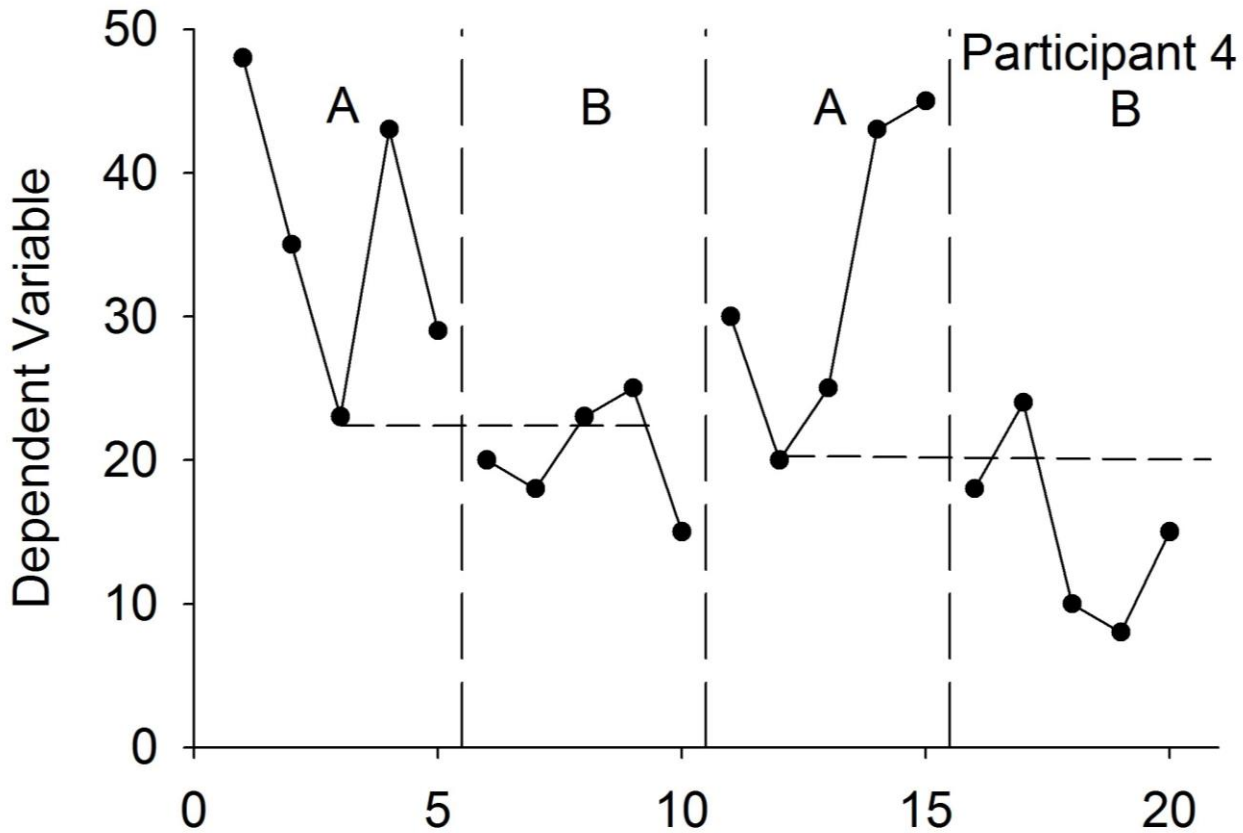
Data analysis

- Visual Analysis
- Emphasis on graphical displays of data

Data analysis

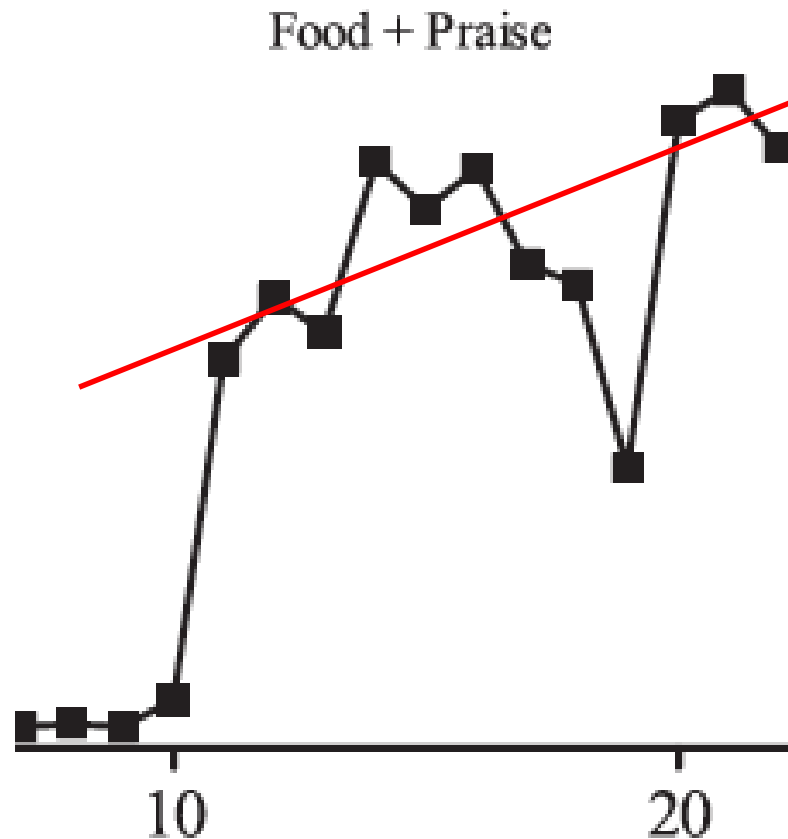
- Is there a reliable effect of the intervention?
- What is the magnitude of the effect?
- Are the results clinically meaningful and socially valid?
- Emphasis on individual subject effects.
- Statistical analyses can be used along with visual analysis.
 - Nonparametric
 - Trajectory analyses

Variability and overlapping data



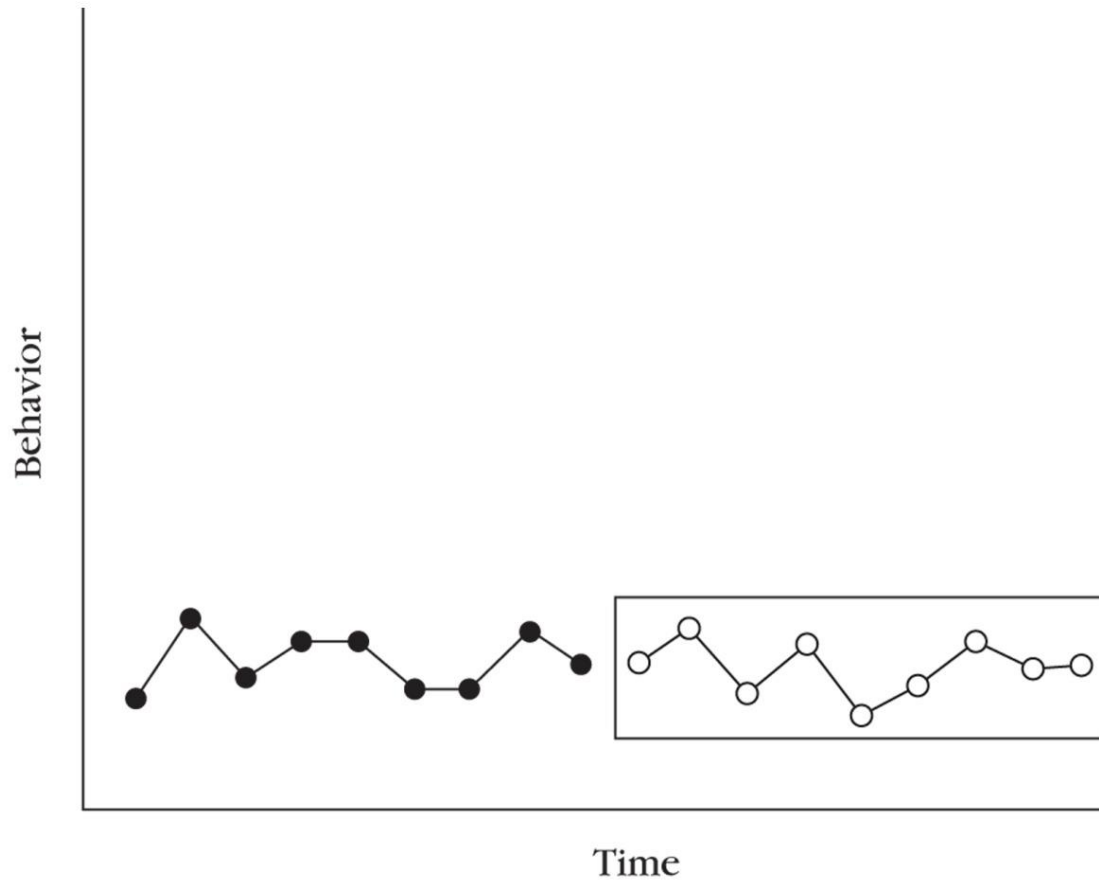
Trends

- Consistent change in a single direction

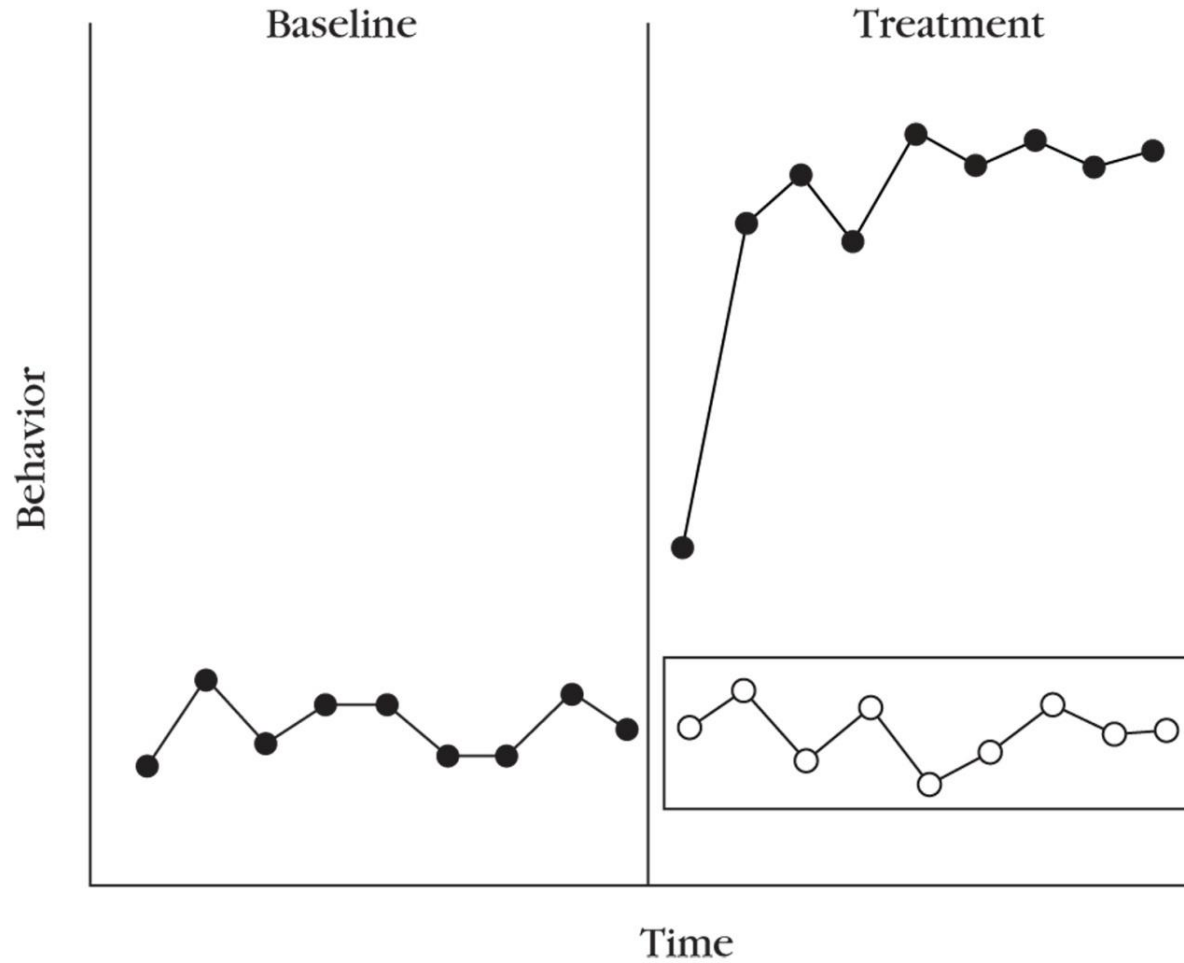


Importance of stability

- Prediction

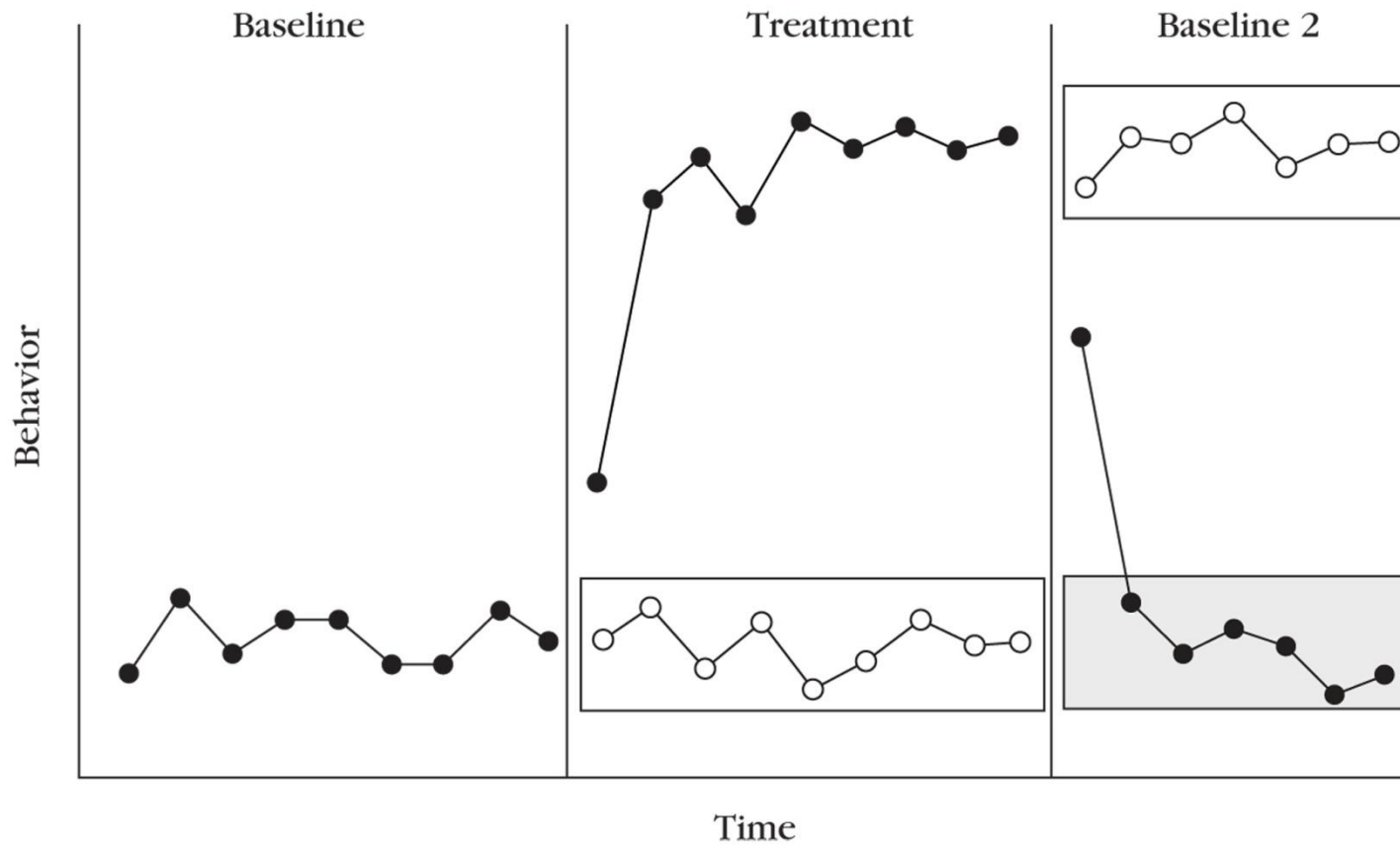


Importance of stability

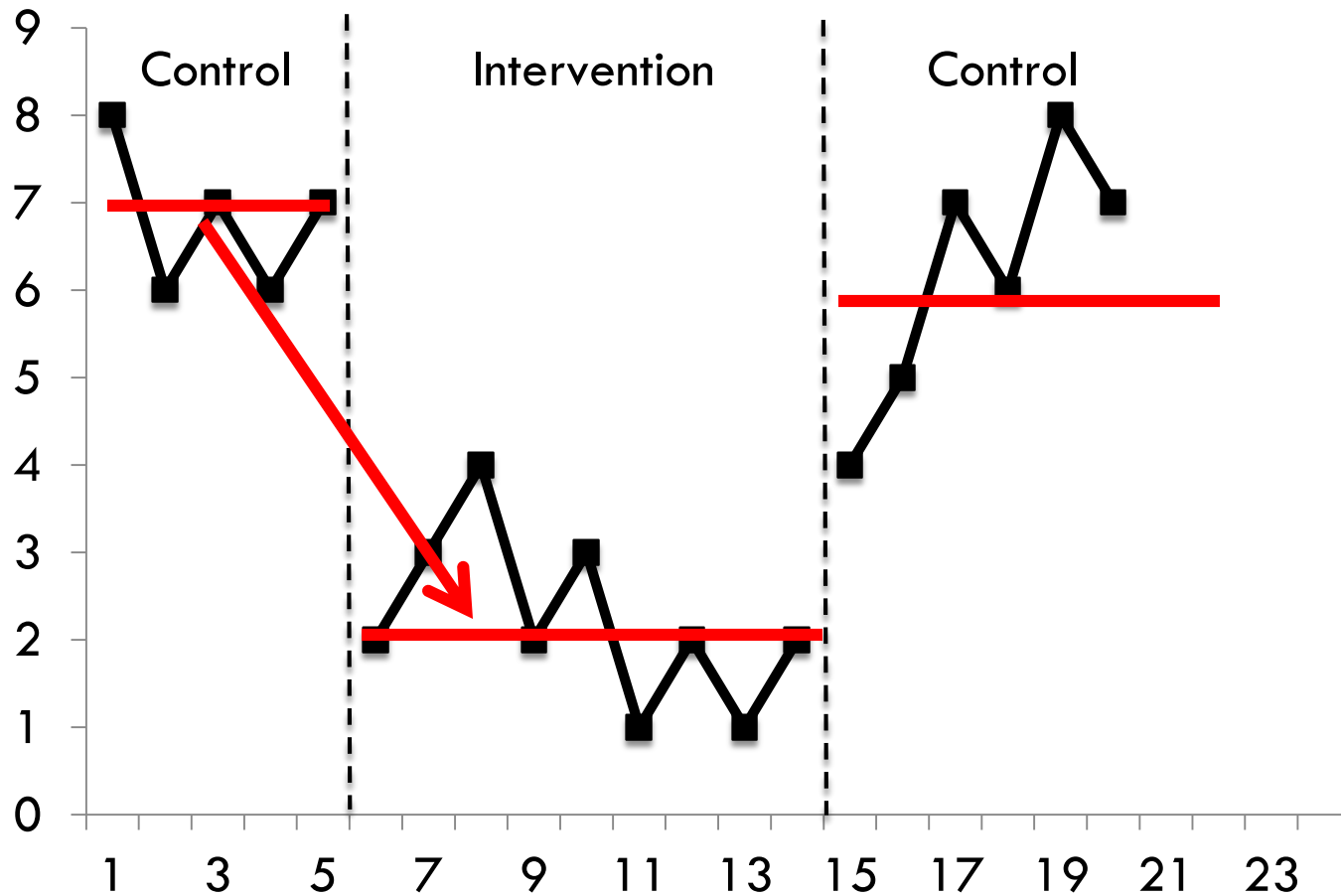


Importance of stability

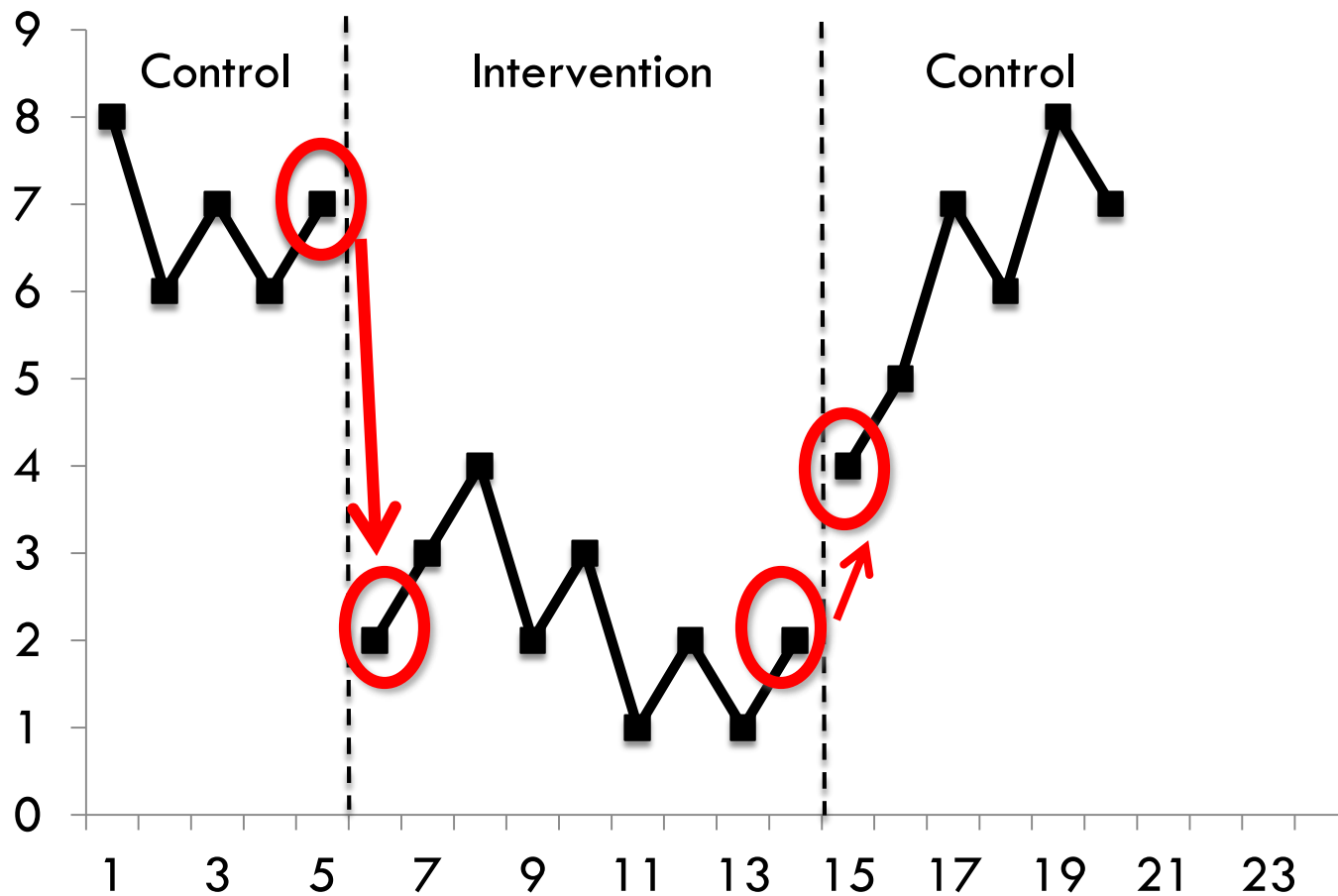
- Verification



Mean Shift

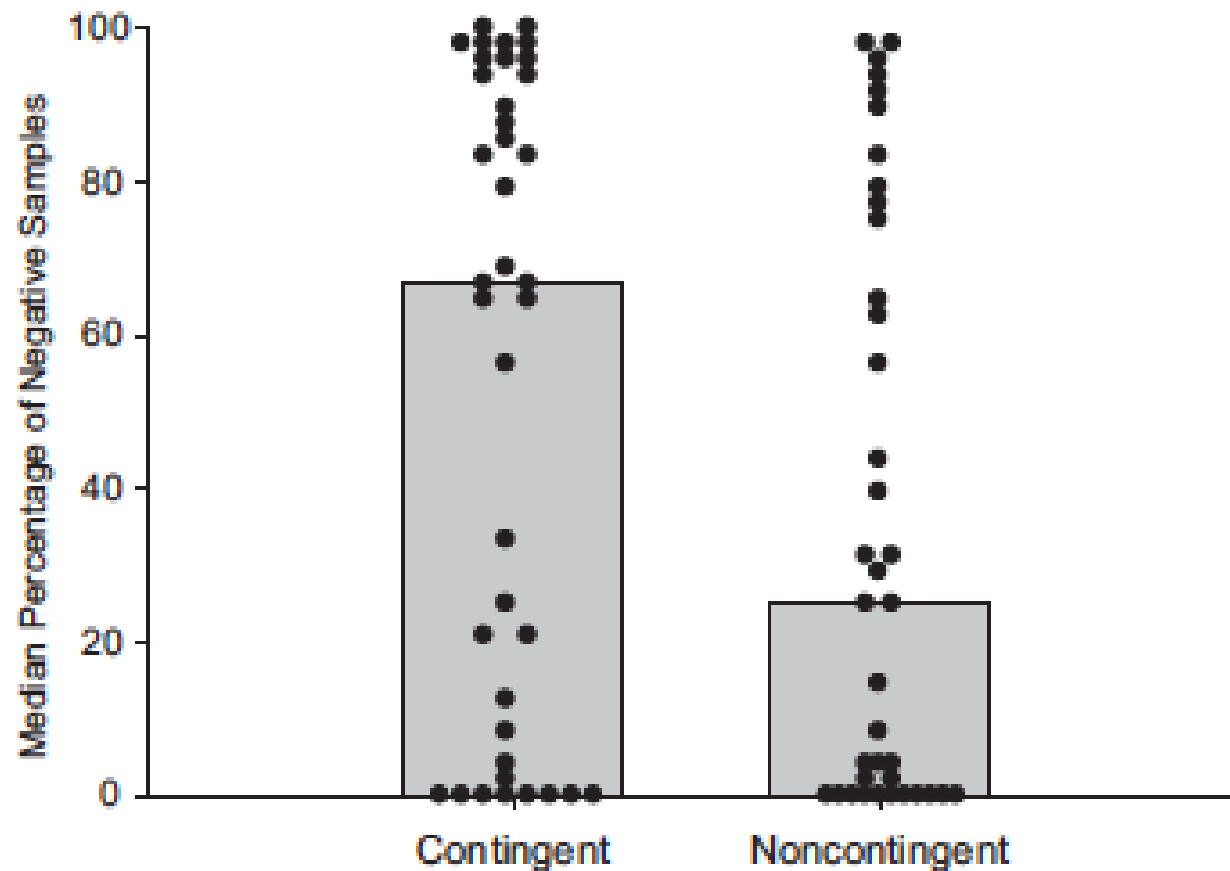


Level Shift



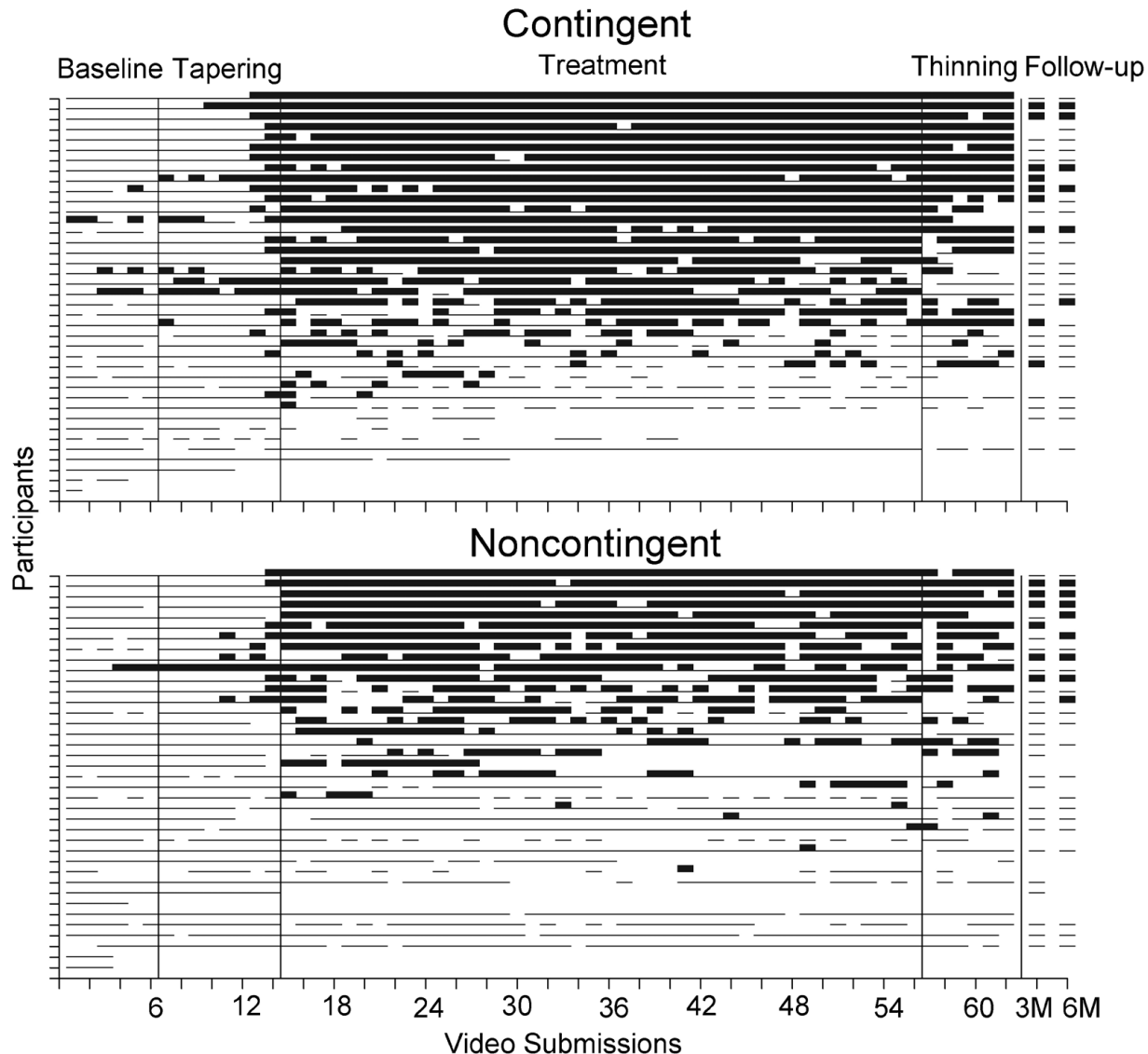
Emphasis on individual subjects

(Dallery et al., 2013)



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Standards for evaluating SCDs

- The following guidelines have been proposed:
 1. Systematically manipulate an independent variable
 2. Collect inter-observer agreement
 3. Phase must include at least THREE data points (preferably FIVE or more)
 4. At least THREE attempts to demonstrate an intervention effect at different time points (e.g., participants, conditions, criteria, etc)

General Conclusion about SCDs

- Rigorously and efficiently establish feasibility and preliminary efficacy
- Overcome ethical barriers to withholding or discontinuing effective treatments
- Obviate logistical issues (e.g., access to a large number of participants)

For more information about SCDs

Books

- Barlow & Nock (2008). *Single-case experimental designs: strategies for studying behavior change*. Pearson Publishers
- Kazdin (2010). *Single-case research designs: methods for clinical and applied settings*. Oxford Publishers
- Kratochwill & Levin (2015). *Single-case research design and analysis: New directions for Psychology and Education*.

Journal Articles

- Dallery, J. & Raiff, B.R. (2014). Optimizing behavioral health interventions with single-case designs: from development to dissemination. *Translational Behavioral Medicine: Practice, Policy and Research (online first)*.
- Dallery, J., Cassidy, R., Raiff, B.R. (2013). Single-case experimental designs to evaluate technology-based health interventions. *Journal of Medical Internet Research, 15*, online. doi: 10.2196/jmir.2227

Thank you!

Questions?