National Autism Conference

pennsylvania
DEPARTMENT OF EDUCATION
Bureau of Special Education
Pennsylvania Training and Technology Assistance Network

PROGRESS THROUGH PARTNERSHIP

Use of Single Subject Designs to Evaluate Educational Outcomes for Students with Autism

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Florida State University

Use of Single Subject Designs to Evaluate Educational Outcomes for Students with Autism

This is a rather narrow title since students with autism also have ***behavioral*** outcome goals

And, it is also narrow in that you can't really have "outcomes" without understanding the ***processes*** that make the outcomes happen

So, our new title is…

Use of Single Subject Designs to
Evaluate Educational and Behavioral, Processes and Outcomes,
for Students with Autism

Assumptions:

Students have a right to effective treatments.

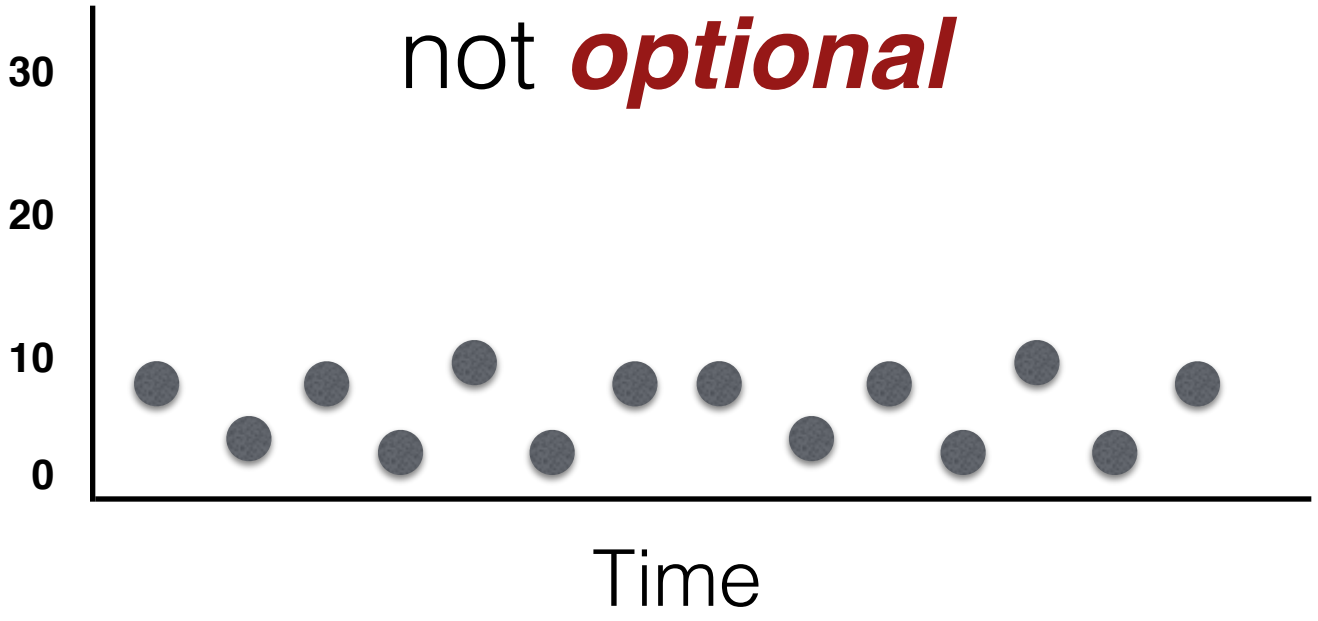
Assumptions:

We will use **data** for decision making about treatments that are being proposed or are in effect.

Assumptions:

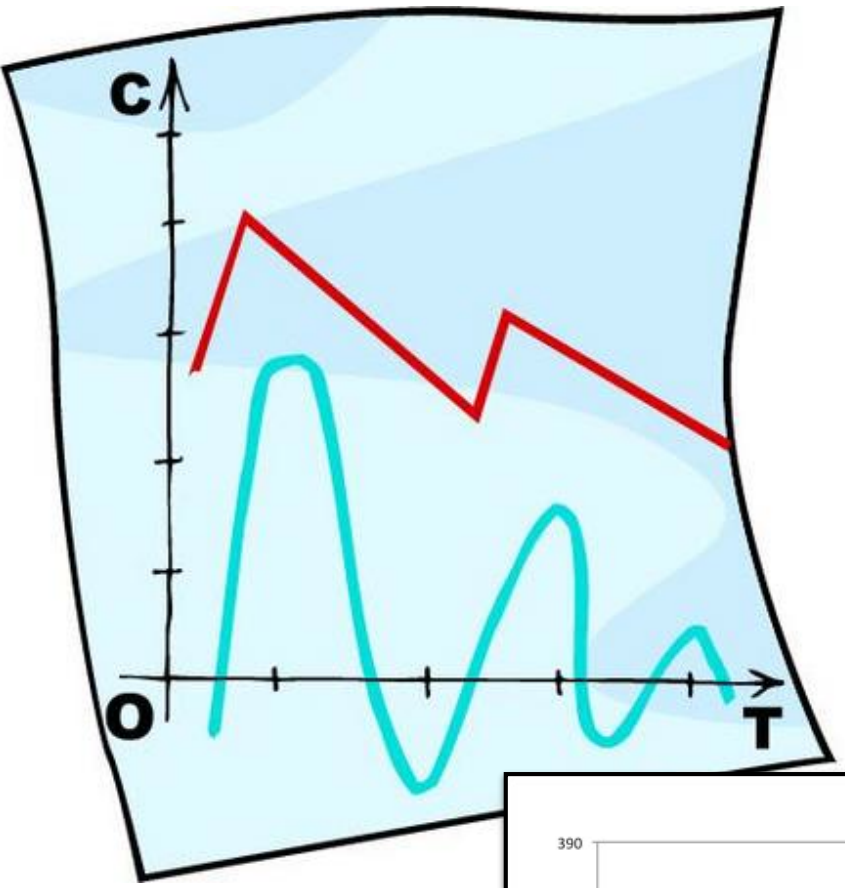
Repeated Measures of Behavior are **ESSENTIAL**

not ***optional***



Assumptions:

We will graph the behavioral data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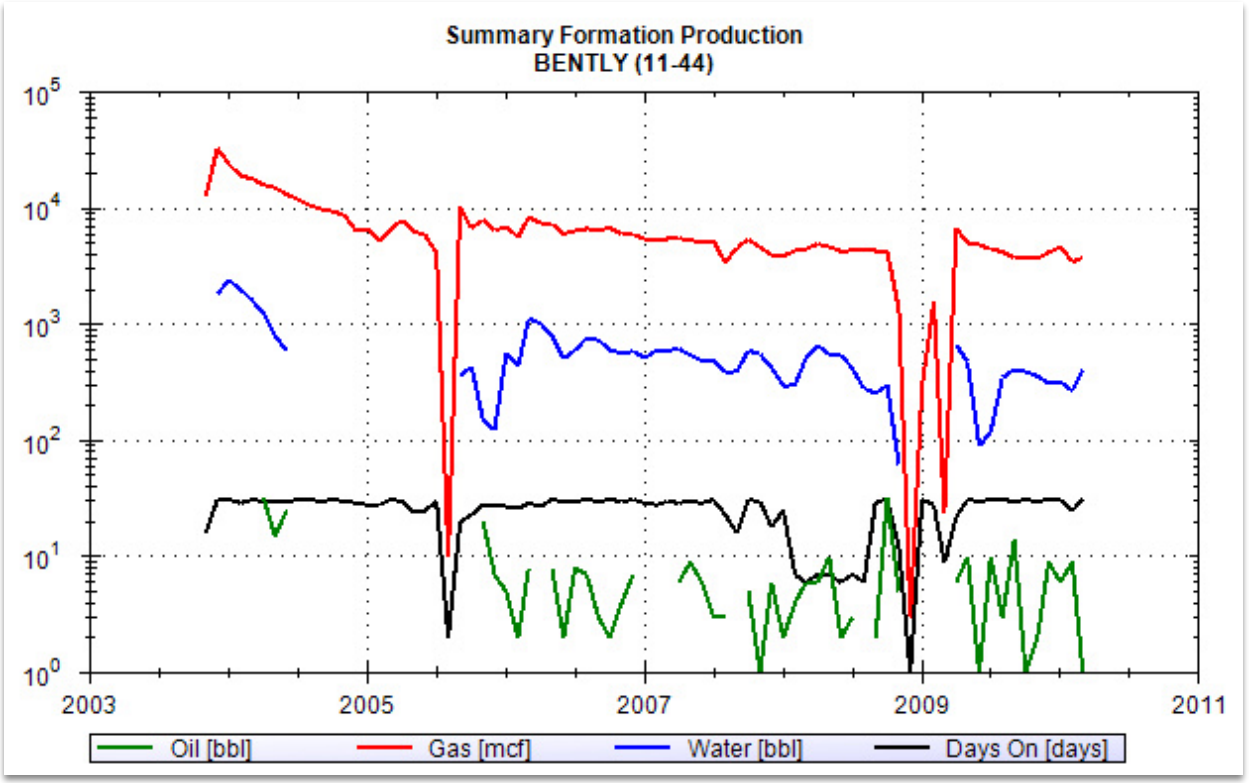
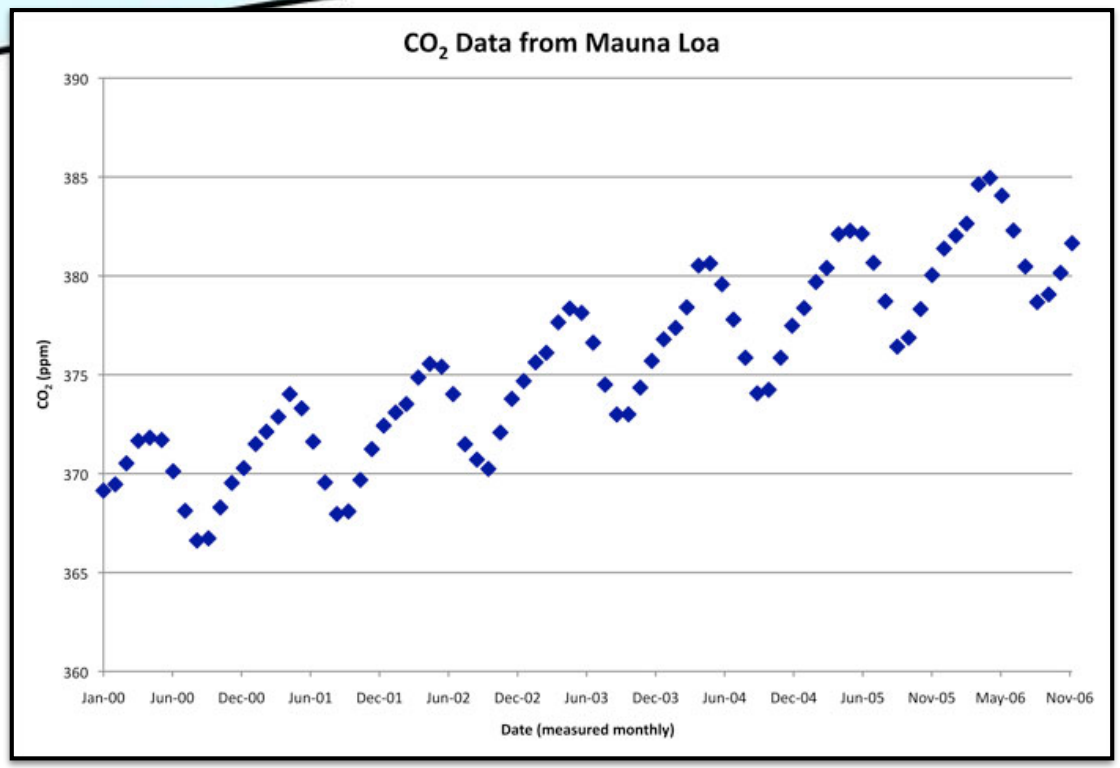

Summary Formation Production
BENTLY (11-44)
10^5
10^4
10^3
10^2
10^1
10^0
2003
2005
2007
2009
2011
Oil [bbl]
Gas [mcf]
Water [bbl]
Days On [days]


CO_2 Data from Mauna Loa
CO_2 (ppm)
390
385
380
375
370
365
360
Jan-00
Jun-00
Dec-00
Jun-01
Dec-01
Jun-02
Dec-02
Jun-03
Dec-03
Jun-04
Dec-04
Jun-05
Nov-05
May-06
Nov-06
Date (measured monthly)

Assumptions:

We will visually analyze the data to determine if a treatment or intervention was effective

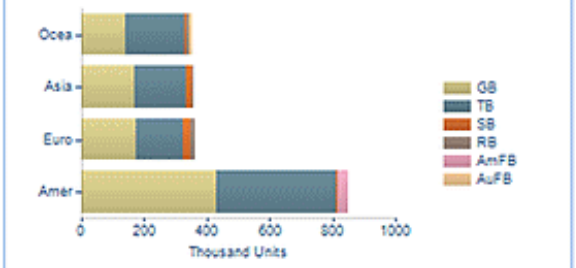
Executive Summary | Sales | Finance | **Production** | Logistics | Safety | Financial Analysis

Production Scorecard

Measure	Sep 2013 Actual	Budget	Variance	Zone	Trend	Micro Chart	Aug 2013 Actual	Budget	2013 YTD Actual	Budget
Production	1.9 MU	2.0 MU	-69.6 kU				4.0 MU	4.1 MU	33.6 MU	34.3 MU
OEE	67.6%	68.9%	-1.2%				68.1%	68.9%	68.6%	68.8%
Down Time	464.2 kU	426.8 kU	37.4 kU				960.2 kU	882.0 kU	7.7 MU	7.3 MU
Availability	83.7%	85.0%	-1.3%				83.7%	85.0%	84.3%	85.0%
Reject	262.9 kU	217.7 kU	45.3 kU				493.2 kU	449.8 kU	4.2 MU	3.7 MU

September 2013

Production by Region

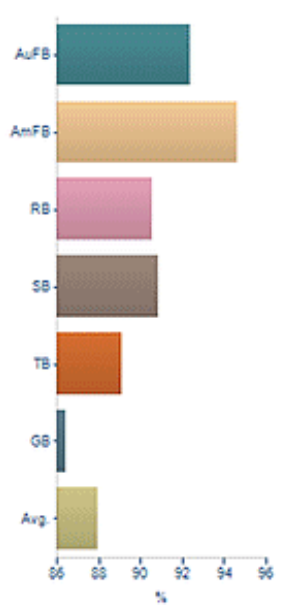


September 2013

Production Trend

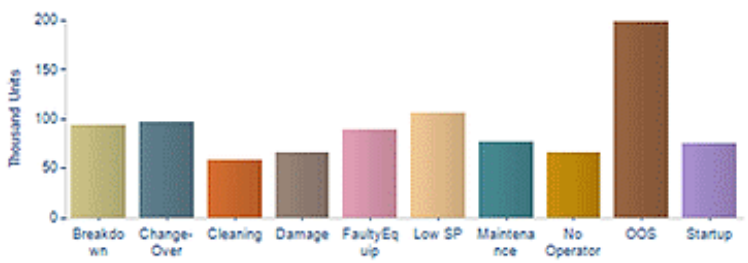
September 2013

Quality by Product



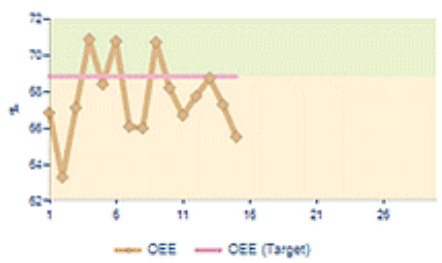
September 2013

Downtime by Cause



September 2013

OEE Trend



September 2013

We

Whi

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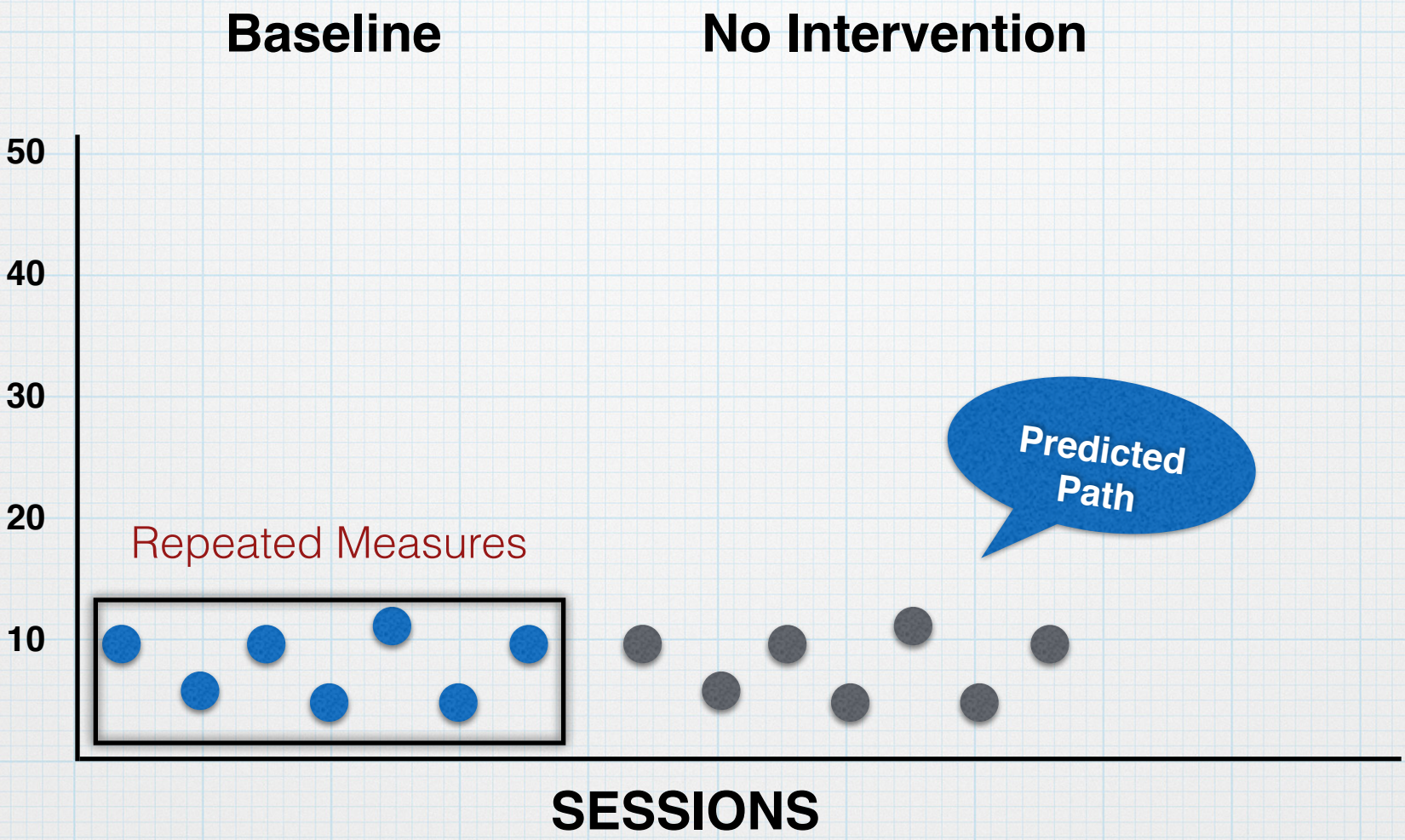
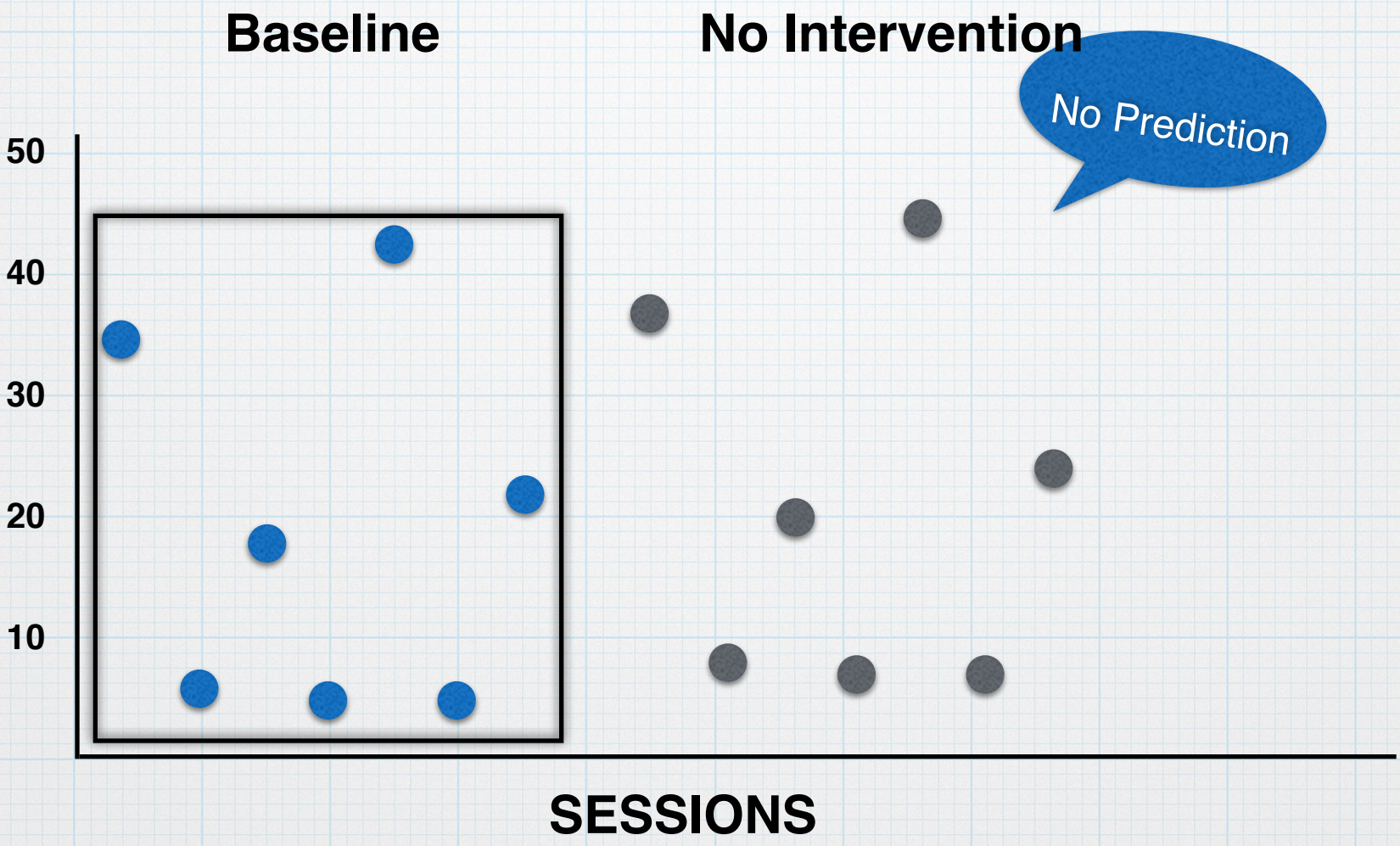
We start with Baseline Logic



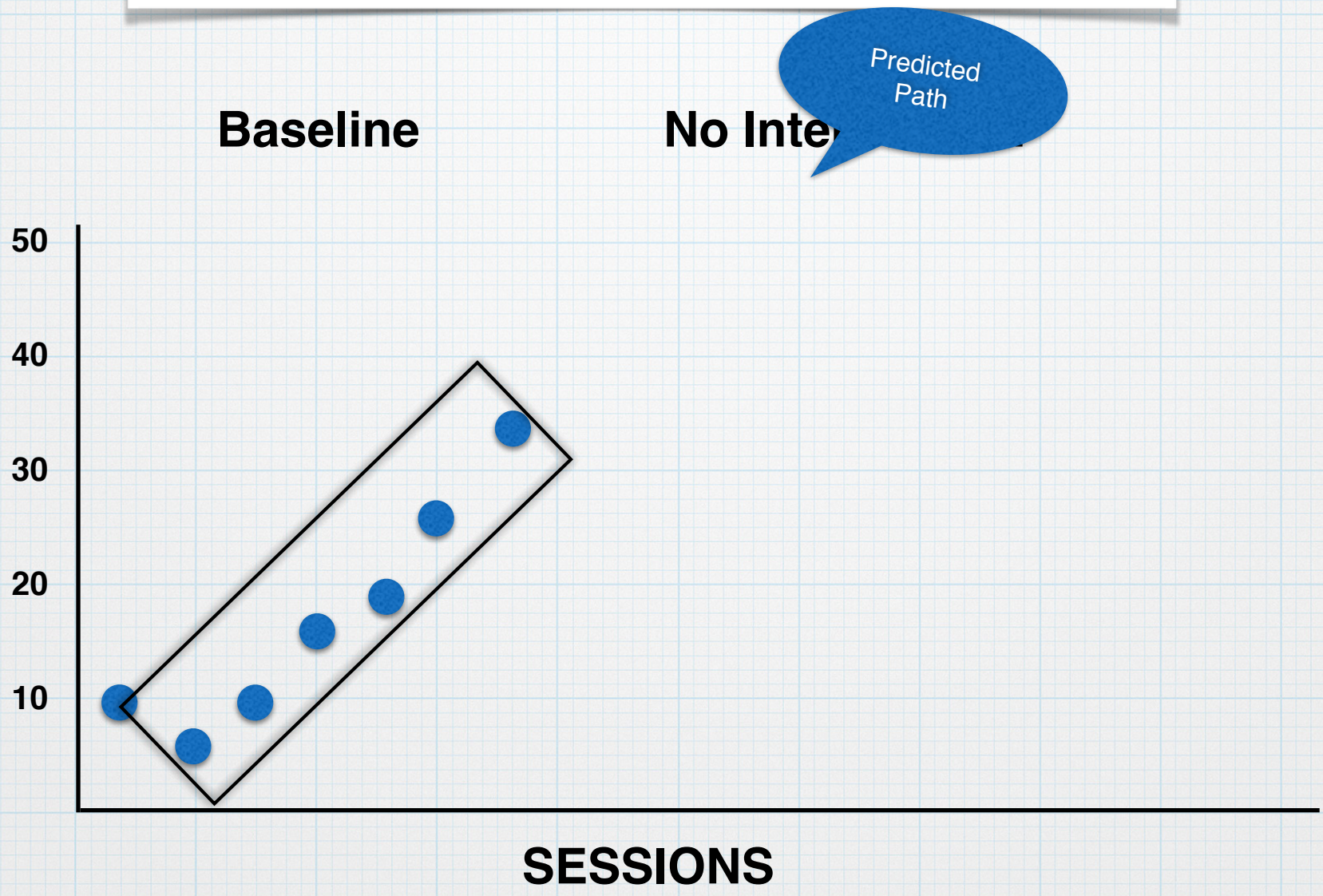
This is a good, stable baseline with an easy prediction.

Baseline Logic cont.



This an unstable baseline with no prediction.

Baseline Logic cont.



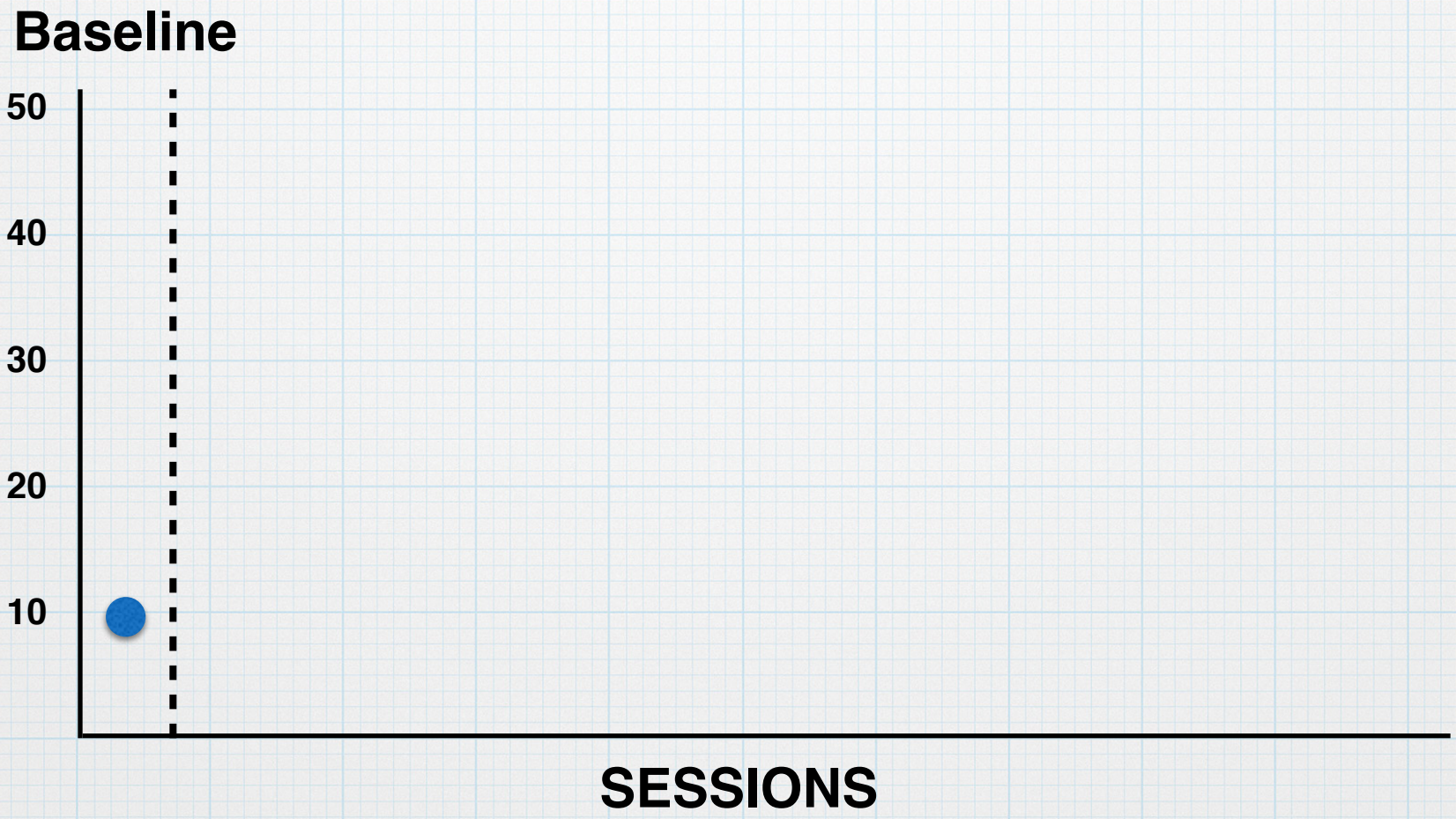
This is an uptrending, baseline with a fairly easy prediction.

If you want to…

Evaluate Educational and Behavioral, Processes and Outcomes for anyone

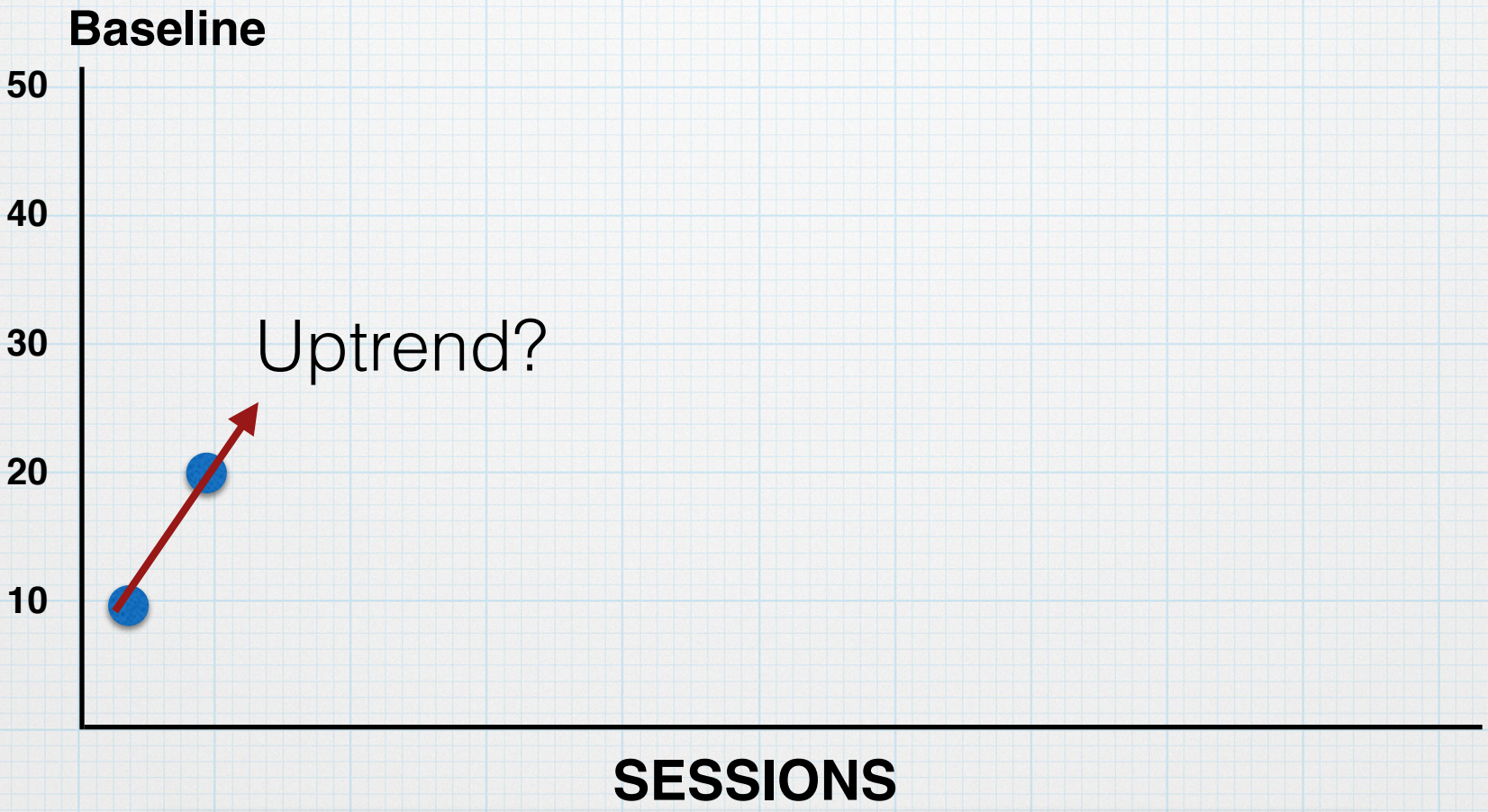
You will need to start by looking closely at the Baseline data and determine the direction of the desired effect of treatment or intervention

What do you think of this Baseline?



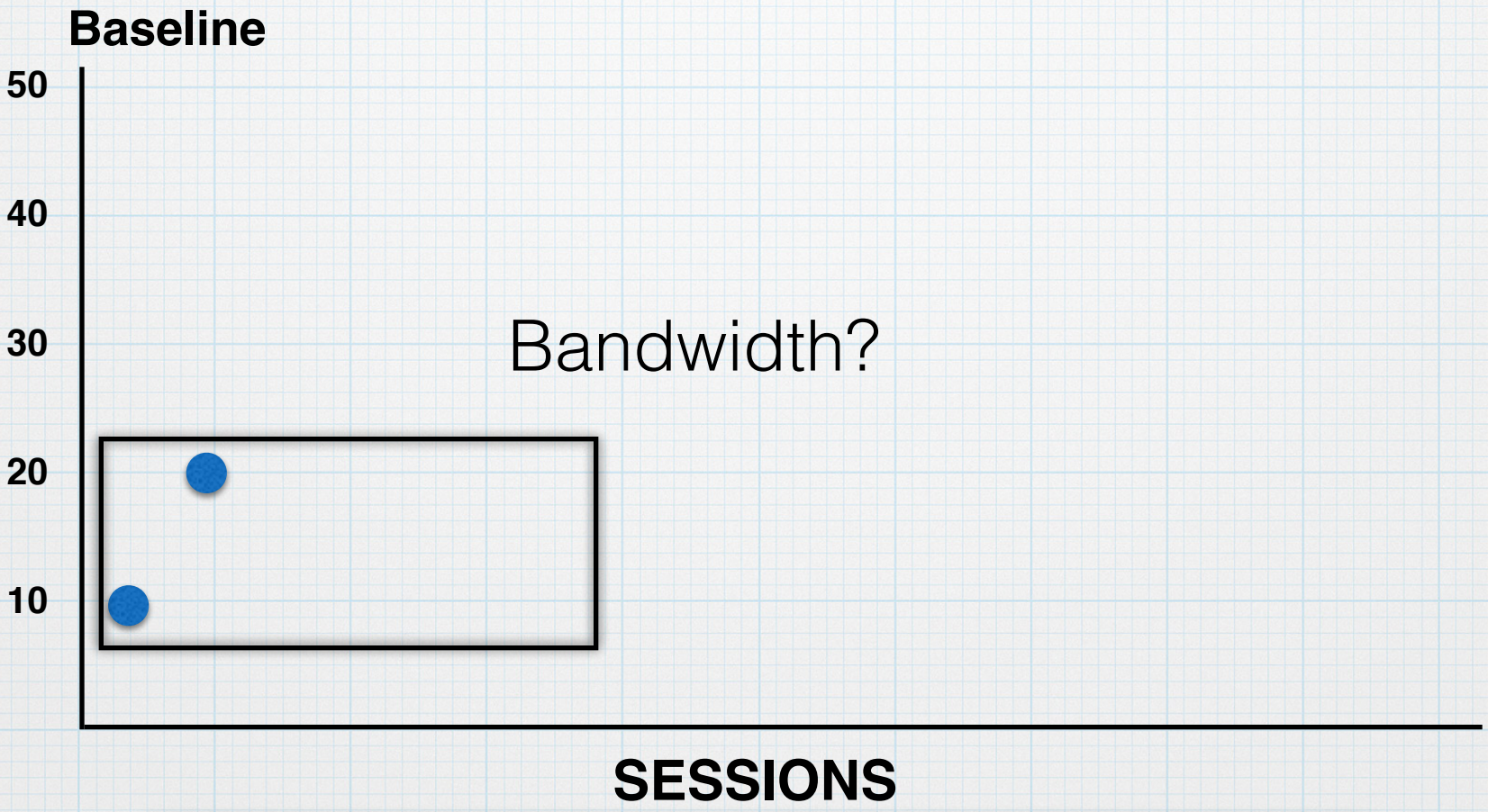
Clearly not enough data to make a prediction

How about two data points?



Still not enough data to make a prediction

How about two data points?



Still not enough data to make a prediction

How about two data points?

Still not enough data to make a prediction

Some people will try to get you to look at the *mean* not the trend.

This is clearly misleading. Don't be misled.

Single-Subject

Basic Research Designs

for the evaluation of treatments

PURPOSE:

To demonstrate:

a) A cause-effect relationship between treatment and behavior change (i.e. “Proof”), and

b) Help the consumer determine if the size of effect is *clinically significant*

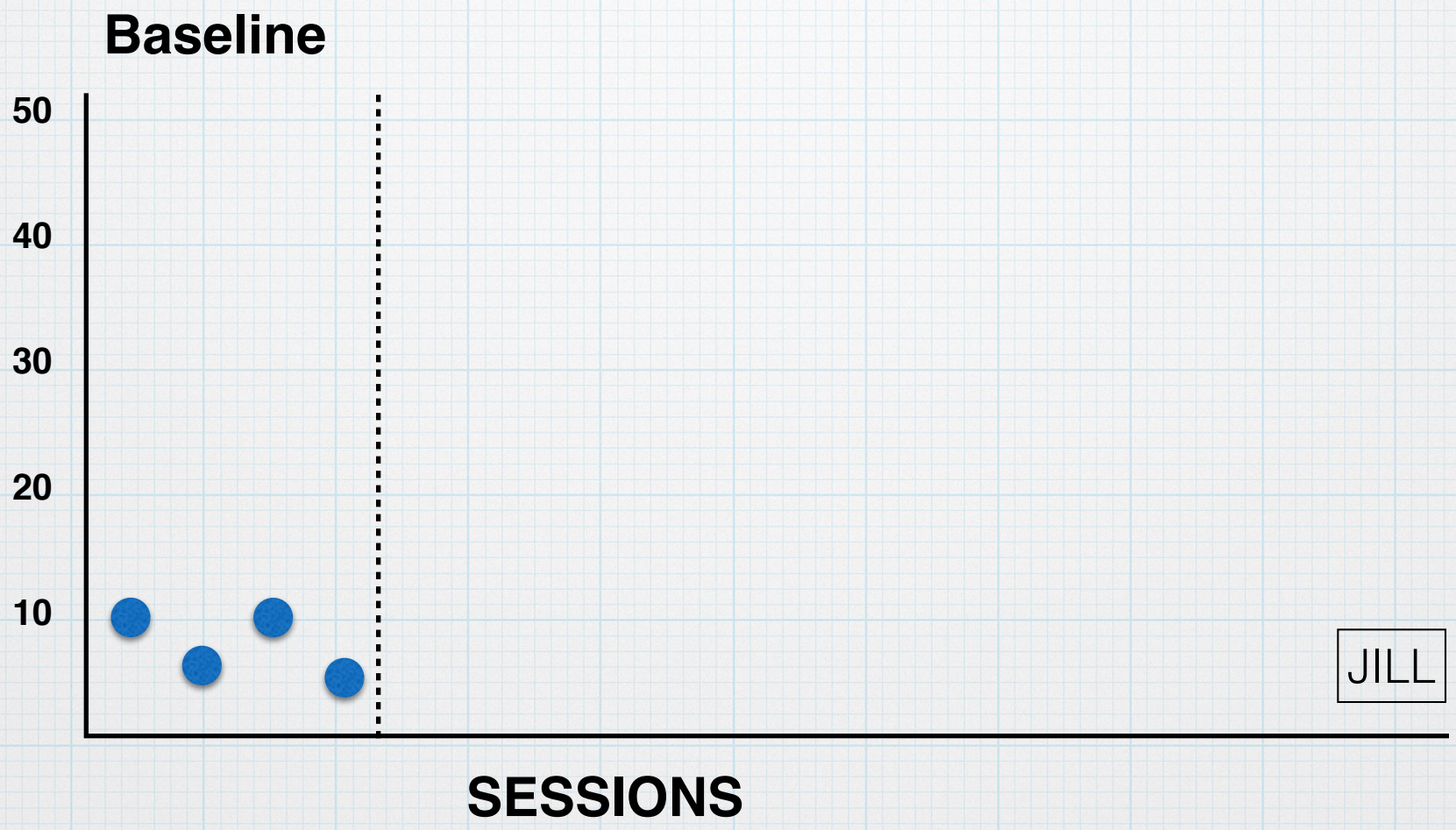
$$SS = \frac{(X - \overline{X})^2}{n} = \sum X^2 - \frac{\sum X}{n}$$

Single-Subject

Basic Research Designs

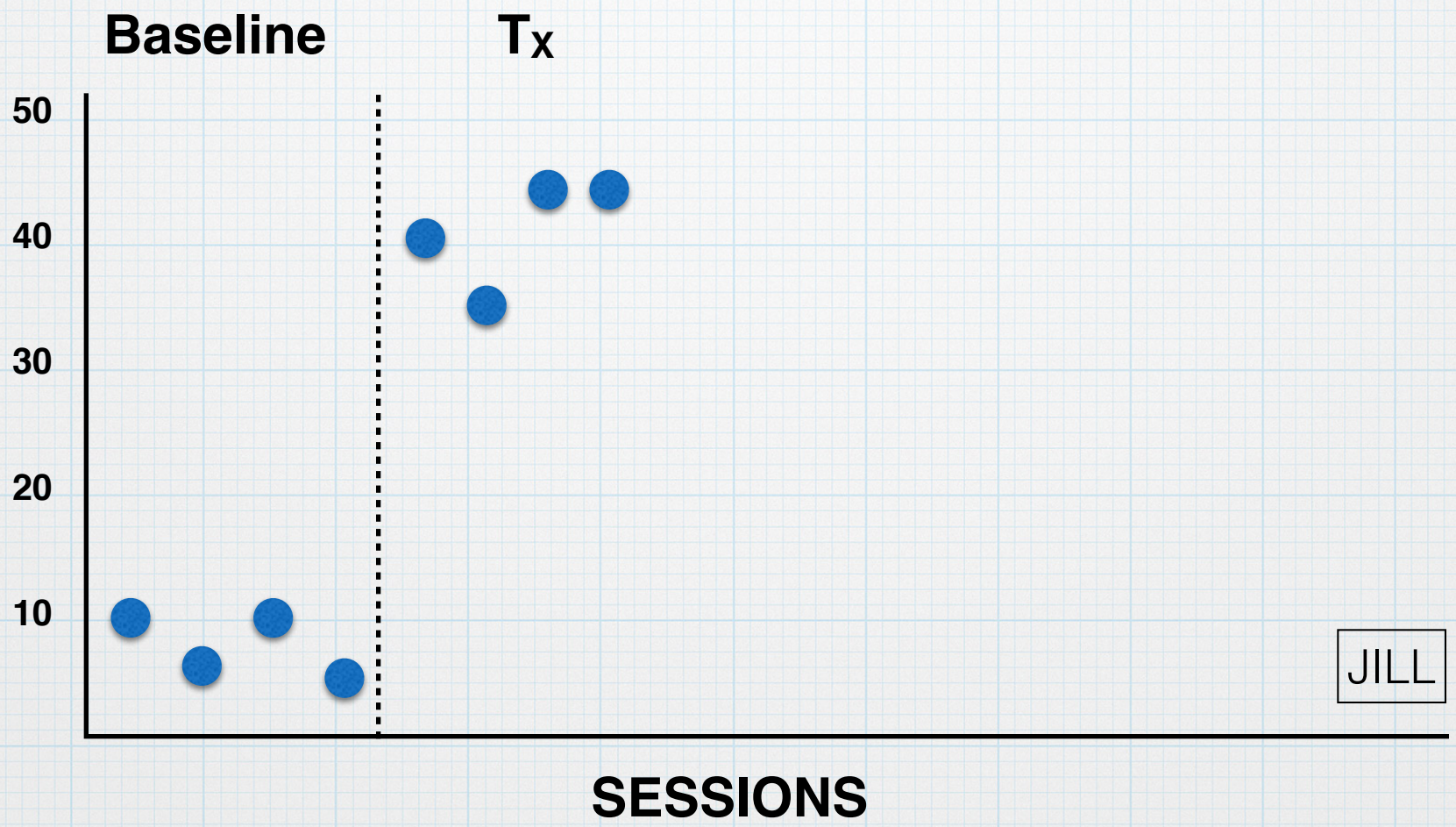
1. Reversal Design
2. Multiple Baseline Design
3. Multielement Design

1. Reversal design



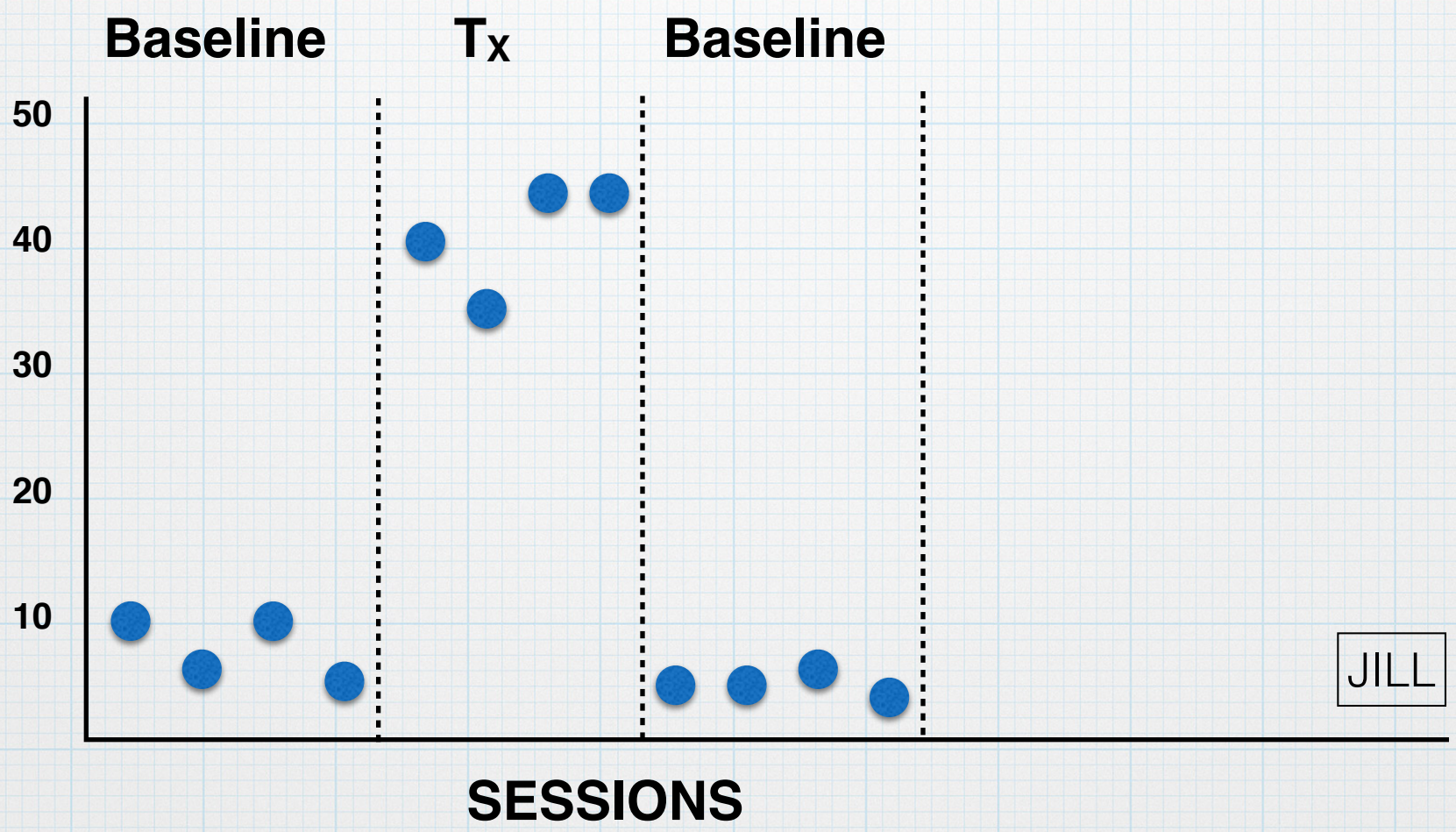
This is a good, stable baseline with an easy prediction.

1. Reversal design



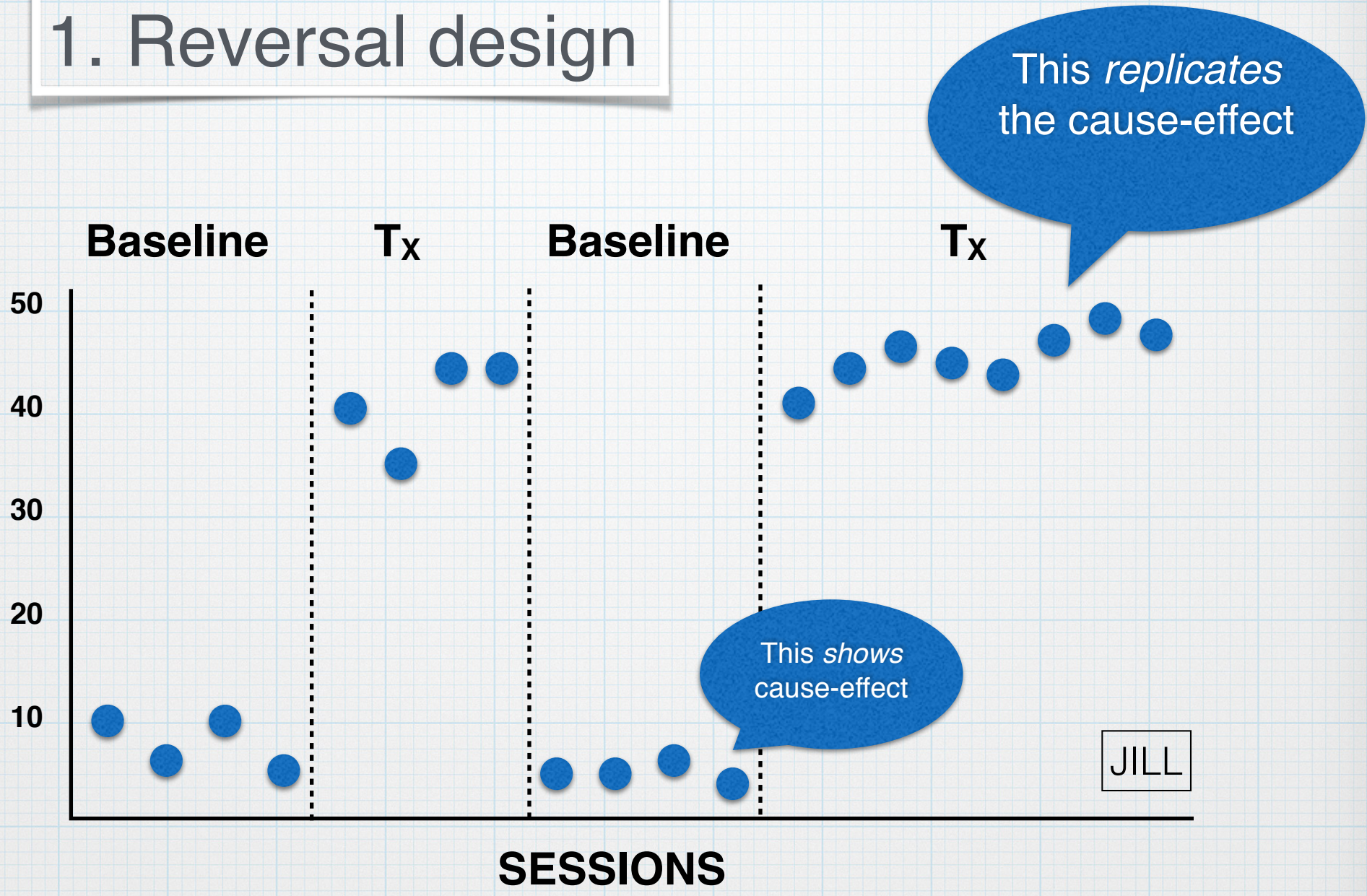
Here's a Treatment with an immediate effect.

1. Reversal design



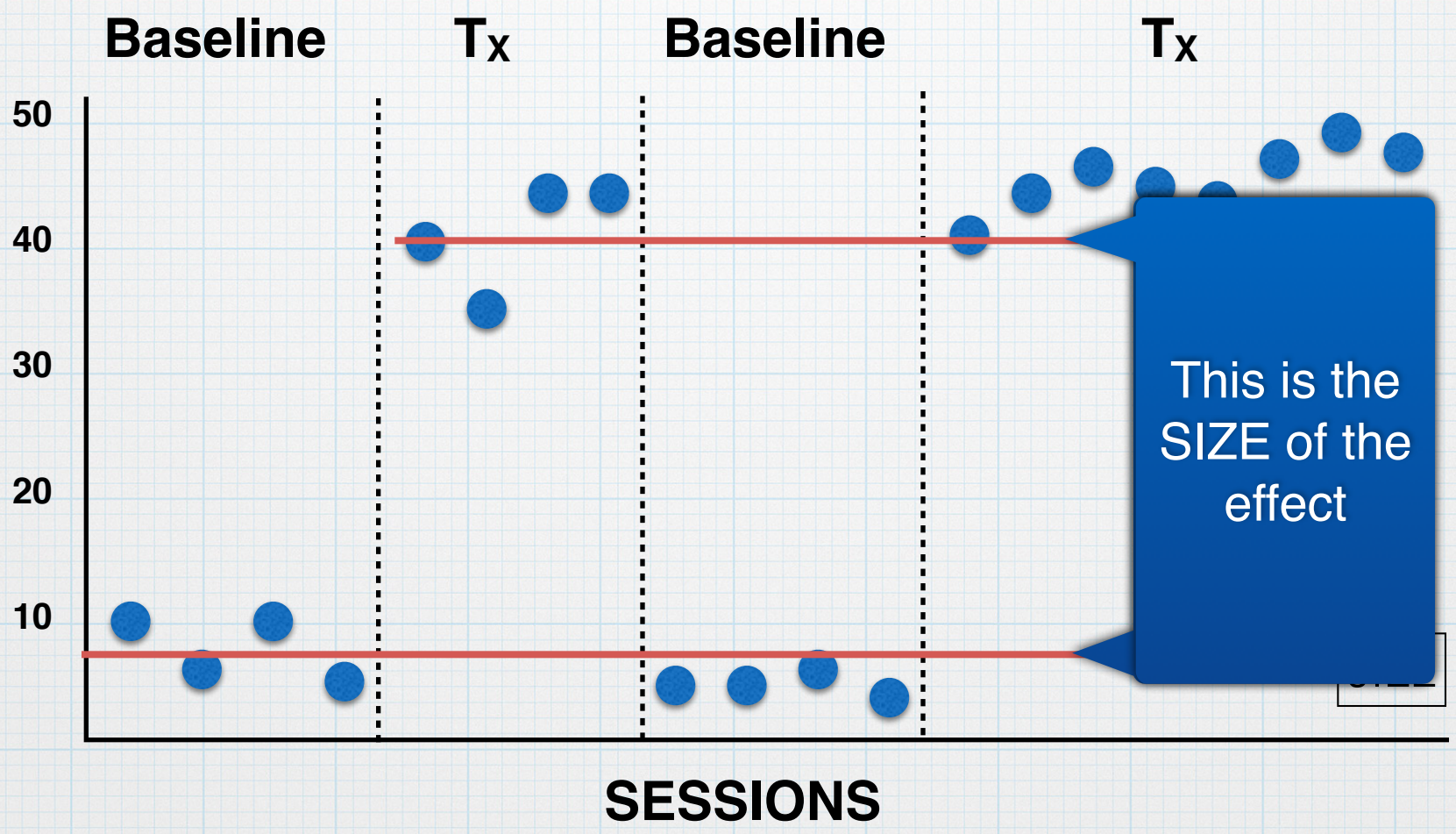
The 2nd Baseline replicates the first which it must do.

1. Reversal design



The 2nd Treatment Replicates the 1st application

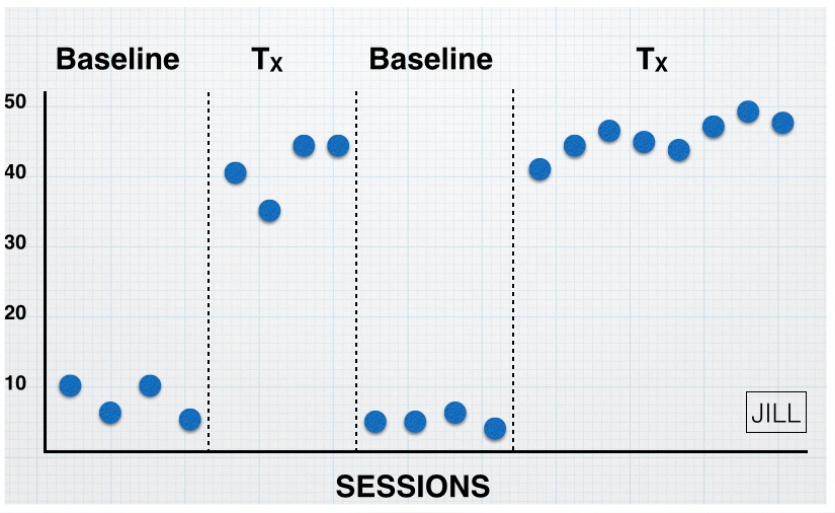
1. Reversal design



We can also see the size-of-effect

1. Reversal design

- **Shows cause effect**
  The T_X produced this effect.
- **Shows size of effect**

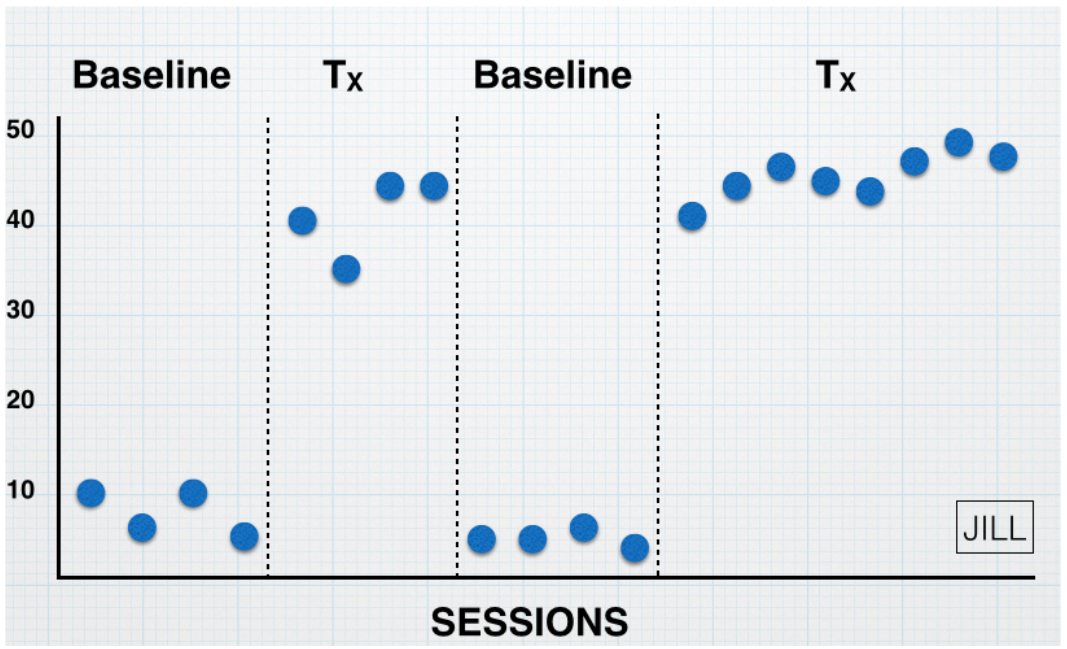


This is a powerful design when the data are stable and the T_X shows a strong effect.

It is amazing that you can use single subject designs like this for INDIVIDUAL students…

to find out if a treatment works and if it is worthwhile

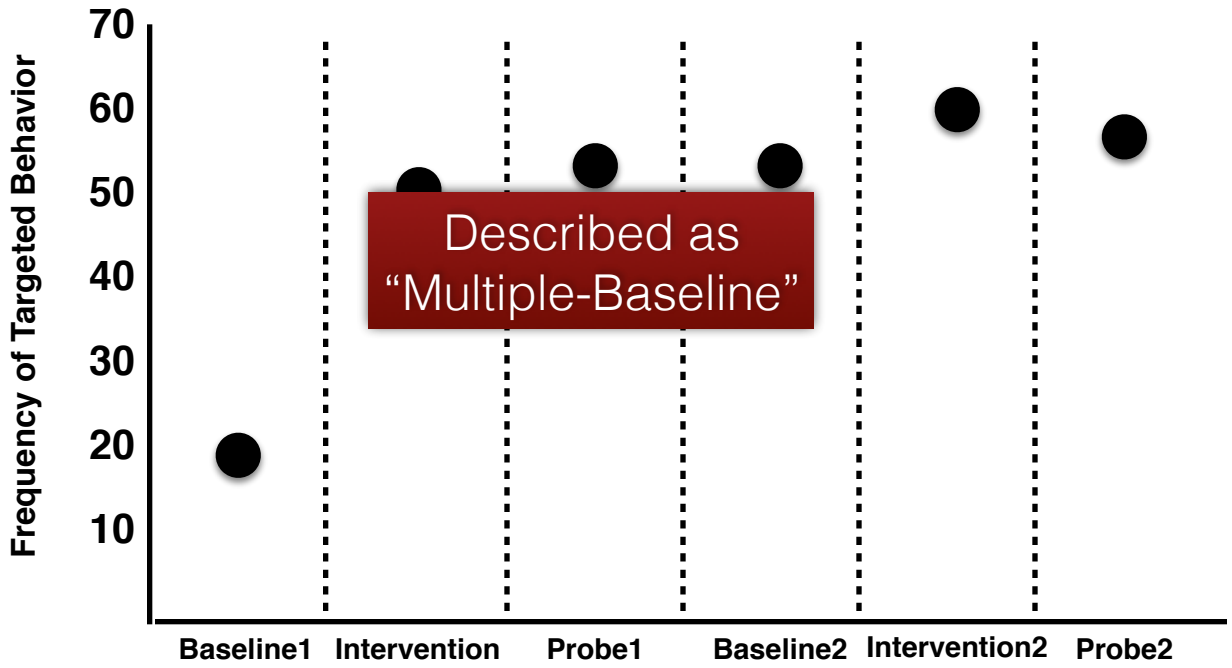
1. Reversal design*



*The main problem with the reversal is just that, you are reversing a behavior that may not work that way. There is also an ethical question.

These are known as “limiting conditions”

Effects of Role-Play on Social Behaviors of High Functioning Autism Adolescents



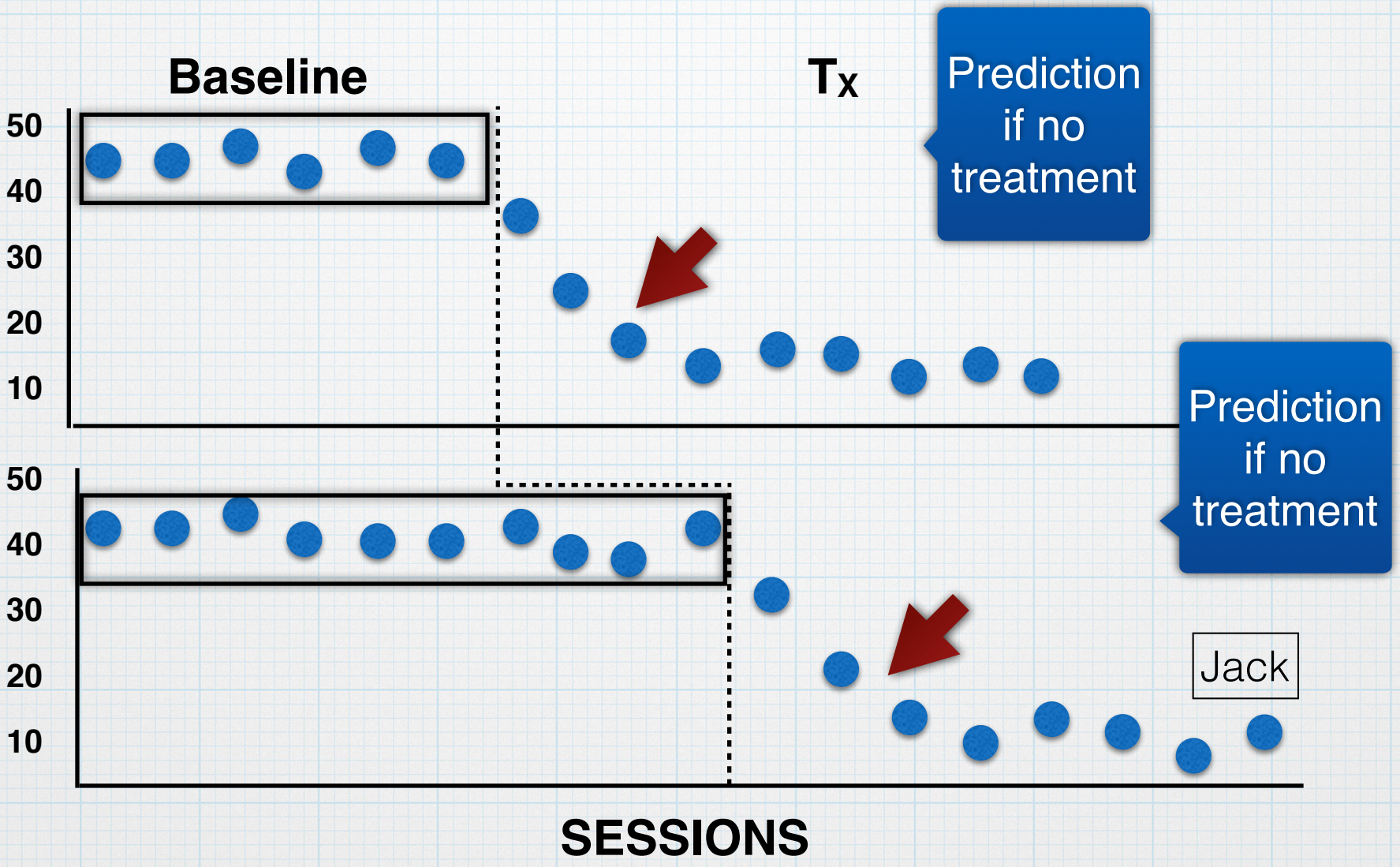
No actual Baseline

Baseline2 does not replicate Baseline1

There is no "Proof" this treatment works

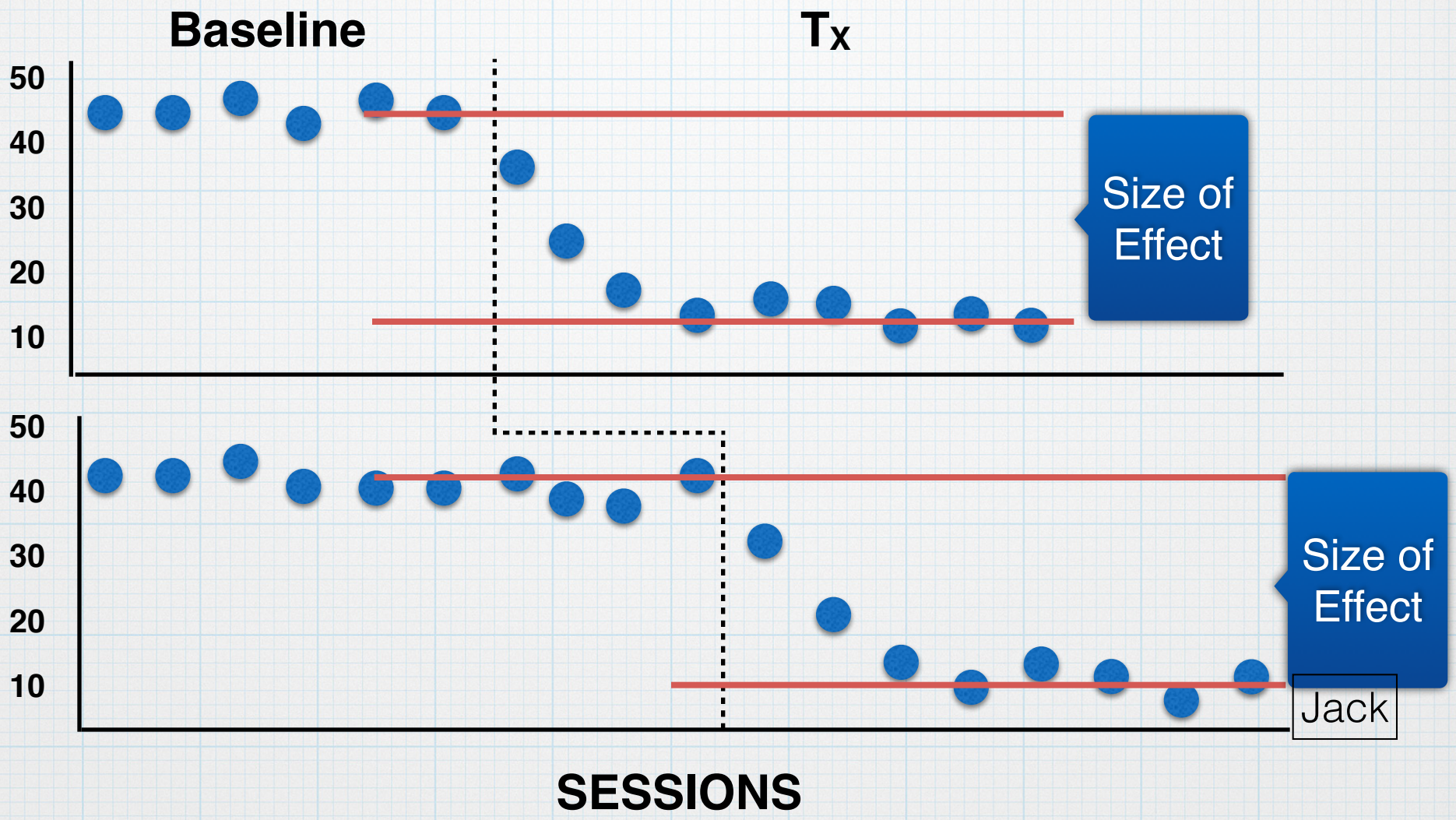
"Excuse me, what other designs do you have that don't have these limiting conditions?"

2. Multiple Baseline design



This is a “2-leg” Multiple Baseline, proof is shown by replication of results.

2. Multiple Baseline design



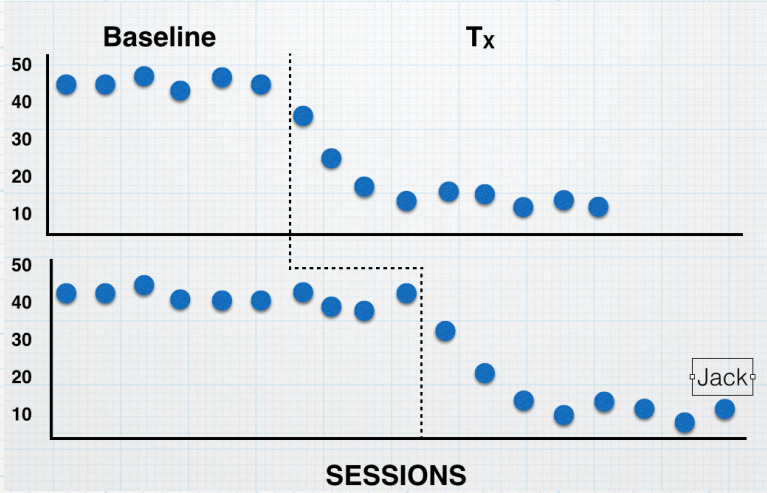
The T_X is replicated and you can see the size of effect.

2. Multiple Baseline design

- **Shows cause-effect**

  The T_X *produced* this effect.

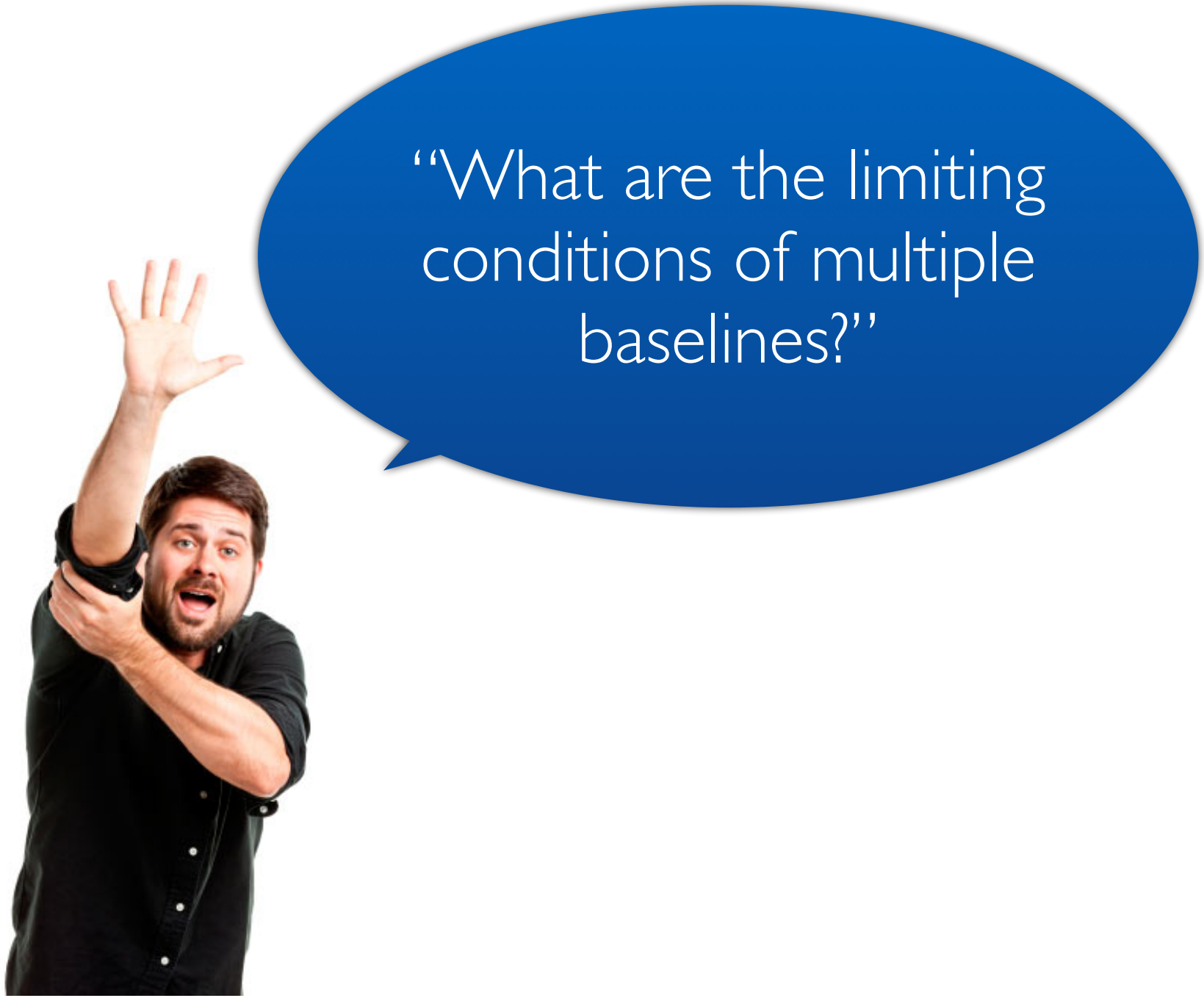
- **Shows size of effect**



This is a strong design when the data are stable and the T_X shows an immediate effect.

It is **still** amazing that you can use single subject designs like this for INDIVIDUAL students…

to find out if a treatment works and if the effect is worthwhile


"What are the limiting conditions of multiple baselines?"

I was afraid someone would ask that.

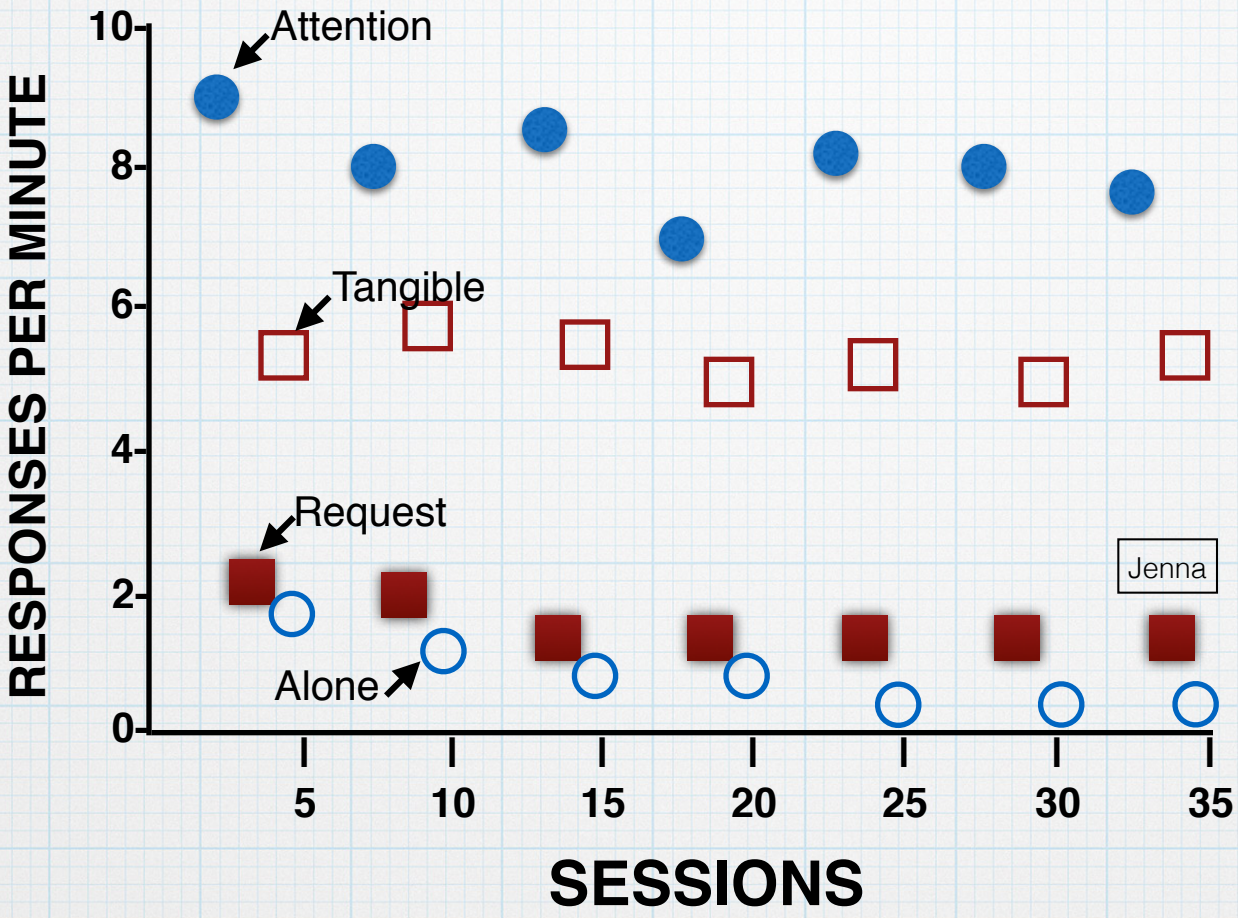
"What *are* the limiting conditions of multiple baselines?"

The treatment effect may generalize from one baseline to another

Outside variables may produce strange effects

But, it is an *ethical* design

3. Multielement design



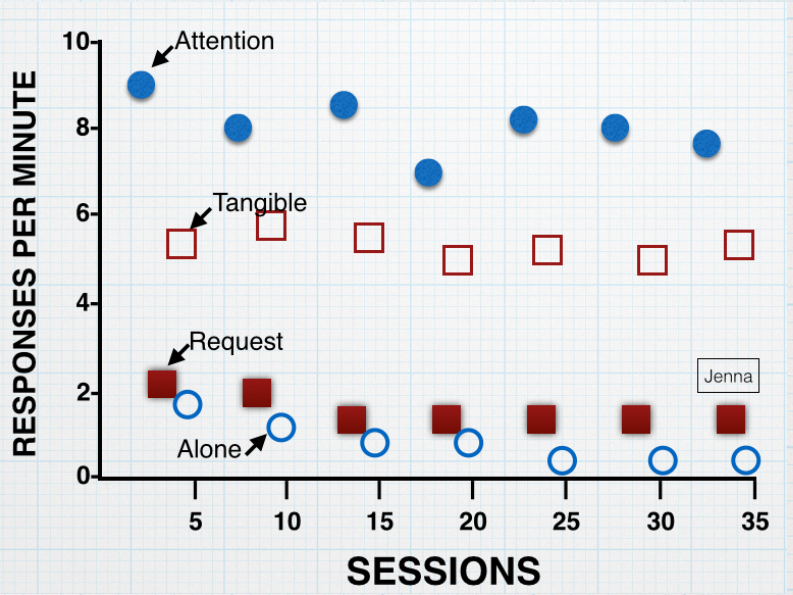
Several conditions are tested simultaneously

- Attention
- Tangible objects
- Requests
- Alone

The most responses occur when attention is given, the next most when tangibles are available, very few responses occur when requests are made or when the student is alone.

3. Multielement design

- Used to show relative controlling variables
- Many comparisons simultaneously



This is used primarily to find effective reinforcers and then paired with a multiple baseline or reversal design for proof of effect.

"What are the limiting conditions of multielement design?"

"What *are* the limiting conditions of multielement designs?"

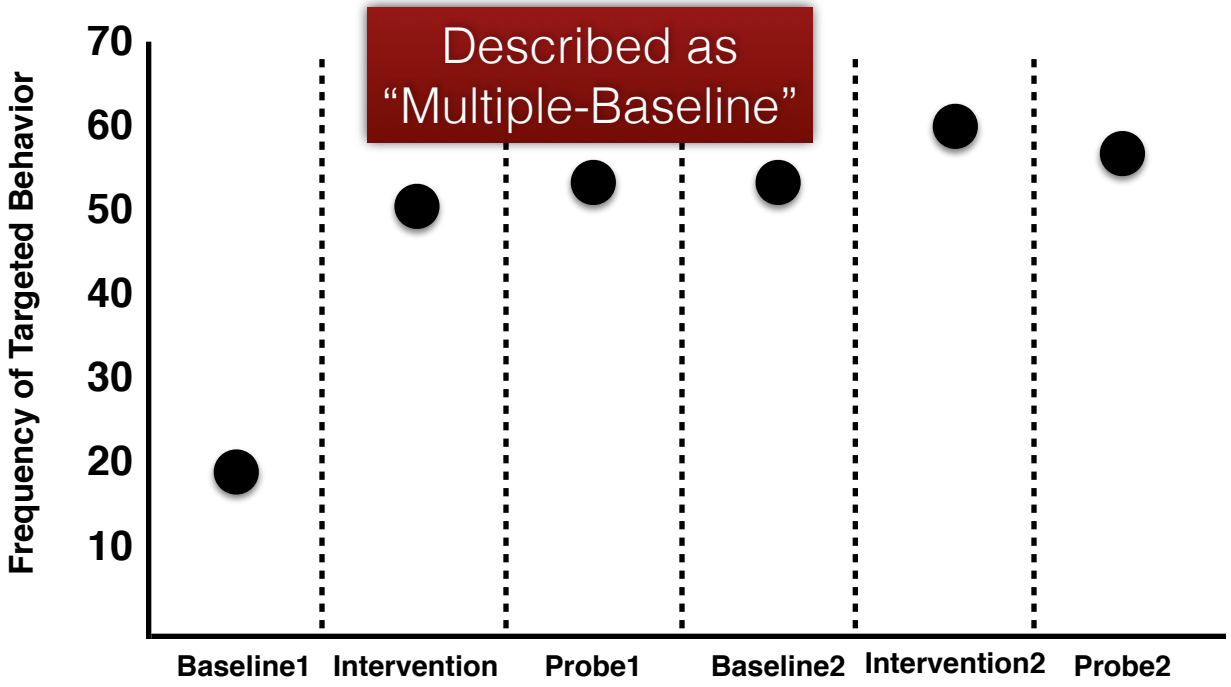
The effects may trend up or down over time

There may be interactions among the treatments

But you can find out a lot of information quickly.

Remember This Example?

Effects of Role-Play on Social Behaviors of High Functioning Autism Adolescents



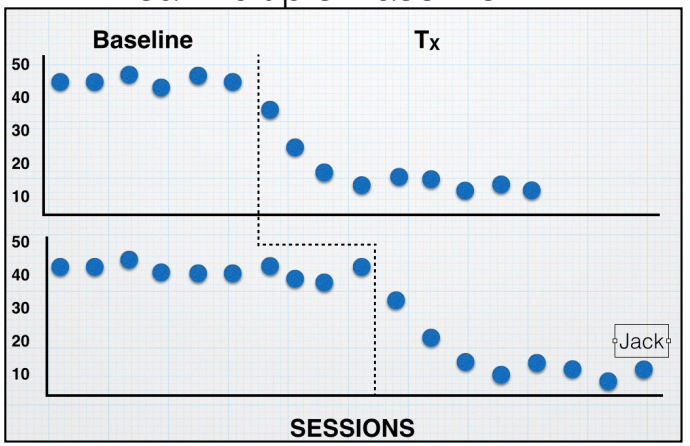
What did the authors say?

Our results show that adolescents with HFA

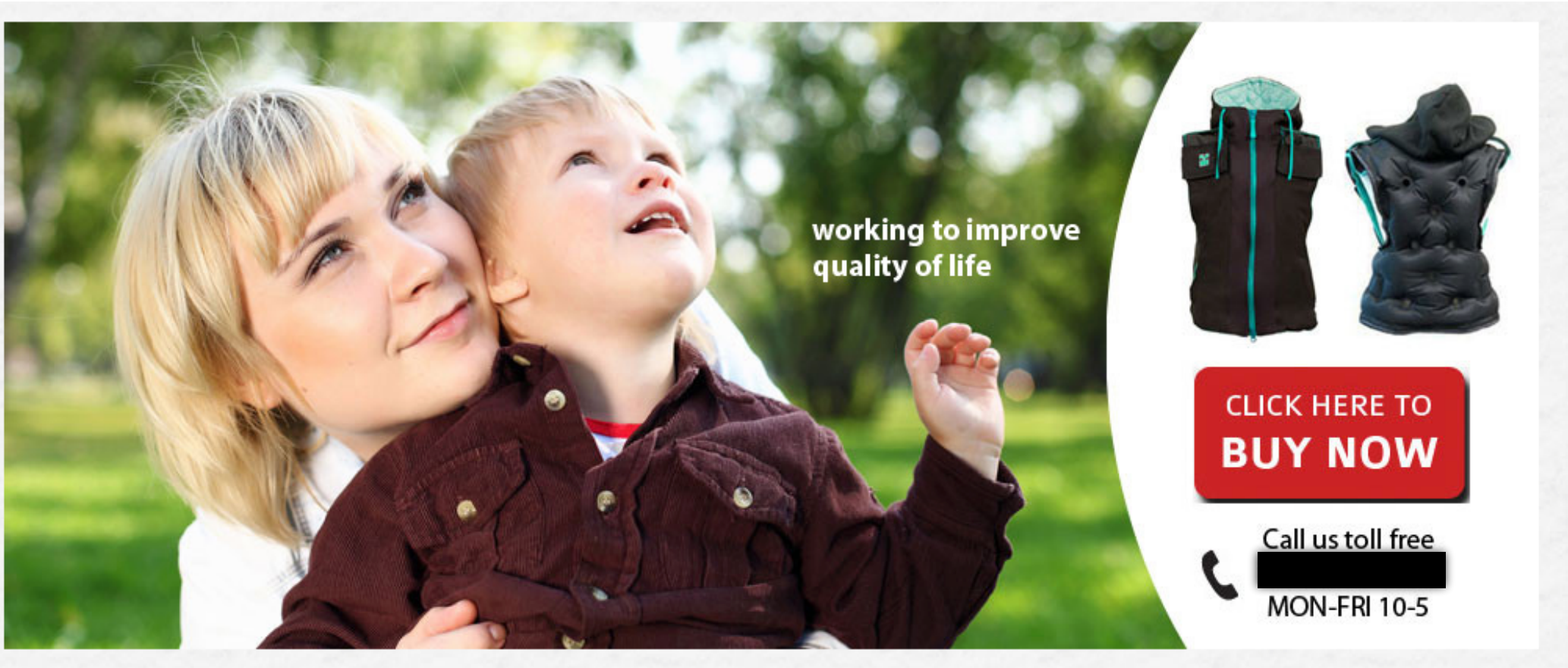
Not Really

nonverbal behavior as a result of a role-play intervention.

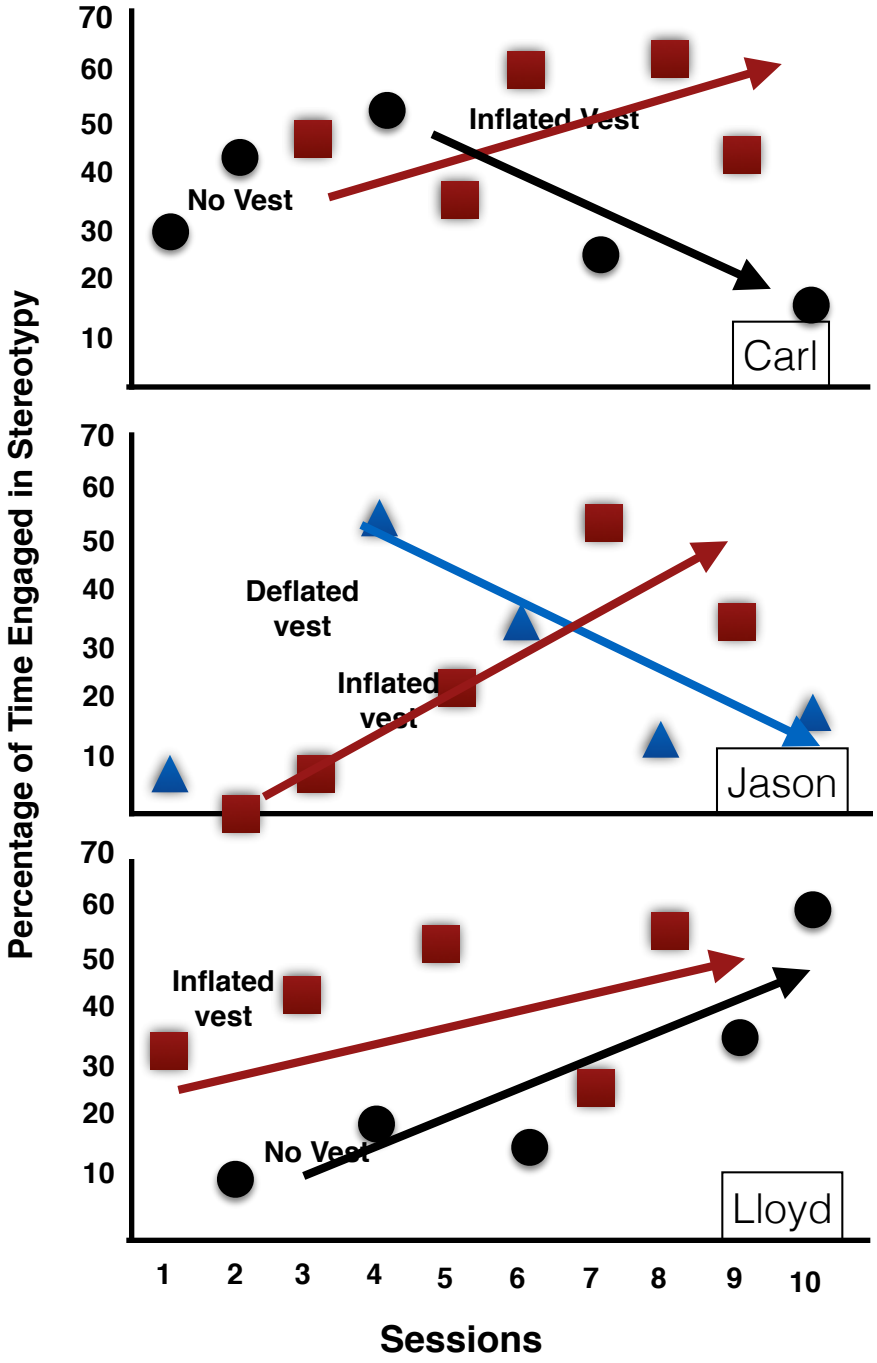
Real Multiple-Baseline



The Effectiveness of the Snug Vest on Stereotypic Behaviors in Children Diagnosed With an Autism Spectrum Disorder



Effectiveness of the Snug Vest on Stereotypic Behaviors in Children with ASD



What did the authors say?

The results of the study show that

Absolutely

any participants stereotypy.

*In three out of three cases the vest **increased** stereotypy*

1. Reversal Design

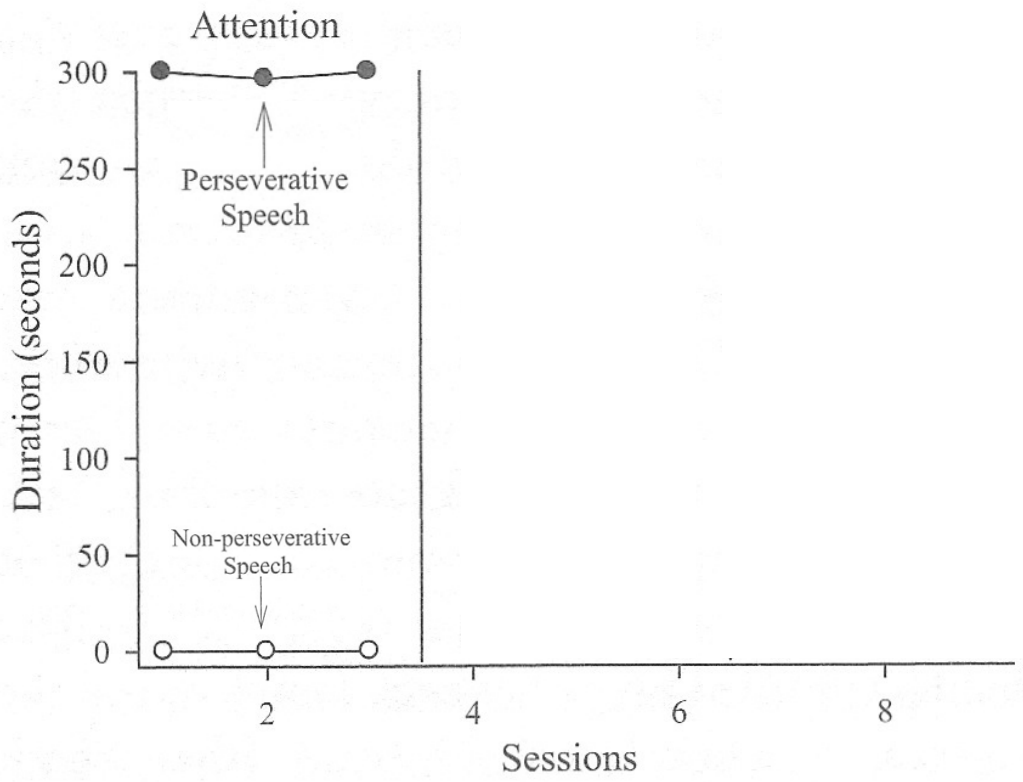


Figure 1. Levels of perseverative and nonperseverative speech during the attention and ignore conditions of the functional analysis.

2. Multiple Baseline Design

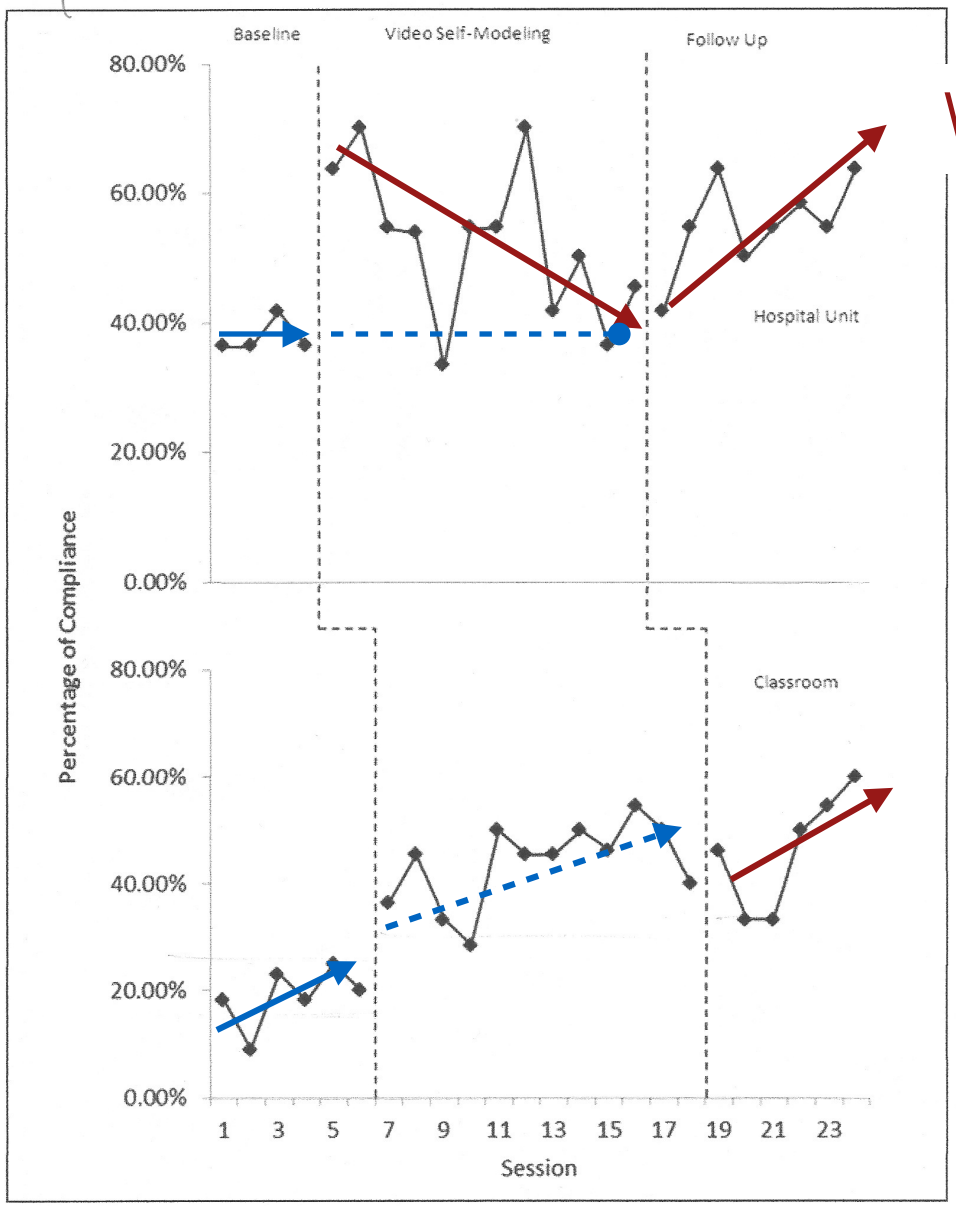


Figure 2. Percentage of compliance for baseline, intervention, and follow-up conditions for Dan in the hospital unit and classroom settings.

Why?

2. Multiple Baseline Design

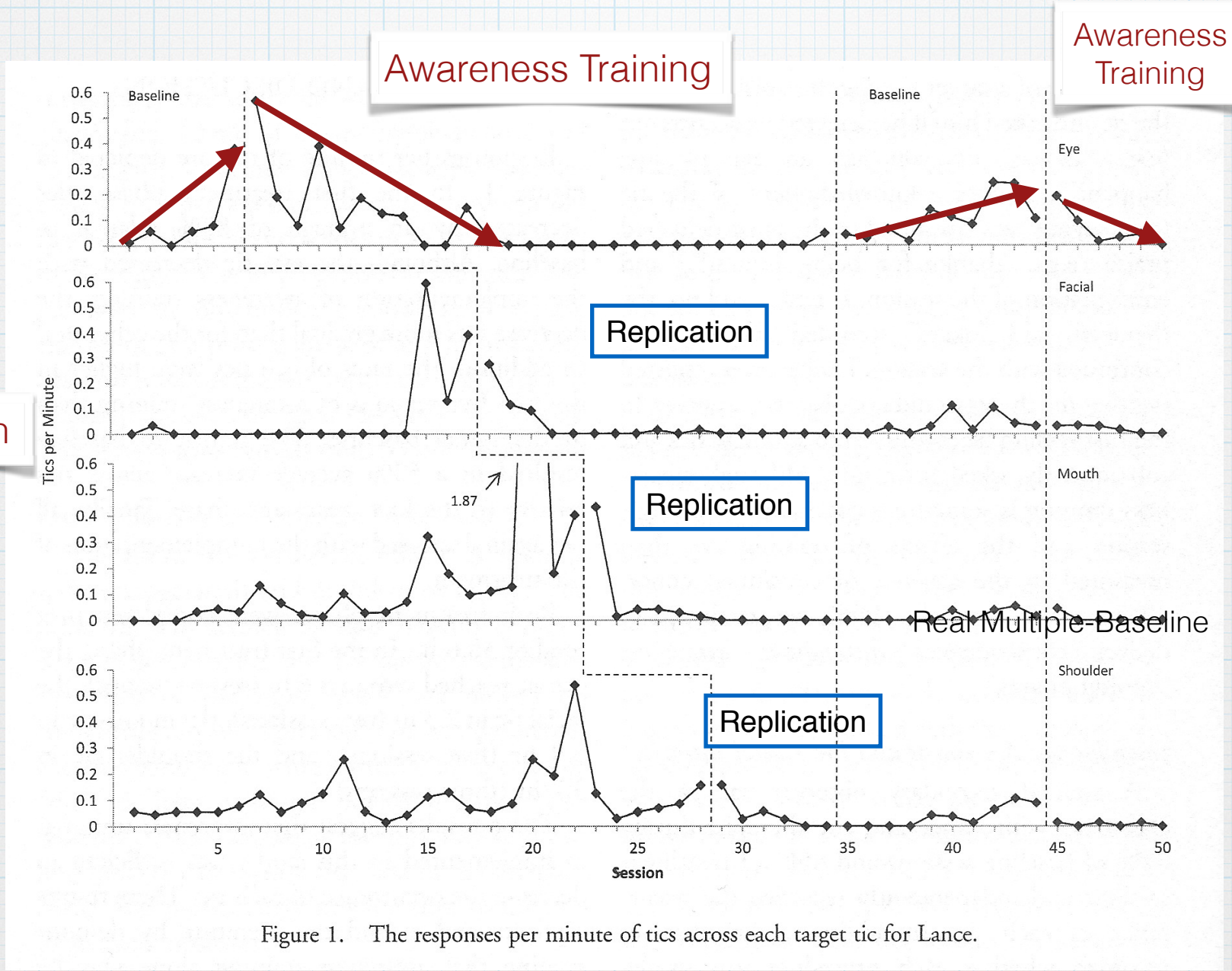


Figure 1. The responses per minute of tics across each target tic for Lance.

3. Multielement Design

Ritualistic Toy Arranging

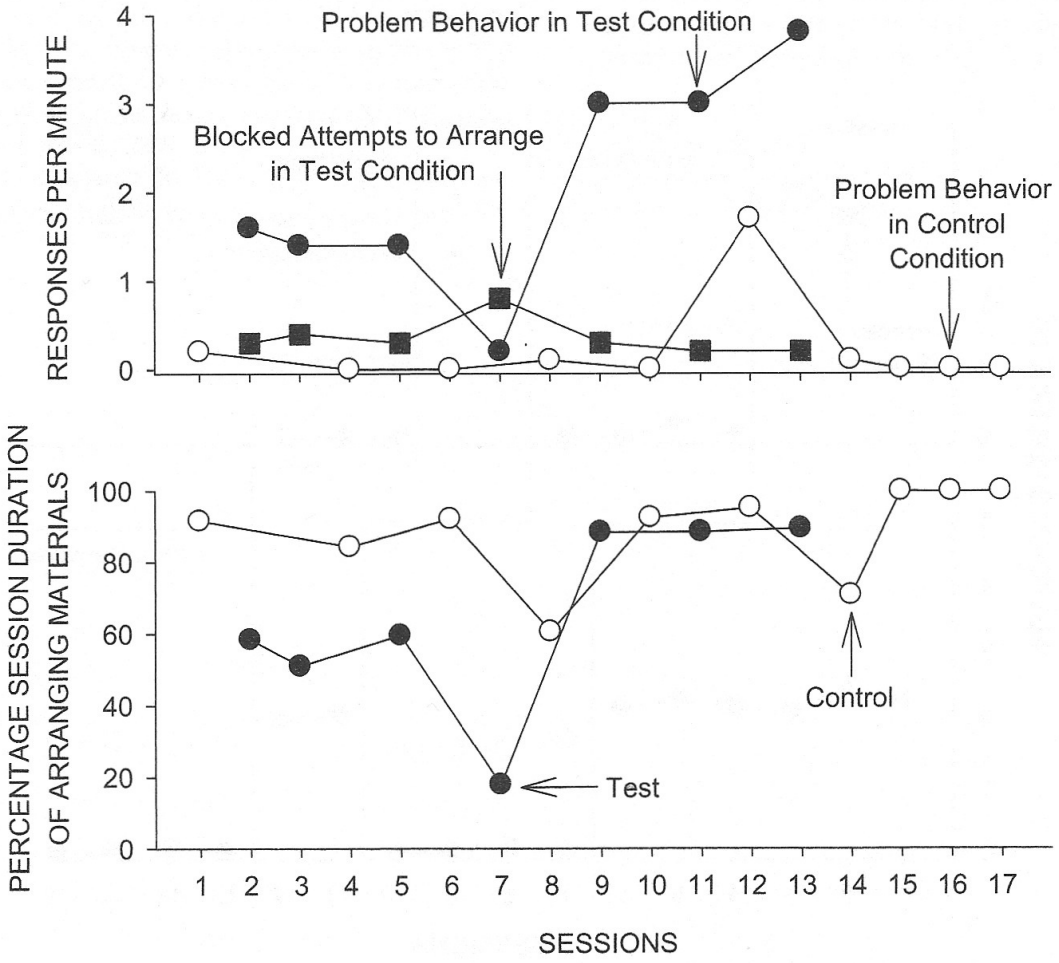


Figure 1. Rate of problem behavior and blocked attempts to arrange during test and control conditions of the blocking assessment (top) and percentage of session duration of toy arrangement (bottom).

3. Reversal/Multiple Baseline Design

Assessment of Problem Behavior Evoked by Disruption of Ritualistic Toy Arrangements in a Child with Autism

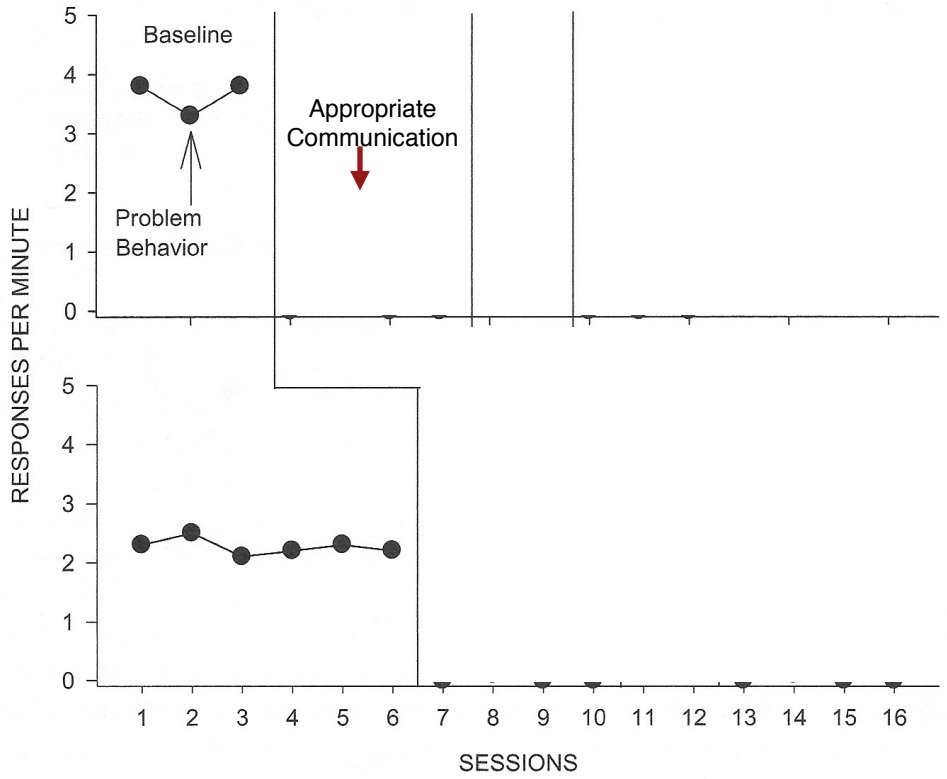


Figure 2. Rate of problem behavior and appropriate communication during baseline and treatment conditions across contexts during the treatment evaluation. FCT = functional communication training.

3. Reversal/Multiple Baseline Design

Assessment of Problem Behavior Evoked by Disruption of Ritualistic Toy Arrangements in a Child with Autism

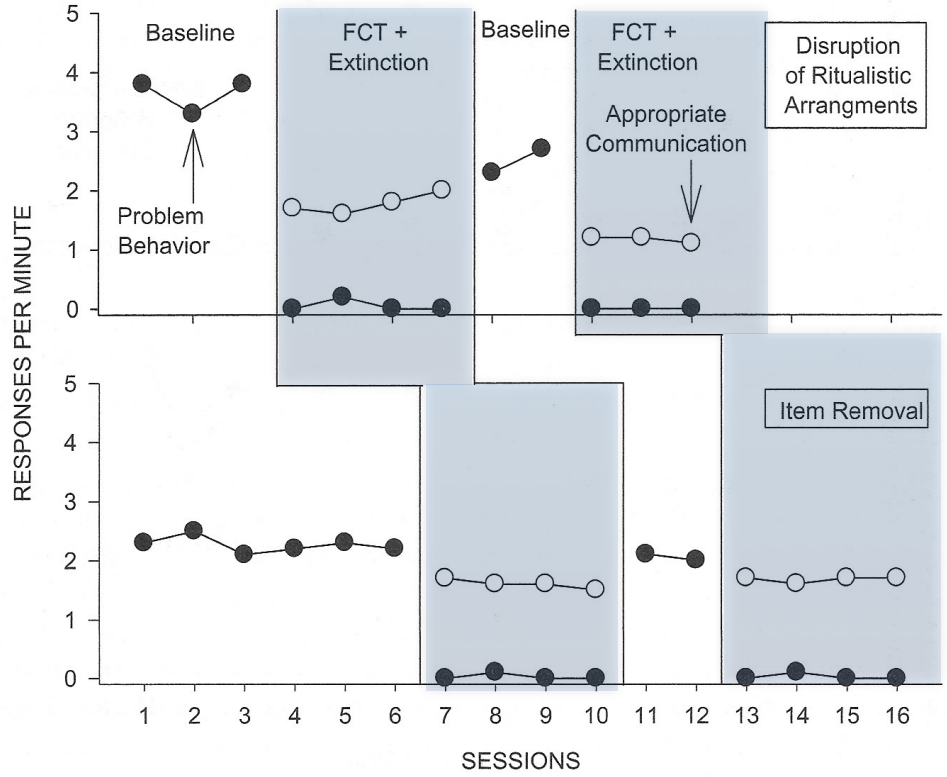


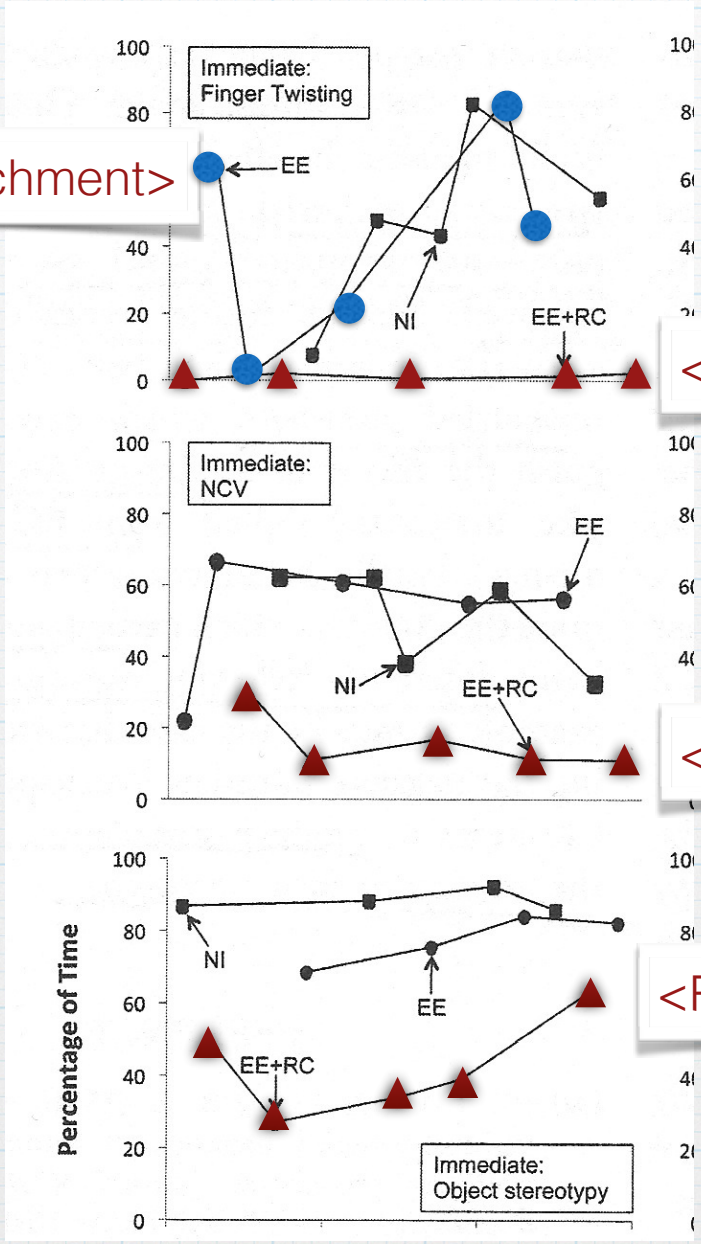
Figure 2. Rate of problem behavior and appropriate communication during baseline and treatment conditions across contexts during the treatment evaluation. FCT = functional communication training.

What two research designs were used?

3. Multielement Design

Environmental Enrichment and Response Cost: Immediate and Subsequent Effects on Stereotypy

Environmental Enrichment>



<Removal of Preferred Item

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Note Uptrend in the Data

3. Multielement Design

Does Sensory Integration Work?

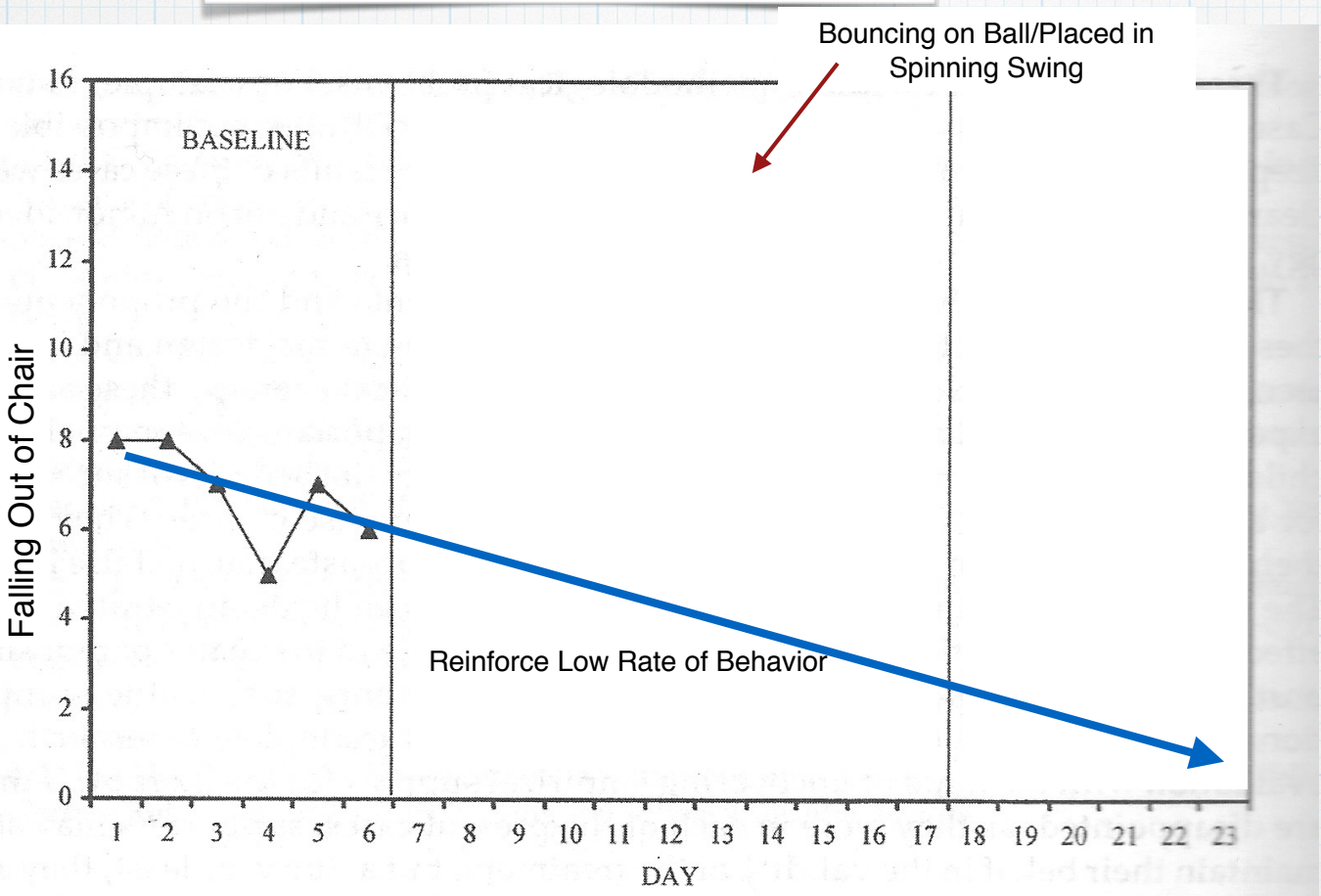

FIG. 16.3. Frequency of inappropriate sitting behavior (falling out of chair). During the intervention phase, sensory integration therapy (broken line) prior to the daily session was alternated with a differential reinforcement of low rate (DRL) program (solid line) during the session. In the follow-up condition, only the DRL program was in effect.

1. Reversal Design

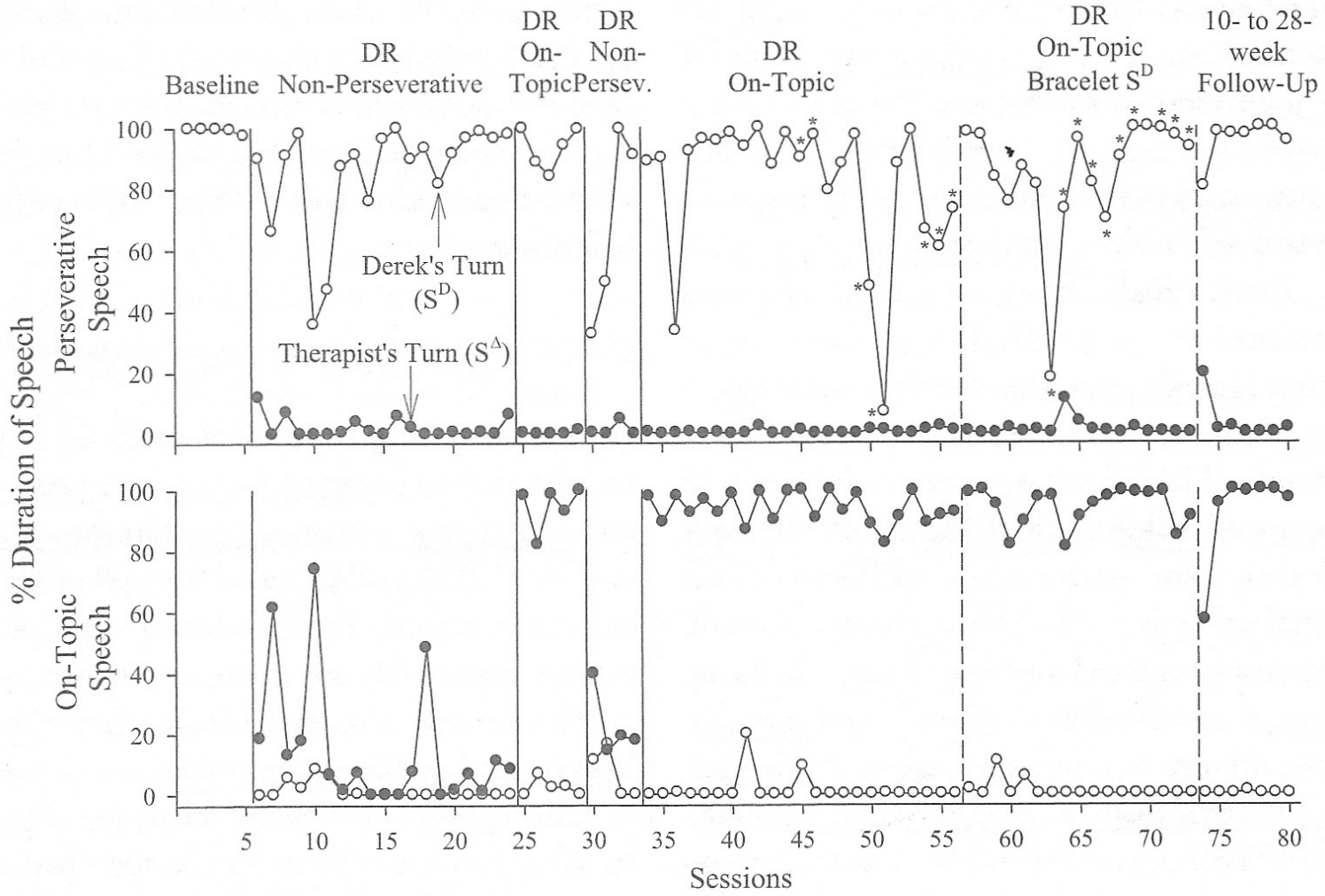

Figure 2. Treatment analysis data. The top panel shows the percentage of speech that was perseverative. The bottom panel shows the percentage of speech that was on topic. Asterisks denote sessions conducted by Derek's mother (Sessions 45 to 56), novel therapists (Sessions 63 to 69), and brother (Sessions 71 to 73).

So, what have we learned?

It is possible to evaluate a wide variety of interventions with individual children.

These evaluations are made possible by single-subject designs adapted to each child, their distinctive behaviors and any type of treatment.

We can test the **effects** of a treatment and look at the **size of effect**.

There are limiting conditions for each type of single-subject design.

Unfortunately there are many treatments though widely accepted simply do not work

If you are an educated consumer you can separate the wheat from the chaff

If you are an educated consumer you **can** separate the wheat from the chaff

National Autism Conference

pennsylvania
DEPARTMENT OF EDUCATION
Bureau of Special Education
Pennsylvania Training and Technology Assistance Network

PROGRESS THROUGH PARTNERSHIP

Thank You for Inviting Me to Penn State

It is an Honor and a Privilege

Jon S. Bailey, PhD, BCBA-D
Florida State University