Three Pillars of Effective Interventions: Defining Behavior, Dimensional Measurement, and Standard Visual Display

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# Information



### Hunter/Gatherer Age







### **Agricultural Age**

### Industrial Age





### **Information Age**





#### Hunter/Gatherer Age

### Records

Cave Walls

### Wealth

None

Agricultural Age	Industrial Age	Information Age
Hides & Skins	Paper	Bytes
Land	Capital	Knowledge







#### Understanding

### Is Bigfoot real?



#### Is Bigfoot real?



# Context



#### Understanding

# Behavior Analysis



### **Behavior Analysis**

The science in which procedures derived from the principles of behavior are systematically applied to improve socially significant behavior to a meaningful degree and to demonstrate experimentally that the procedures employed were responsible for the improvement in behavior.

(Cooper, Heron, & Heward, 2007)





Helping people (Change behavior)



## Behavior analysis



Precision Teaching based on Lindsley adapting part of behavior analysis for teachers, parents, and other performance engineers.

Precision Teaching (PT), a system for "defining instructional targets, monitoring daily performance, and organizing and presenting performance data in a uniform manner to facilitate timely and effective instructional decisions" (White, 2005, p. 1433).







### Helping people (Change behavior)

### Measuring behavioral changes



## Behavior analysis

## Precision Teaching







### Measuring behavioral changes

## **Behavior Analysis Information**

## Precision Teaching





### **Behavioral Decision Making Framework** Intervention Decision Behavior \_ Making Analysis Record Visual Display

### Label Behavior

### Observe/ Count

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### **Behavioral Decision Making Framework**

### Multistep Process Choices for each step

Label Behavior Observe/ Count



**Choices** -General label -Operational definiton -Pinpoint

Choices -Discontinuous observation -Continuous observation

Choices -Dimensional quantities -Dimensionless quantities

Visual Display

Analysis



Choices -Linear graphs -Ratio graphs

Choices -Structured analysis -Unstructured analysis

Choices -Information driven -Opinion driven

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#### Understanding

### **Behavioral Decision Making Framework**









### 

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## Three pillars of information for applied behavioral scientists

### Pinpoint behavior



### Count behavior

### Display of counted behavior





# Pinpoint Behavior













#### "Behavior is what an organism is doing..." (Skinner, 1938, p. 6).



### Key term: Doing



Behavior Analysis for Effective Teaching

Contradicted Material

Second Edition



Construction of Manufacture

#### "Action of an individual including actions that take place inside the individual, such as thinking, breathing, or holding one's breath (Vargas, 2013, p. 341).



#### Key term: Action



FIFTH EDITION

#### Behavior Analysis and Learning



W. David Pierce and Carl D. Cheney Ψ Puriting that

#### "Behavior: Everything that an organism does, including covert actions such as thinking" (Pierce & Cheney, 2013, p. 470)



### Key term: Does



Good, authentic descriptions of a target behavior will always involve *doing*, *movement*, or *action*.



### **Field-wide Problems for Defining Behavior**

- -Using nouns (e.g., aggression, tantrums)
- -Defining behavior with improper verb forms (e.g., yelling, hitting)
- -Having targets that lack movement (e.g., sitting still, being quite)
- -Using ambiguous verbs (e.g., understanding math facts, transition to social studies class)
- -Including constructs (e.g., forgetting to use manners)
- -Kitchen-sink targets



### **Operation definition from ABA Journal**

#### **Uses noun** for behavior

**Disruptive behavior**: Speaking above a whisper without permission from the teacher, standing up and moving away from the assigned seat, rocking back in the chair such that at least one leg of the chair was no longer touching the ground, loudly tapping objects, banging the table, stomping feet, and manipulating objects that were not relevant to the assigned work.

**Improper verb form** 





### **Operational definition** - the procedures (or

operations) for measuring a behavior or qualities





## Operational **Definition Study**





The Journal of General Psychology, 2013, 140(4), 269-281 Copyright © 2013 Taylor & Francis Group, LLC

#### Behavior Description Effect on Accuracy and Reliability

ABSTRACT. The clinical and scientific efficacy of behavioral analysis is dependent upon interveners' accurate and reliable detection and measurement of target behaviors. This study compared the accuracy and reliability of observers' detection and recording of a designated target behavior when different forms of a target behavior description were used. Using an intra-subject design, undergraduate college students were asked to count the number of target behaviors depicted on a videotape under each of two conditions. Conditions differed only to the extent that each contained a different description of the target behavior. Results showed that participants' detection and recording of the target behavior was more accurate and reliable when the target behavior description used a verb (in the present tense, active voice) depicting an action with an observable and discrete beginning and end and omitted modifiers requiring observers to make subjective or relative judgments. Analysis of the data using methods developed by Signal Detection Theory demonstrated the potential utility of this approach for studying observer detection of target behaviors.

Keywords: accuracy, description, gold standard, reliability, Signal Detection Theory, target behavior

THE CLINICAL AND SCIENTIFIC EFFICACY OF BEHAVIOR ANALYSIS is dependent upon accurate and reliable detection and measurement of behavior (Baer, Wolf, & Risley, 1968). Applied behavior analysts (hereinafter referred to as "practitioners") focus their attention on socially significant behaviors ("target" behaviors) and design interventions to modify them. They typically name and describe target behaviors to facilitate detection, measurement, and treatment. In practice, measurement (data collection) and treatment (intervention) are seldom performed by practitioners but by others, referred to as "interveners." Interveners

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JOSEPH V. LAMBERT ZACHARY MOORE The University of the Sciences



### **Operational Definition Study**

Participants: Eighteen undergraduate, the Sciences in Philadelphia

# psychology students, at the University of



### **Operational Definition Study**

# "hit her head" frequently, sometimes injury

Video of 12 year-old-girl with autism who "forcefully," creating the risk of physical



### **Operational Definition Study**

### Participants scored presence or absence of behavior using two separate descriptions of the same target behavior

1. Operational Definition TBD

### TBD2. Pinpoint TBD



TBD #1: Forcefully swings an open or closed fist in the direction of her head or chin, swings objects in the direction of her head/chin, or swings her head in the direction of a wall or desk with or without making contact.

**Operational definition:** the procedures (or operations) for measuring a behavior or qualities




Pinpoint: action verb + object receiving action + context

TBD #2: The child touches any part of her head with her hand or an object she is holding in her hand or moves her head so that it touches an object.

**Pinpoint: Touches head with hand or object** Pinpoint: Moves head so it touches an object







FIGURE 1. Mean and range of percent agreement with "gold standard" under each TBD condition.



FIGURE 2. Percent agreement vers under each TBD condition.

FIGURE 2. Percent agreement versus the "gold standard" for each participant

# **Operation definition from ABA Journal**

**Elopement** : Walking or running more than 1 m away from the therapist without permission, walking more than 1 m outside of a designated waiting area, or attempting to elope measured by taking at least two steps away from the therapist or from the designated waiting area without permission.



**Elopement**: Walking or running more than 1 m away from the therapist without permission, walking more than 1 m outside of a designated waiting area, or attempting to elope measured by taking at least two steps away from the therapist or from the designated waiting area without permission.

# 1. Walking more than 1 m away from the therapist without permission









**Elopement**: Walking or running more than 1 m away from the therapist without permission, walking more than 1 m outside of a designated waiting area, or attempting to elope measured by taking at least two steps away from the therapist or from the designated waiting area without permission.

# 2. Running more than 1 m away from the therapist without permission









**Elopement** : Walking or running more than 1 m away from the therapist without permission, walking more than 1 m outside of a designated waiting area, or attempting to elope measured by taking at least two steps away from the therapist or from the designated waiting area without permission.

# 3. Walking more than 1 m outside of a designated waiting area





**Elopement**: Walking or running more than 1 m away from the therapist without permission, walking more than 1 m outside of a designated waiting area, or attempting to elope measured by taking at least two steps away from the therapist or from the designated waiting area without permission.

# 4. Taking at least two steps away from the therapist without permission









**Elopement**: Walking or running more than 1 m away from the therapist without permission, walking more than 1 m outside of a designated waiting area, or attempting to elope measured by taking at least two steps away from the therapist or from the designated waiting area without permission.

# 5. Taking at least two steps away from the designated waiting area without permission









# **Pinpointing Scorecard**

Information Inhibitor	
Inclusion of subjective adverbs	
Inclusion of ambiguous verbs	
Wordy definiton	
Number of behaviors necessary for observation	
Response class established	



# **Operation definition from ABA Journal**

**Elopement** : Walking or running more than 1 m away from the therapist without permission, walking more than 1 m outside of a designated waiting area, or attempting to elope measured by taking at least two steps away from the therapist or from the designated waiting area without permission.

Inclusion of subjective adverbs

Adverb: A word or phrase that modifies or qualifies an adjective, verb, or other adverb or a word group



# **Pinpointing Scorecard**

Information Inhibitor	
Inclusion of subjective adverbs	
Inclusion of ambiguous verbs	
Wordy definiton	
Number of behaviors necessary for observation	
Response class established	

# Potential for information loss - moderate to high

	Details
OS	None
S	None
	Yes: 47 words
ary	5
3	No

# **Operation definition from ABA Journal**

**Disruptive behavior**: Speaking above a whisper without permission from the teacher, standing up and moving away from the assigned seat, rocking back in the chair such that at least one leg of the chair was no longer touching the ground, loudly tapping objects, banging the table, stomping feet, and manipulating objects that were not relevant to the assigned work.



# **Pinpointing Scorecard**

Information Inhibitor	
Inclusion of subjective adverbs	
Inclusion of ambiguous verbs	
Wordy definiton	
Number of behaviors necessary for observation	
Response class established	

# Potential for information loss - high to very high

	Details
OS	Yes -1
S	Yes - 1
	Yes: 57 words
ary	7
3	No



# **Observe** Benavior



# **Behavioral Decision Making Framework**

# Multistep Process

## Label Behavior





<u>Choices</u> -General label -Operational definiton -Pinpoint <u>Choices</u> -Discontinuous observation -Continuous observation <u>Choices</u> -Dimensional quantities -Dimensionless quantities



Analysis

Decision Making

<u>Choices</u> -Linear graphs -Ratio graphs <u>Choices</u> -Structured analysis -Unstructured analysis

<u>Choices</u> -Information driven -Opinion driven

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# **Continuous observation**: Procedures where all possible occurrences of a target behavior can be detected during an observational period.









# Gym ends at 1:30



Continuous observation is observing all possible responses for the entire 5 minute period

# 1:12 5 minute observational period





**Discontinuous observation**: Procedures where all possible occurrences of a target behavior are not necessarily detected during an observational period.







# Discontinuous observation

1:07



# 1:12 5 minute observational period







Discontinuous observation means observing only some of the possible responses for the entire 5 minute period







Intervention: Guidelines for Practitioners Kate Fiske and Lara Delmolino Douglass Developmental Disabilities Center and Rutgers, The State University of New Jersey

#### ABSTRACT

Over the past three decades, researchers have examined the sensitivity and accuracy of discontinuous data-collection methods. Momentary-time sampling (MTS) and partial-interval recording (PIR) have received particular attention in regards to their ability to estimate the occurrence of behavior and their sensitivity to behavior change compared to continuous data collection. In this article, we summarize these findings and provide recommendations for designing a discontinuous measurement system with consideration of the dimensions of behavior to be measured and the expected direction of behavior change.

Keywords: discontinuous data collection, momentary time sampling, partial interval recording

irect observation and measurement of behavior is a defining characteristic of applied behavior analysis as a science and as a practice (Baer, Wolf, & Risley, 1968). The data generated via direct observation serve as the basis upon which practitioners make treatment decisions and evaluate treatment effects. Therefore, designing a high-quality measurement system is an essential early step in developing and evaluating a behavioral intervention. The "quality" of a direct measurement system is determined by the extent to which the system (a) generates accurate data, (b) produces reliable outcomes, and (c) is sensitive to changes in the occurrence of behavior. Each of these features will be determined in part by the operational definitions written to guide data collectors and by the training level of the data collectors implementing those systems. Quality also is influenced considerably by the specifics of the data collection system itself.

Continuous data collection systems are those that capture every possible behavioral occurrence, either by recording each instance of a hehavior (i.e., frequency recording) or by recording the number of seconds each instance of

behavior occurs (i.e., duration recording) during an observation. These systems offer a complete record that can be reported in standard scientific units, such as responses per minute or percentage of observation (Johnston & Pennypacker, 2009). Alternatively, discontinuous data collection systems are those that capture only a sample of behavior during an observation. These systems involve dividing an observation into equal duration intervals, and scoring the occurrence or nonoccurrence of behavior within each interval (Mudford, Taylor, & Marrin, 2009). Three variants of discontinuous measurement have been described in the literature; these systems differ in terms of how they define-and how an observer scores—a behavioral occurrence or nonoccurrence during each interval. When using partial-interval recording (PIR), an occurrence is defined as an instance of target behavior that occurs designing an optimal measurement at any time during the interval. Whole-system, with consideration of factors interval recording (WIR) defines an affecting measurement accuracy, have occurrence as when the target behavior occurs for the entire duration of the interval. Momentary-time sampling (MTS) defines an occurrence only if the target behavior occurs as the interval ends, frequently in the last second of

### Use of Discontinuous Methods of Data Collection in Behavioral



the interval. Data are reported as the percentage of intervals during which behavior was scored.

Due in large part to their ease of implementation, discontinuous measurement systems are popular in practice and in applied research. For example, Mudford, Taylor, and Martin (2009) found that 45% of studies published in the Journal of Applied Behavior Analysis from 1995 to 2005 used discontinuous measures of data collection. Given that research protocols are often characterized by more rigorous measurement (such as continuous data collection) than everyday behavioral practice, this number is likely an underestimate of the extent to which discontinuous data collection methods are used in clinical and educational settings. Despite the widespread use of discontinuous measurement, clear recommendations for not been presented in a consolidated format. The purpose of this paper is to provide recommendations on designing measurement systems based upon the published literature with regard for such variables as dimensions of behavior,

#### The Behavior Analyst 1981, 4, 19-31

## CURRENT MEASUREMENT IN APPLIED BEHAVIOR ANALYSIS

### Bonnie Springer, Tom Brown, and Philip K. Duncan Drake University

#### ABSTRACT

The analysis of behavior began with a form of data, rate of responding, which allowed for efficient study and for the description of the basic principles of behavior. Especially important were the facts that rate of responding was a direct reflection of fundamental properties of behavior, and that rate of responding was measured continuously within an experimental session. As behavior analysts moved from purely experimental to applied settings, discontinuous, time-based methods of measurement evolved, which neither directly reflect fundamental properties of behavior nor continuously record behavior within an experimental session. This paper offers a critical discussion of current measurement practices, and discusses factors possibly related to the use of discontinuous, time-based observing/recording procedures. A theoretical basis for observing/recording procedures is presented which emphasizes continuous measurement of response dimensions directly related to fundamental properties of behavior.

#### No. 1 (Spring)



## **Argument for Discontinuous Observation**

# *Reasonable accuracy*: Under certain limited conditions the discontinuous observations are close to continuous measures.



# **Truth about Discontinuous Observation**

# While time or interval sampling (discontinuous observation) may occasionally approximate continuous measures, there is no guarantee the approximations will be consistent.



# **Truth about Discontinuous Observation**

# occasionally approximate your true heart rate.



No guarantees my approximations are consistent.

Measuring your heart rate with my machine may



## **Argument for Discontinuous Observation**

# **Observer ease:** Discontinuous observation does not require constant observation (except in some forms of whole interval).





# **Truth about Discontinuous Observation**



# Relations between environmental events and the target behavior are obscured.



# Trade off:



Easier to use syringe without carefully paying attention to mL scale.

Chances of getting the wrong dosage are almost 100%.

## **Argument for Discontinuous Observation**

# Definitional ease: Low precision needed for response definitions.

a careful designation of when to start and stop recording (high precision).

# Dimensional measures like frequency necessitates



# **Truth about Discontinuous Observation**

# **Resulting discontinuous observational** data lose accuracy.





# **Truth about Discontinuous Observation**

Time sampling will always overestimate or underestimate the occurrence of the behavior.





SUMMARY AND CONCLUSIONS The preceding discussion has examined issues related to measurement in applied behavior analysis. This discussion has suggested, on both conceptual and empirical grounds, that the use of discontinuous, time-based observation and recording procedures are inherently inaccurate, and that their continued use can but retard the discovery of clinically or experimentally important functional relations.

## **Observational Method Scorecard**



# **Pinpoint+: See-do hits peer during recess**



### 14 minutes

### **Frequency recording**



# 19 per 14 minutes


# 2 min interval

### **Partial Interval recording**





4 min interval

### **Partial Interval recording**





# 8 min interval H **Partial Interval recording**



Length of observation interval (Longer - less sensitive)

# **Observational Method Scorecard**





# 1 min <td

8/14 intervals = 57% occurrence of pinpoint

1 min
<td





**5/7 intervals = 71%** occurrence of pinpoint



### 6 m 30 s interval

# 

1

# **Partial Interval recording**

6 m 30 s interval



# 2/2 intervals = 100% occurrence of pinpoint

# **Observational Method Scorecard**







# 5, 2 min intervals

# 14 minutes



# 0 14 minutes

# 5, 1 min intervals



# 0 14 minutes

# 5, 30 sec intervals

# **Observational Method Scorecard Example**

study was 10-s partial interval recording."

# "The data collection system chosen for the



# **Observational Method Scorecard**





# DISDAV Benavior



# **Behavioral Decision Making Framework**

# Multistep Process

### Label Behavior





<u>Choices</u> -General label -Operational definiton -Pinpoint <u>Choices</u> -Discontinuous observation -Continuous observation <u>Choices</u> -Dimensional quantities -Dimensionless quantities



Analysis

Decision Making

<u>Choices</u> -Linear graphs -Ratio graphs <u>Choices</u> -Structured analysis -Unstructured analysis

<u>Choices</u> -Information driven -Opinion driven

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# How do we know if we have an effect?





# Visual analysis



Visual analysis involves "(a) the extent and type of variability in the data, ( the level of the data, and (c) trends in the data" (Cooper, Heron & Heward, 2007, p 149).

> Leve Trend

# Variability (or Stability)





"Visual analysis of graphic displays of data is a cornerstone of studies using a single case experimental design (SCED). Data are graphed for each participant during a study with trend, level, and stability of data assessed within and between conditions (Lane & Gast, 2014, p 445)."

> Level Trend

# Variability (or Stability)













![](_page_95_Picture_1.jpeg)

![](_page_96_Picture_2.jpeg)

# Lab settings

![](_page_96_Picture_4.jpeg)

# **Applied settings**

![](_page_97_Picture_2.jpeg)

![](_page_97_Picture_3.jpeg)

### **Theses and Dissertations**

![](_page_98_Picture_2.jpeg)

![](_page_98_Picture_3.jpeg)

# Conferences

![](_page_99_Picture_2.jpeg)

![](_page_99_Picture_3.jpeg)

![](_page_99_Picture_4.jpeg)

![](_page_100_Picture_1.jpeg)

### Journals

![](_page_100_Picture_3.jpeg)

![](_page_100_Picture_4.jpeg)

# **Everywhere there is time series data**

![](_page_101_Picture_2.jpeg)

# What is the medium for visual analysis?

![](_page_102_Picture_1.jpeg)

# Visual Display (Graph)

![](_page_103_Picture_1.jpeg)

![](_page_104_Figure_1.jpeg)

Days

# Ratio graph Linear graph Nonstandard or Standard Nonstandard or Standard

# Types of graphs

![](_page_104_Figure_5.jpeg)

![](_page_104_Picture_6.jpeg)

# Nonstandard linear graph (Most popular in behavior analysis, education, and psychology)

![](_page_105_Figure_1.jpeg)

![](_page_105_Figure_2.jpeg)

![](_page_105_Figure_3.jpeg)

![](_page_105_Picture_4.jpeg)

# Standard linear graph

![](_page_106_Figure_1.jpeg)

# Nonstandard ratio graph

![](_page_107_Figure_1.jpeg)

![](_page_107_Figure_3.jpeg)
# Standard ratio graph



Ratio versus Linear graph





## ш N $\boldsymbol{\alpha}$





## Relative perspective

Ratio comparisons offer a proportional view thereby showing behavior changing relative to one another.



## How many more mands emitted in 20 minutes

5 more

1 yesterday, 6 today









## How many more mands emitted in 20 minutes

25 today 20 yesterday, 5 more











### 1 to 6 = +5 difference 20 to 25 = +5 difference

### Who did the intervention work better for?













### Who did the intervention work better for?

### Linear graph

# +5 Intervention worked equally well.

+5





### SCC (Ratio graph)



## Intervention worked better for Sara than Will

x6.0 500% increase





## Linear Thinking

### Linear graph





## **Proportional Reasoning**

### SCC (Ratio graph)

**₽**I

### x1.25 25% increase





x6.0 500% increase

# Magnitude perspective

Ratio comparisons provide statistical information important to behavior analysts (percentage increase and decrease).









### 100% increase

0.2% increase







"The fact that many aspects of our world operate according to proportional rules makes proportional reasoning abilities extremely useful in the interpretation of real world phenomena." (Post, Behr & Lesh p. 79)

Post, T., Behr, M., & Lesh, R. (1988). Proportionality and the development of prealgebra Understanding. In A. Coxford (Ed.), *Algebraic concepts in the curriculum K-12* (1988 Yearbook, pp. 78-90). Reston, VA: National Council of Teachers of Mathematics.

**Current State** Affairs for Linear **Graph Construction** in ABA

### **REVIEW ARTICLE**

### A Critical Review of Line Graphs in Behavior **Analytic Journals**

Richard M. Kubina Jr.<sup>1</sup> • Douglas F. Kostewicz<sup>2</sup> • Kaitlyn M. Brennan<sup>2</sup> · Seth A. King<sup>3</sup>

Published online: 3 September 2015 © Springer Science+Business Media New York 2015

Abstract Visual displays such as graphs have played an instrumental role in psychology. One discipline relies almost exclusively on graphs in both applied and basic settings, behavior analysis. The most common graphic used in behavior analysis falls under the category of time series. The line graph represents the most frequently used display for visual analysis and subsequent interpretation and communication of experimental findings. Behavior analysis, like the rest of psychology, has opted to use non-standard line graphs. Therefore, the degree to which graphical quality occurs remains unknown. The current article surveys the essential structure and quality features of line graphs in behavioral journals. Four thousand three hundred and thirteen graphs from 11 journals served as the sample. Results of the survey indicate a high degree of deviation from standards of graph construction and proper labeling. A discussion of the problems associated with graphing errors, future directions for graphing in the field of behavior analysis, and the need for standards adopted for line graphs follows.

Keywords Line graphs · Time series · Graphical construction guidelines · Graphing standards

Behavior analysis, a subfield of psychology, owes a great debt to the visual display of data. For example, the cumulative recorder offered a standard visual display of an organism's performance data. The distinctive visual patterns of behavior led to the discoveries such as schedules of reinforcement (Lattal 2004). As behavior analysis moved forward in time, the visual displays shifted from cumulative recorders to line graphs. Data show that cumulative records in the

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Behavior analysis, education, and psychology use a nonstandard linear graph as its main tool of time series behavior analysis and communication.



Nonstandard linear graph can widely distort data and provide a false picture of change due to practitioners violating graph construction guidelines.



-American Statistical Association, 1915 -American Standards Association, 1938 -American National Standards Institute & American Society of Mechanical Engineers,

1960, 1979

-Scientific Illustration Committee 1988

-Department of the Army, 2010





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### **ABA Graph Construction Rule Breakers #1**

# Manipulate the vertical and horizontal proportions







## **Proportional Construction rule**

Vertical axis 5/8 to 3/4 size of horizontal axis

Quantitative Value

7.9 inches

11.8 inches x .63 = 7.4 inches x .75 = 8.9 inches Unit of Time















Figure 1. Graphical depiction of adherence and depression scores across participants.

### ABA Graph Construction Rule Breakers #2

# Manipulate the scaling on the vertical and horizontal axes















Quantitative Value



## Slopes shift due to rescaling.
#### 0 to 2 shows one effect

#### 0 to 40 shows a different effect



conditions.



#### 1 to 2 = 100% growth



#### ABA Graph Construction Rule Breakers #3

## Use a non-time unit (i.e., Sessions) on a time series line graph





National Institute of Standards and Technology

# Quantitative Value



The International System of Units (SI)

Unit of Time = Seconds Minutes Hours Days Weeks Months Years









#### **ABA Graph Construction Rule Breakers #4**

## Misalign compared graphs

















Figure 1. DBDRS-P and SCAS-P data for cases with 2-, 3-, and 4-week baselines (Participants 1-8). B = Baseline; T = Treatment (including 1-week posttreatment); F = 6-month follow-up; DBDRS-P = Disruptive Behavior Disorders Rating Scale, Parent Version; SCAS-P = Spence Child Anxiety Scale, Parent Version.





#### ABA Graph Construction Rule Breakers #5

## Use different vertical or horizontal scalings on compared graphs







**Chartlytics** entralReach Product

Figure 3. Rate of target responding across baseline, leisure, and edible conditions.





Figure 3. Rate of target responding across baseline, leisure, and edible conditions.

#### Nonstandard Linear Graph Scorecard

Graph Construction Guideline	Yes	Νο
Proportional Construction Rule		
Labeled axes		
Horizontal axis has unit of time		
Condition Labels		
Data points legible		
Data points described/idenitfied on graph		
Graph has tick marks		
Horizontal and vertical values align with tick marks		

#### **Nonstandard Linear Graph Scorecard Example**



#### Nonstandard Linear Graph Scorecard

Graph Construction Guideline	Yes	No
Proportional Construction Rule		$\overline{\mathbf{v}}$
Labeled axes		
Horizontal axis has unit of time		
Condition Labels	(Not clear)	
Data points legible	Borderline	
Data points described/idenitfied on graph		1 out of 2
Graph has tick marks		
Horizontal and vertical values align with tick marks		

#### Potential for information loss - high to very high

## Conclusion



## **Behavioral Decision Making Framework** Intervention Decision Behavior \_ Making Analysis Record Visual Display

### Label Behavior

## Observe/ Count

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#### **Behavioral Decision Making Framework**

## Multistep Process Choices for each step

Label Behavior Observe/ Count



**Choices** -General label -Operational definiton -Pinpoint

Choices -Discontinuous observation -Continuous observation

Choices -Dimensional quantities -Dimensionless quantities

Visual Display

Analysis



Choices -Linear graphs -Ratio graphs

Choices -Structured analysis -Unstructured analysis

Choices -Information driven -Opinion driven

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#### Understanding

#### **Behavioral Decision Making Framework**









## 

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1. Avoid operational definitions Pinpoint behavior 2. Forgo discontinuous observation Use continuous observation 3. Stop using nonstandard linear graphs **Embrace standard ratio graphs** 



#### **More information**

(Kubina publications) https://www.chartlytics.com/kubinaspublications

(Kubina Blog) https://www.chartlytics.com/blog

(Join SCS on Website) http://celeration.org/

(Join SCS on Facebook) https://www.facebook.com/groups/ 6125768559/





