

Measuring clients' daily behavior with some high-tech devices.

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OUTLINE

1. What is measurement for researchers and practitioners?
2. How to measure?
3. Measuring clients' daily behavior with high-tech devices
 - 3-1. Triaxial accelerometer
 - 3-2. GPS logger
 - 3-3. Portable action camera

OUTLINE

- 1. What is measurement for researchers / practitioners?**
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Definition of measurement

**The act or processes of assigning
quantitative or qualitative labels
to objects or events
using consensus-based rules**

(Bloom, Fisher, & Orme, 2003)

Researchers need measurement

1. Scientists operationalize empiricism

—Without measurement, science is guesswork and opinion

2. Behavioral psychologists measure behavior to achieve CBS's original vision (i. e., the prediction and influence of human behavior)

—We can reach the induction-based conclusion through measuring.

Researchers need measurement

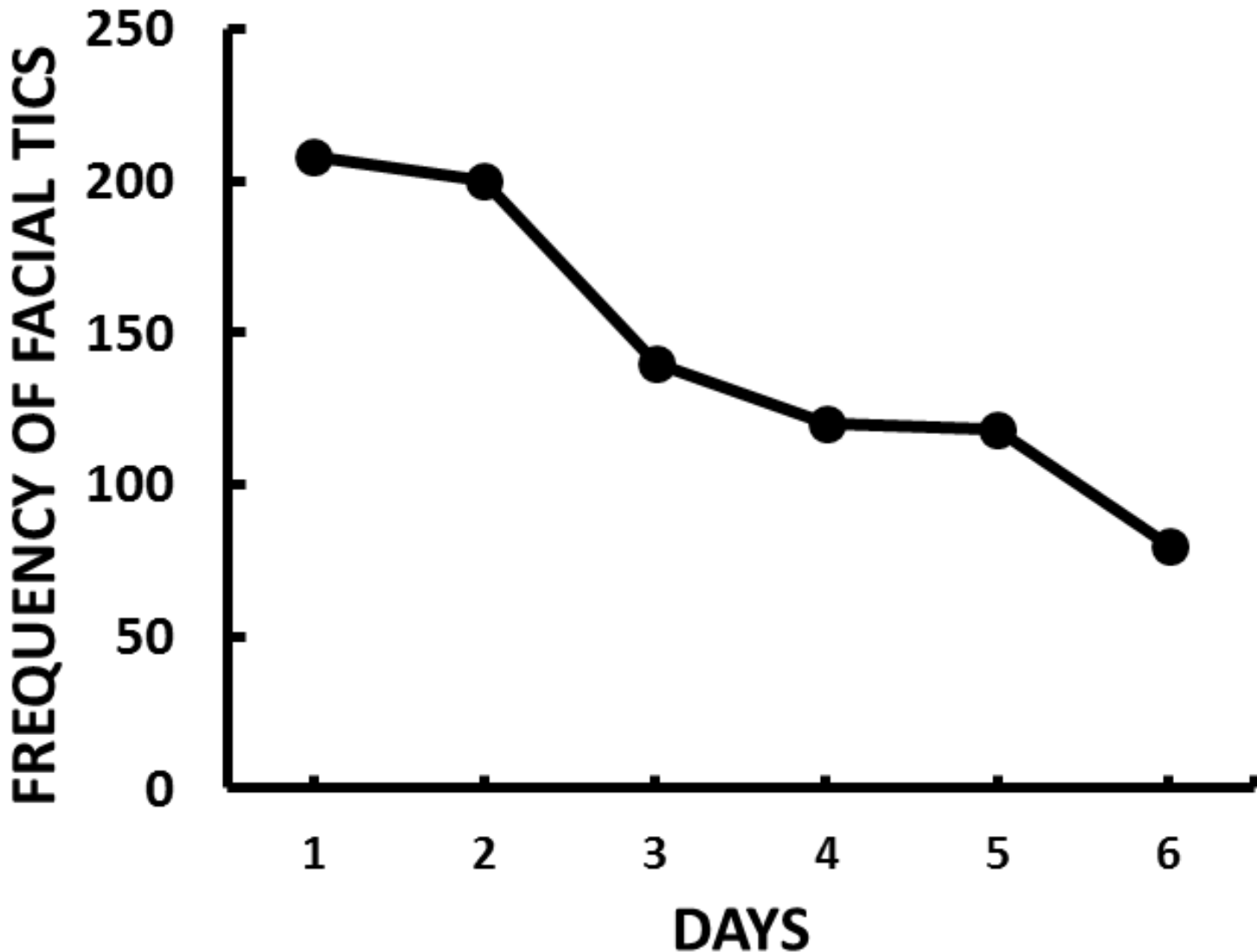
**measurement is
a necessary condition
to conduct
the scientific works**

Does Practitioners also need measurement?

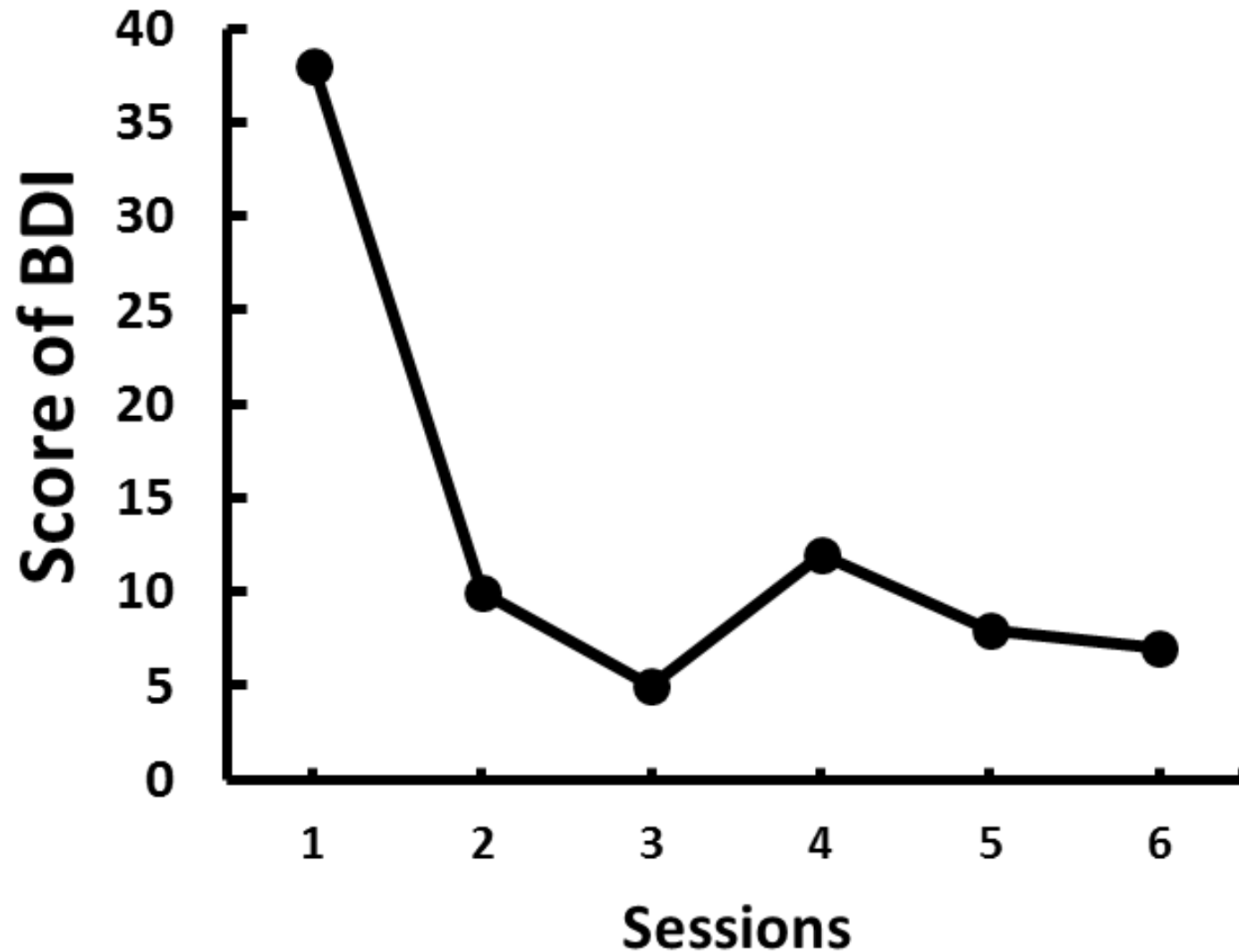
1. To evaluate baseline conditions of clients

- Does it really needs any interventions?
- Choosing the valid target outcome

Does it need any intervention?



Is outcome variable valid?



Does Practitioners also need measurement?

1. To evaluate baseline conditions of clients

- Does it really needs any interventions?
- Choosing the valid target outcome

Does Practitioners also need measurement?

2. To evaluate effects of treatment

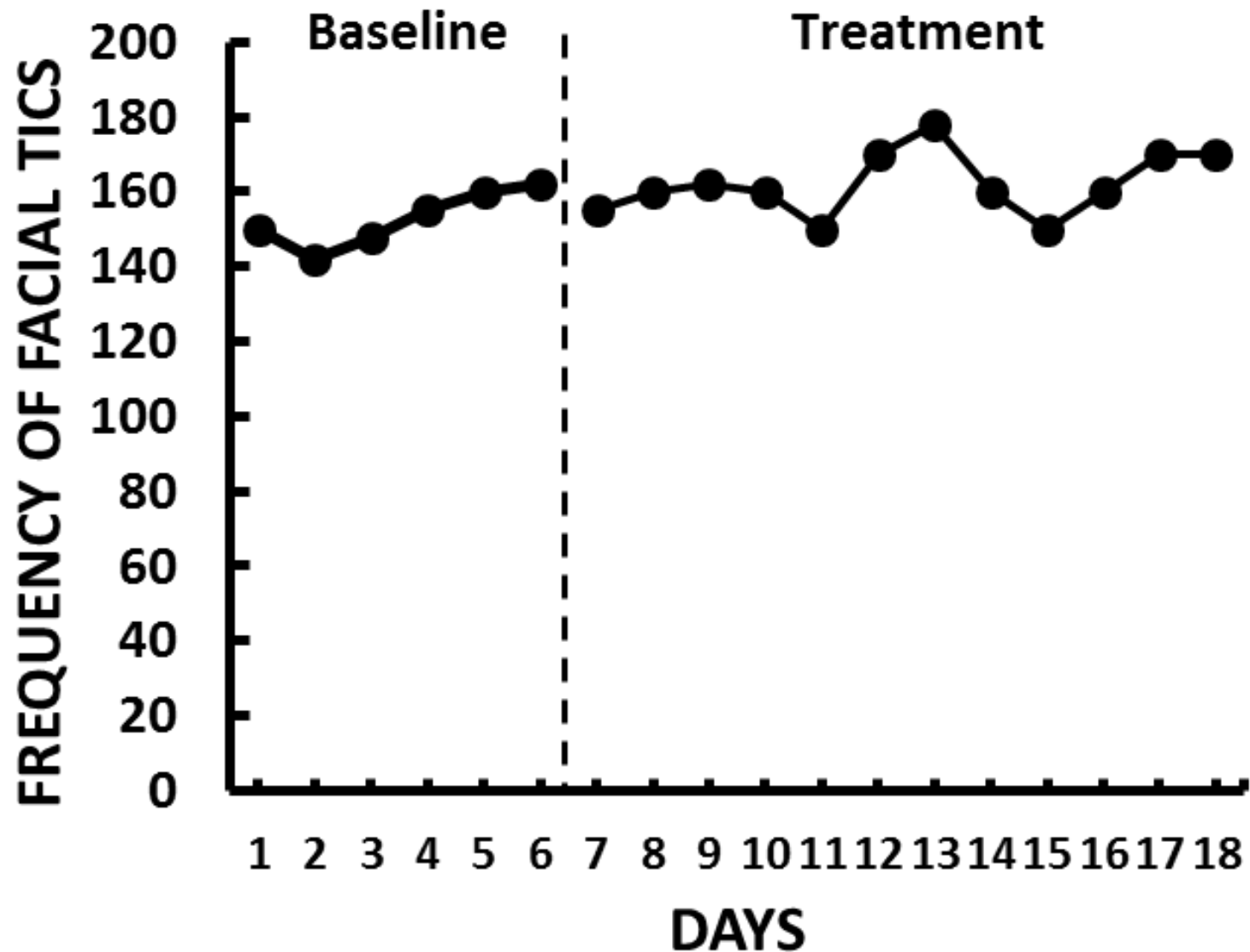
- When did target behavior improve?
- How long did the improvement last?

Does Practitioners also need measurement?

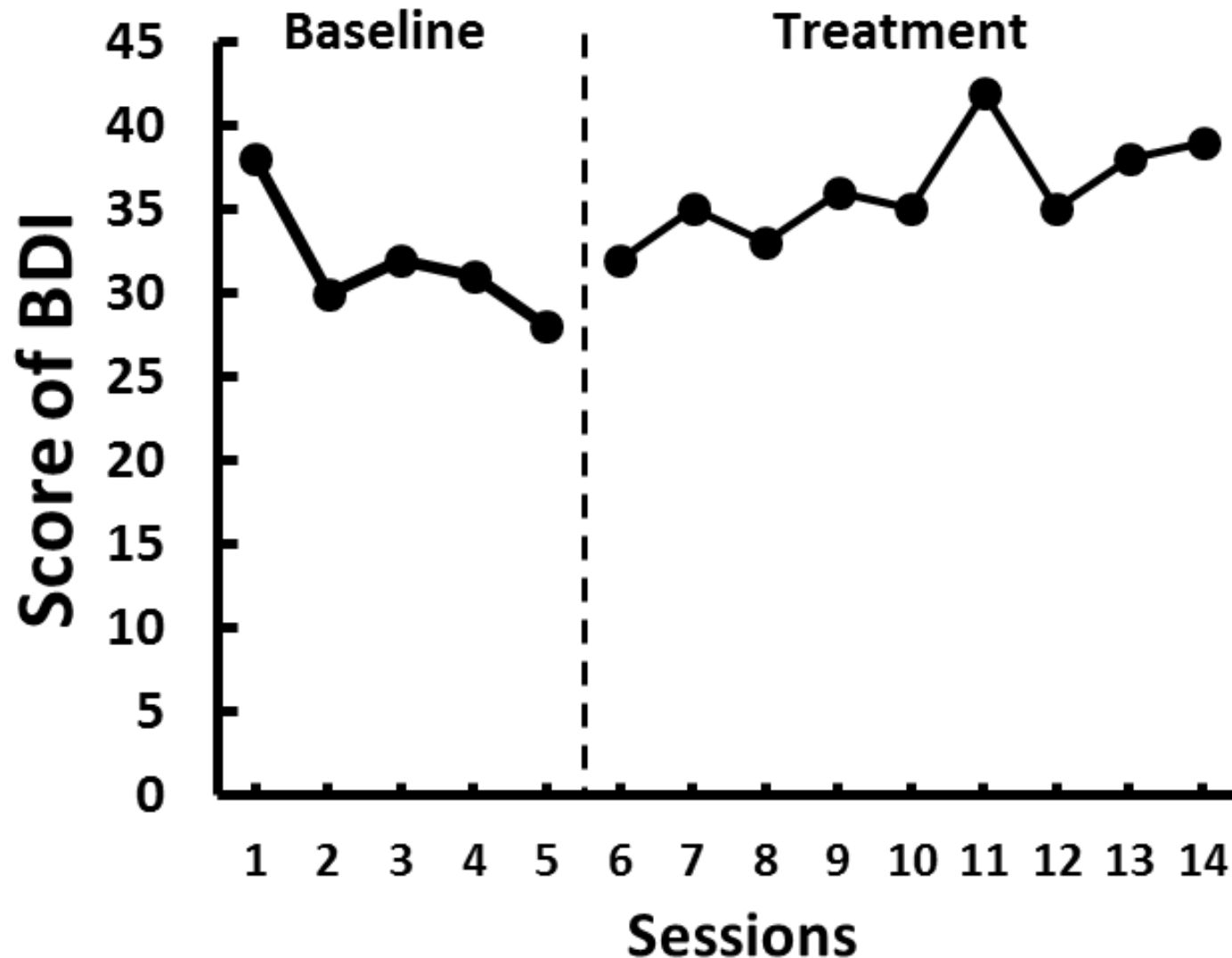
3. To guide clinical decision making

—Repeated measurement allows practitioners the data-based dynamic decision making.

Do you continue or discontinue?



Do you continue or discontinue?



Does practitioners also need measurement?

4. To be responsible for society

— Reliable and valid measurement allows practitioners be ethical and accountable for clients, clients' guardians, consumers, and society.

Does practitioners also need measurement?

measurement is
a necessary condition
to conduct
EBPP

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A variety of measurement



Standardized test

A variety of measurement



Structured interview

A variety of measurement



Questionnaire

A variety of measurement



Physiological measurement

A variety of measurement



Direct observation

How to measure?

■ Traditional methods in **applied behavior analysis**

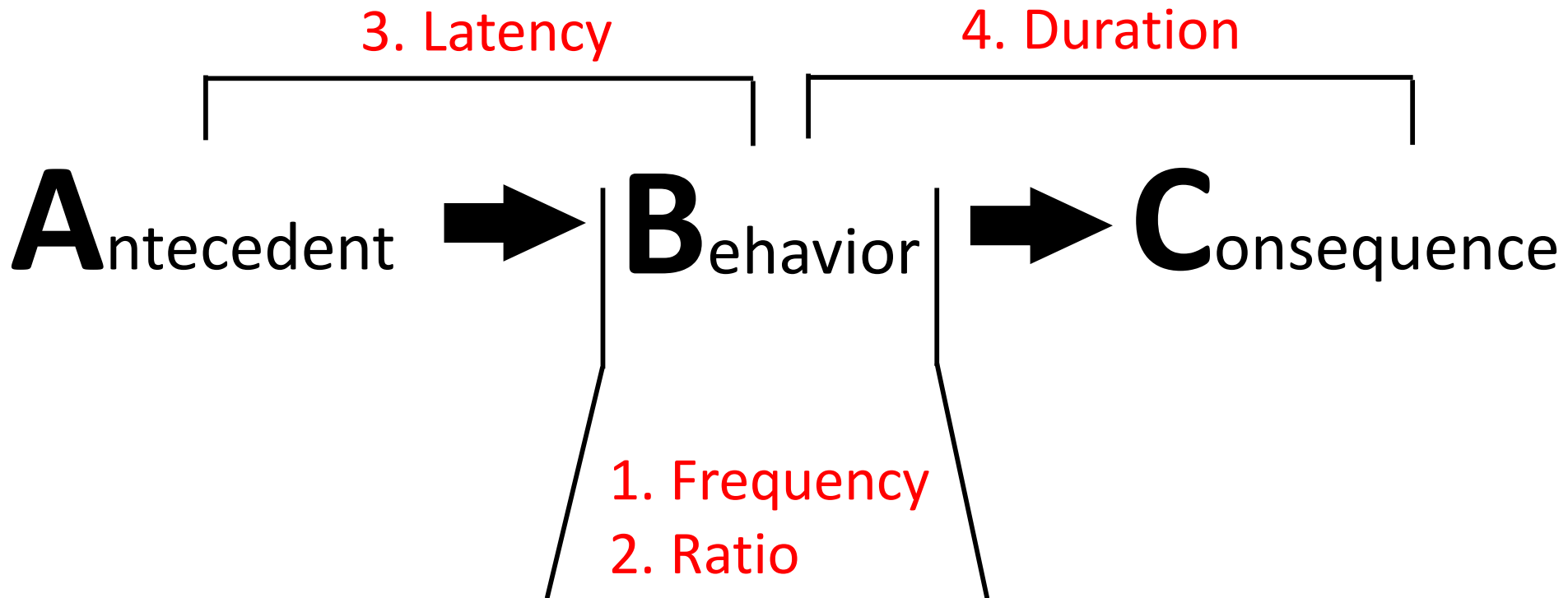
Direct measurement

(e.g., Event recording; Timing)

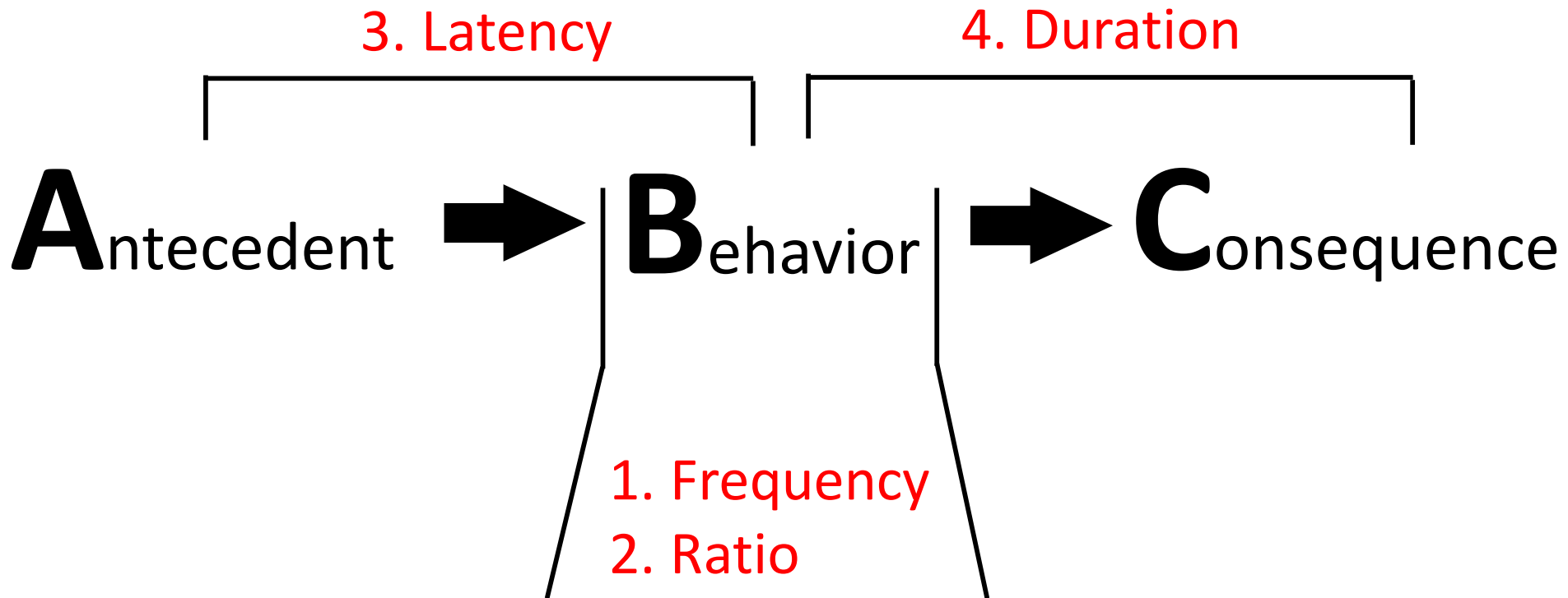


**A therapist is accessible
to target behavior**

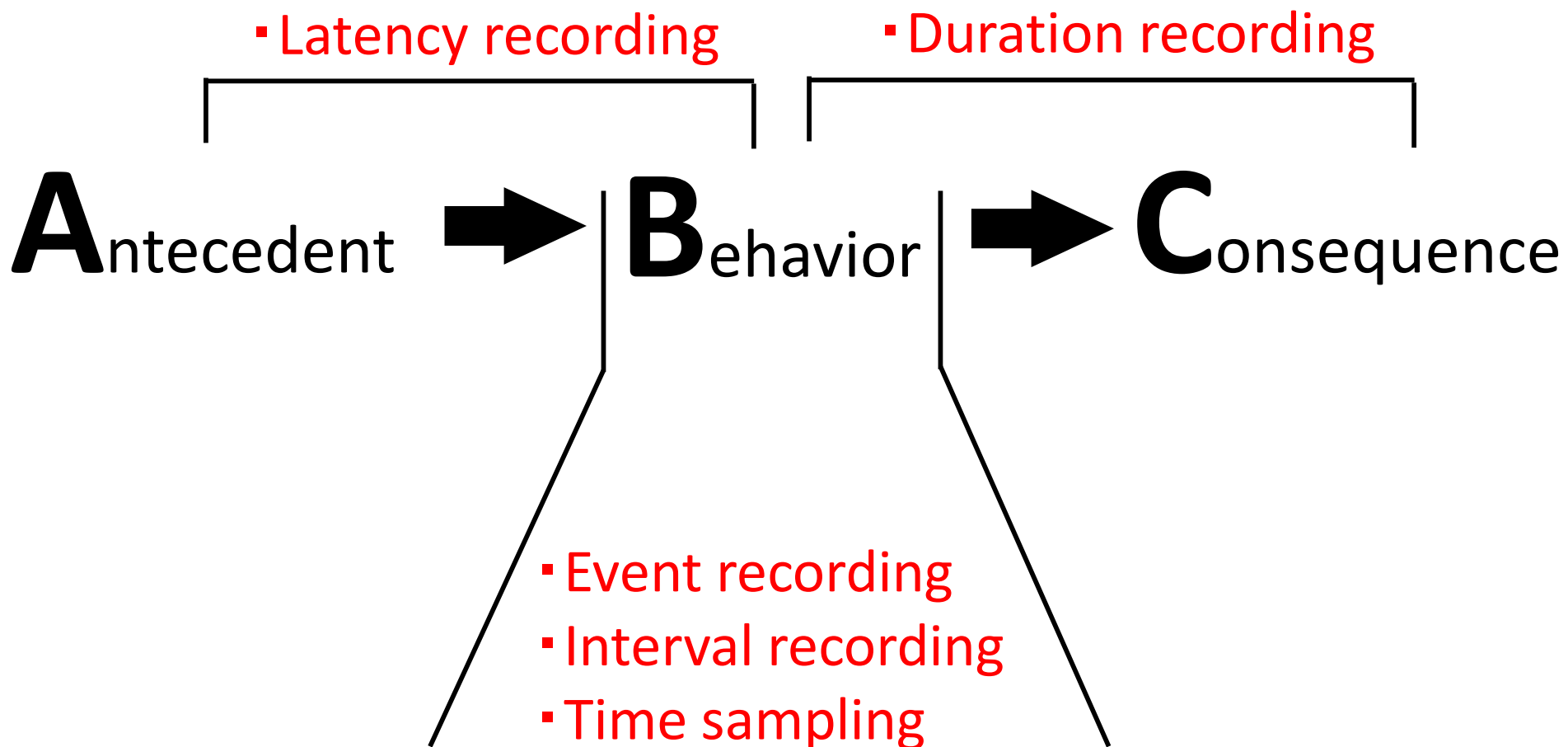
Dimensions of behavior



Procedures of measurement



Procedures of measurement

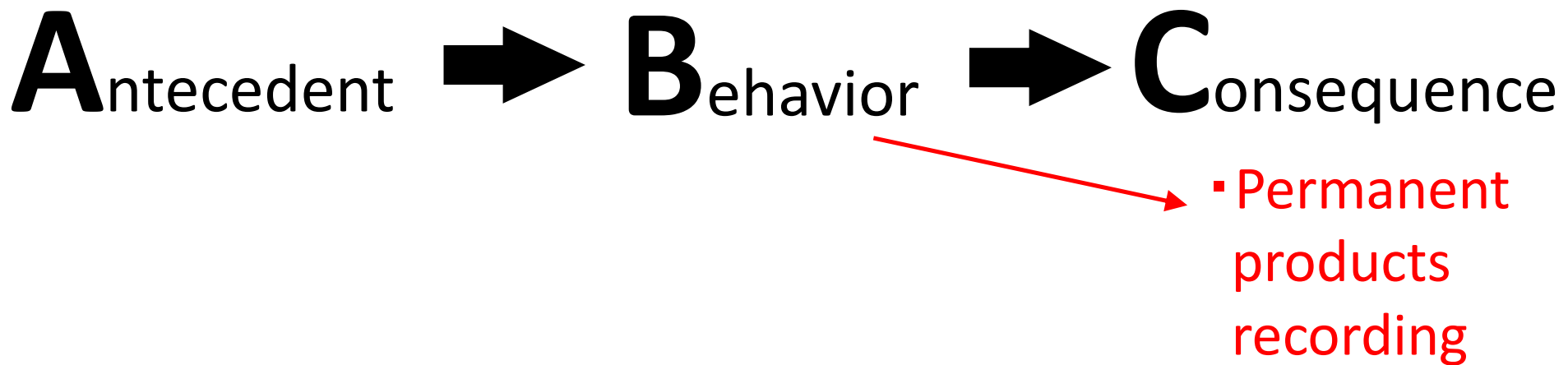


Procedures of measurement

- **ABC observation**



Procedures of measurement

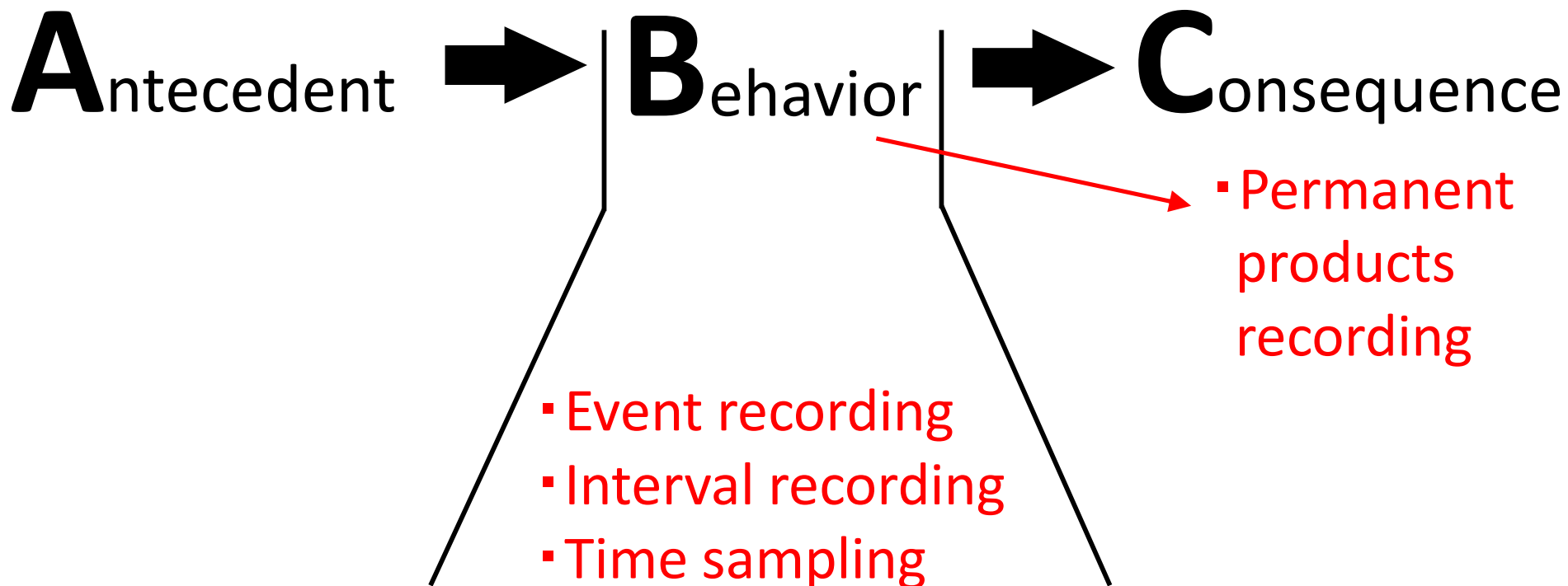


Procedures of measurement

- ABC observation

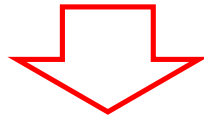
- Latency recording

- Duration recording

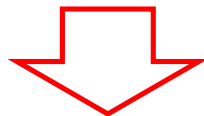


Flow of measurement

Selecting target behaviors



Selecting dimensions of behaviors



Selecting measurement procedure

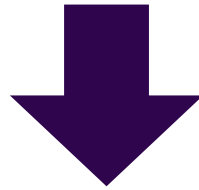
Frequency?
Ratio?
Duration?

Event
recording?
Time
sampling?

How to measure?

■ Traditional methods in **clinical settings**

A Therapist only sees a client intermittently in a therapy room (often weekly).



Measurement by
psychometric scale

Some methodological challenges

The behavior occurs in the
therapy room is occurring
in the **contingencies**
of the therapy room.

(i.e., In relationship between therapist and client)

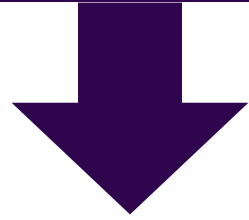
Some methodological challenges

Target behavior

often occur in their daily life

but not in the therapy room.

Some methodological challenges



In order to conduct more **comprehensive** measurement, behavioral therapists are eager to measure clients' **daily behavior** out of the therapy room

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Attention



**I am not a SHILL
for Companies
develop these devices**

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Triaxial accelerometer



Active Style Pro HJA-750c



■ Made by Omron Corporation
(Kyoto, Japan)

■ $40 \times 52 \times 12$ (mm)
23g

■ Battery type: Button battery
Battery life: 2 month

What can we measure?

- **METs** every 10 sec

— METs (Metabolic Equivalent) is a term used to represent the intensity of exercise. 1 MET stands for the amount of oxygen you consume and the number of calories you burn at rest.

[e.g., Climbing stair at slow pace: 4.0 METs
Sitting work: 1.5 METs]

What can we measure?

- **Ex** every 1 hour

— Ex (Exercise) is a term used to represent the amount of the physical activity (i. e., **$Ex = METs \cdot hour$**)

e.g., Walking (3METs) for 20 min $\rightarrow 3METs \cdot 1/3hour = 1Ex$

- **Steps** every 1 hour

- **Calories** every 1 hour

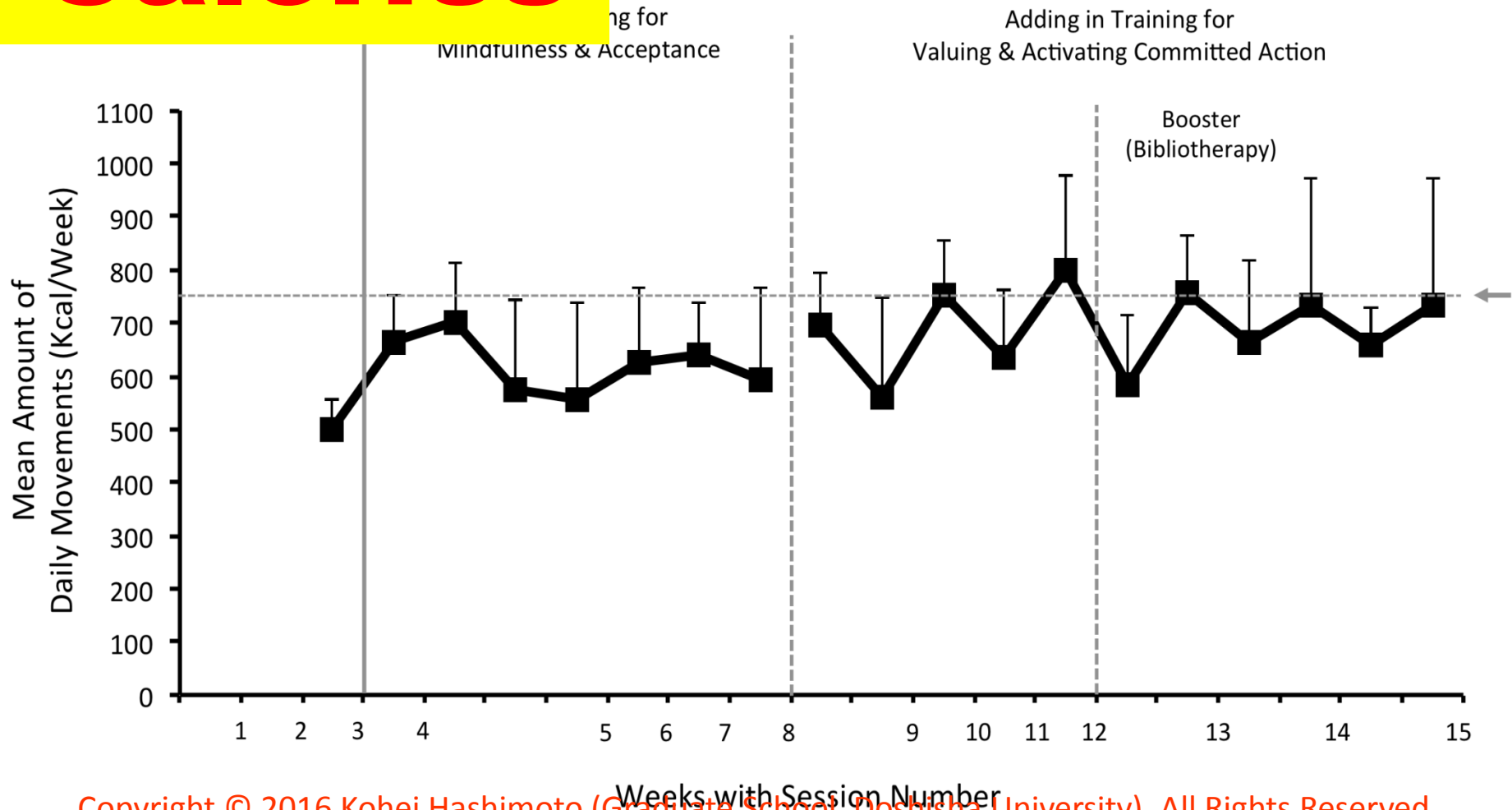
- **Walking duration** per day

In the case of depression

Muto & Mitamura (2015)

Calories

ACT Treatment



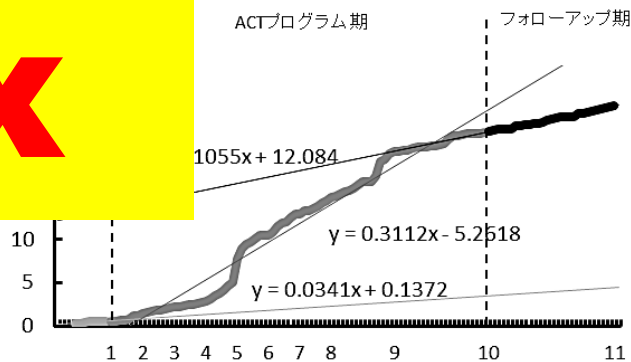
In the case of chronic pain

Sakano et al. (inpress)

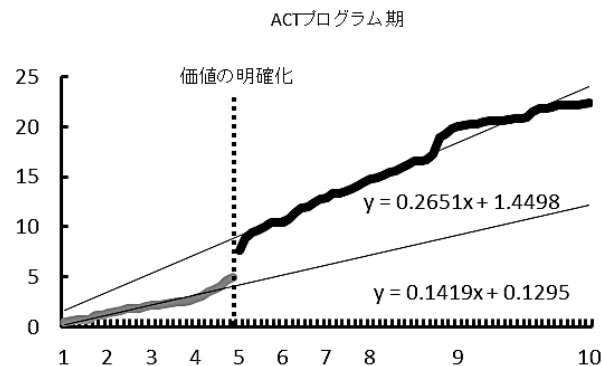
S2

Ex

一日の活動量計装着時一時間あたりのエクササイズ量 (METs × 時間)



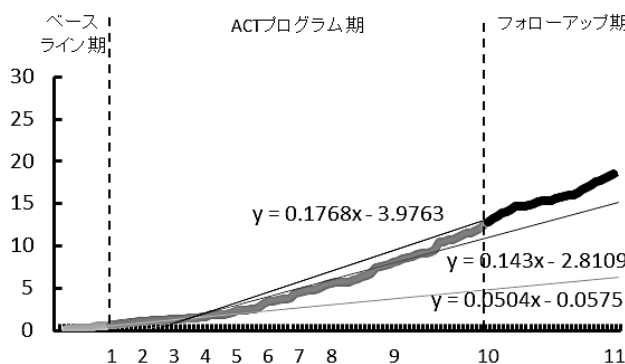
(A) ベースライン期, ACTプログラム期, フォローアップ期における回帰直線を示した図



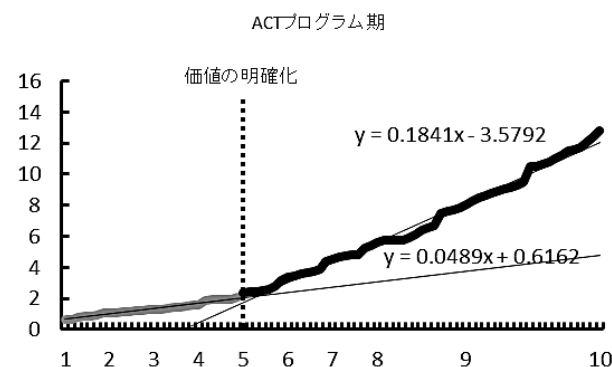
(B) ACTプログラム期の#1~#5, #5~#10のにおける回帰直線を示した図

S3

一日の活動量計装着時一時間あたりの累積値



(A) ベースライン期, ACTプログラム期, フォローアップ期における回帰直線を示した図

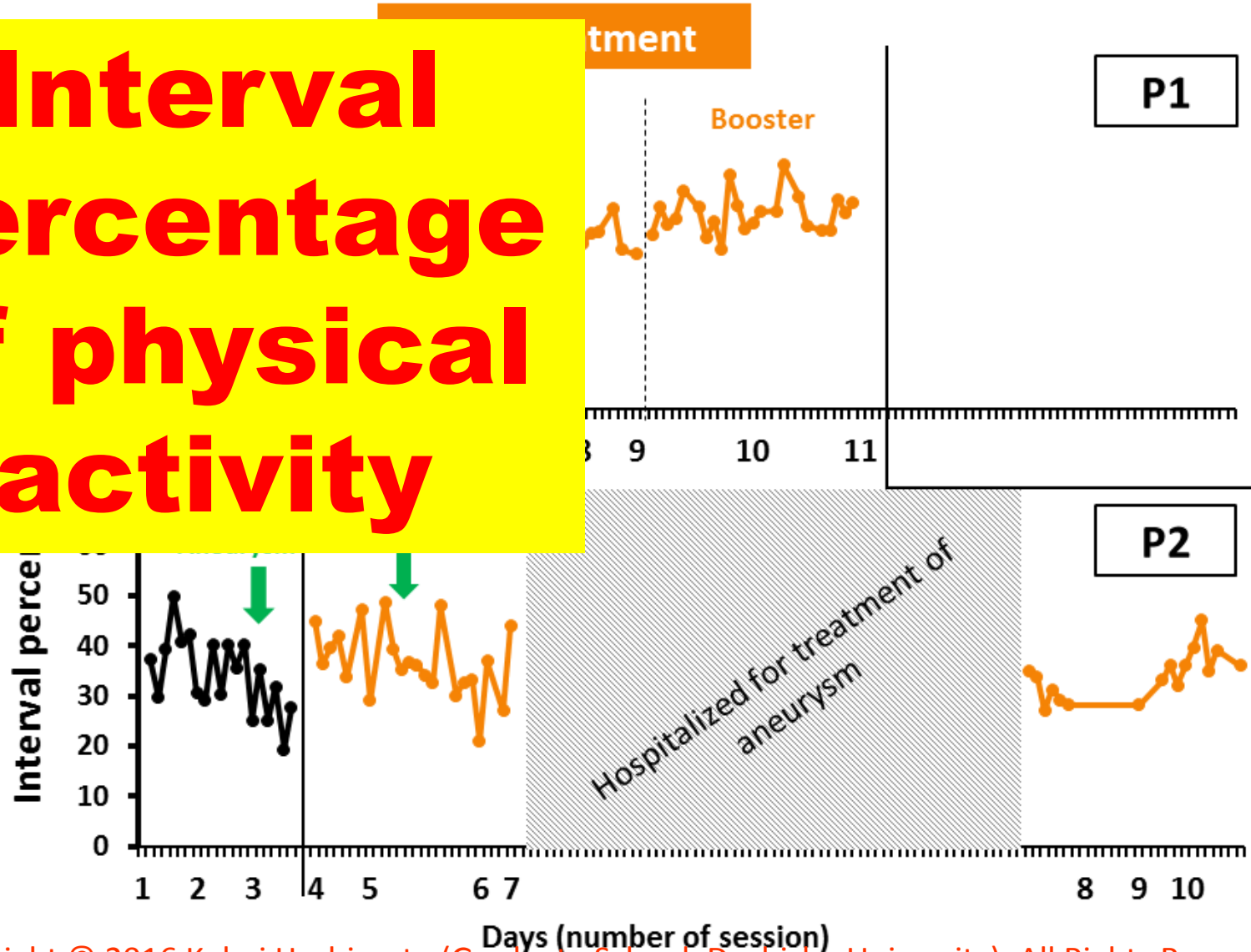


(B) ACTプログラム期の#1~#5, #5~#10のにおける回帰直線を示した図

In the case of social withdrawal

Hashimoto & Muto. (Tonight Poster #2-25)

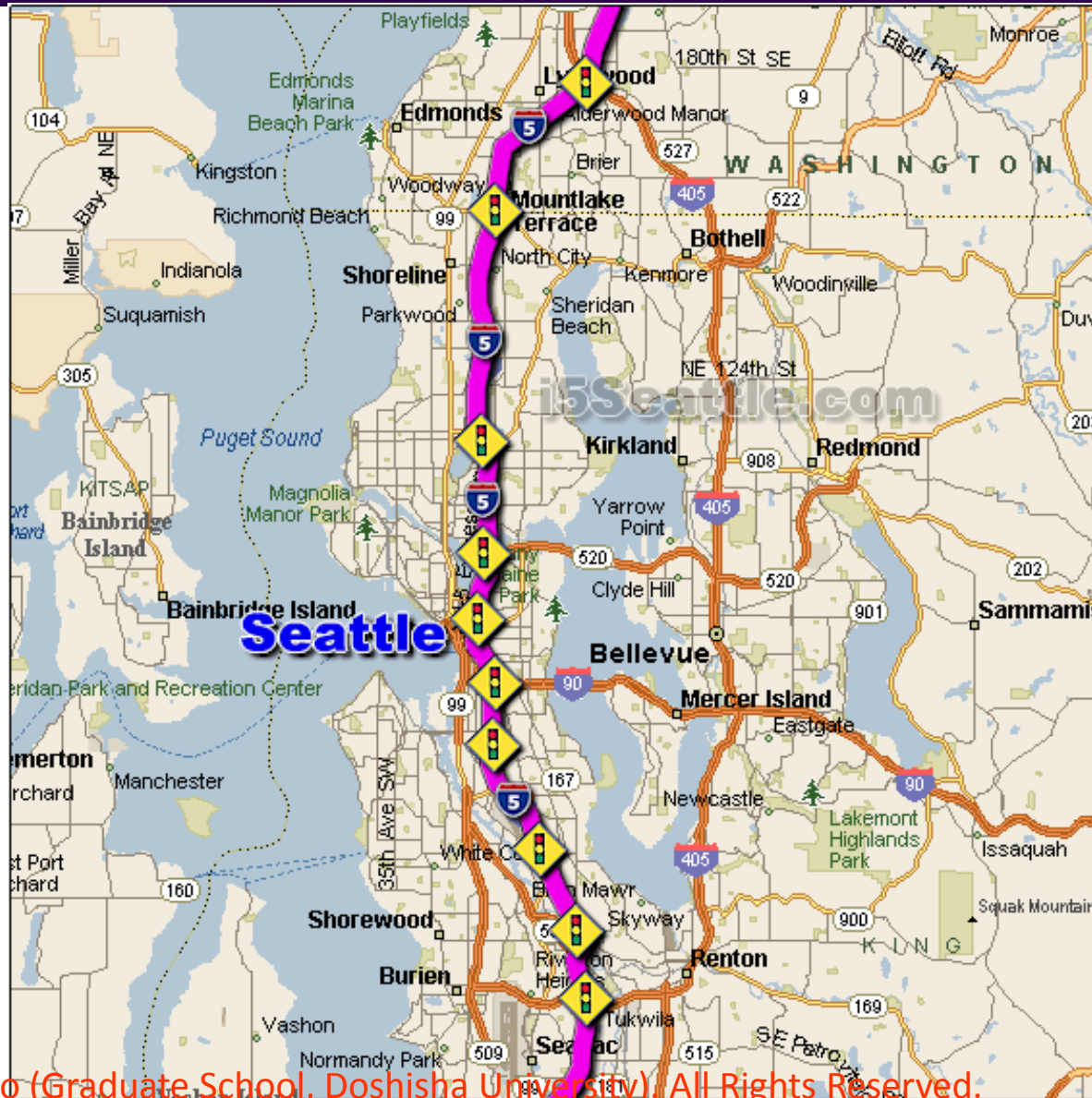
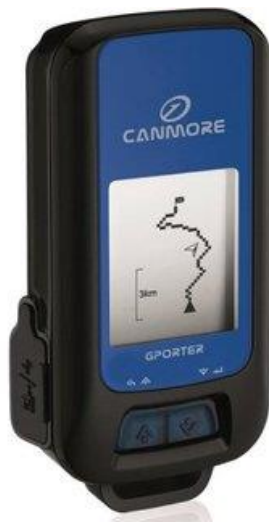
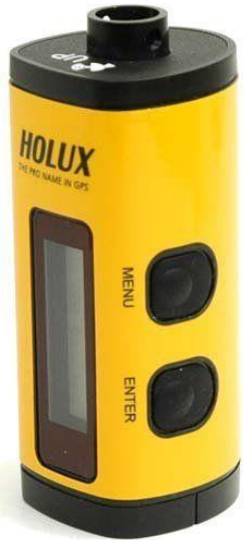
**Interval
percentage
of physical
activity**



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GPS logger



Behavioral Detectives

A Staff Training Exercise Book in Applied Behavior Analysis



Super Trackstick



- Made by Telespial Systems, Inc (California)

- $10.7 \times 3.2 \times 2.3$ (cm)
136g (without battery)

- Battery type: AAA battery
Battery life: up to 2 weeks
(depends on log interval)

What can we measure?

■ **log** (from every 10sec to 15 min)

i. e. Data which includes date, time, longitude, latitude, altitude and course

Device Name *No device connected*

D:\研究1\GPSデータまとめ\01\01-pre(0706-0719).tsf

Filters

Date Range

 All Dates

From 07/06/2015 11:23:00 午前

To 07/17/2015 04:03:30 午後

Status

All

 Greater than 0 Greater than or equal to 0 Less than or equal to 0

Record Number

 All Records Greater than or equal to 2 Greater than or equal to 2 Less than or equal to 1817

Temperature

 All Temperatures Greater than or equal to Greater than or equal to Less than or equal to

Update View

Photos



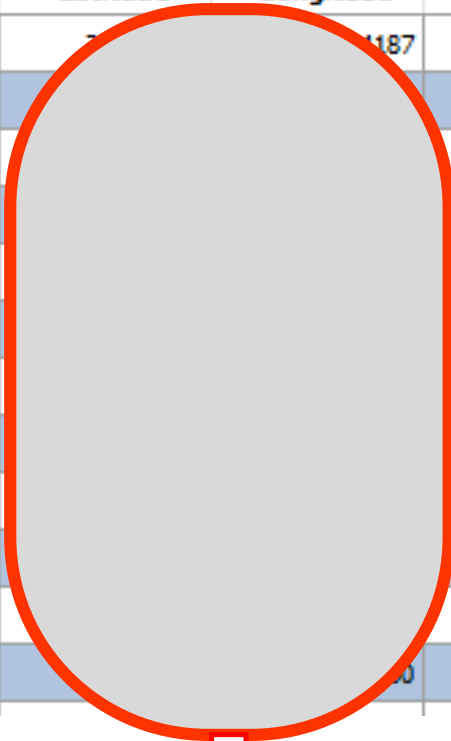
All Tracks Routes Dates Properties

jintei(01) Locations

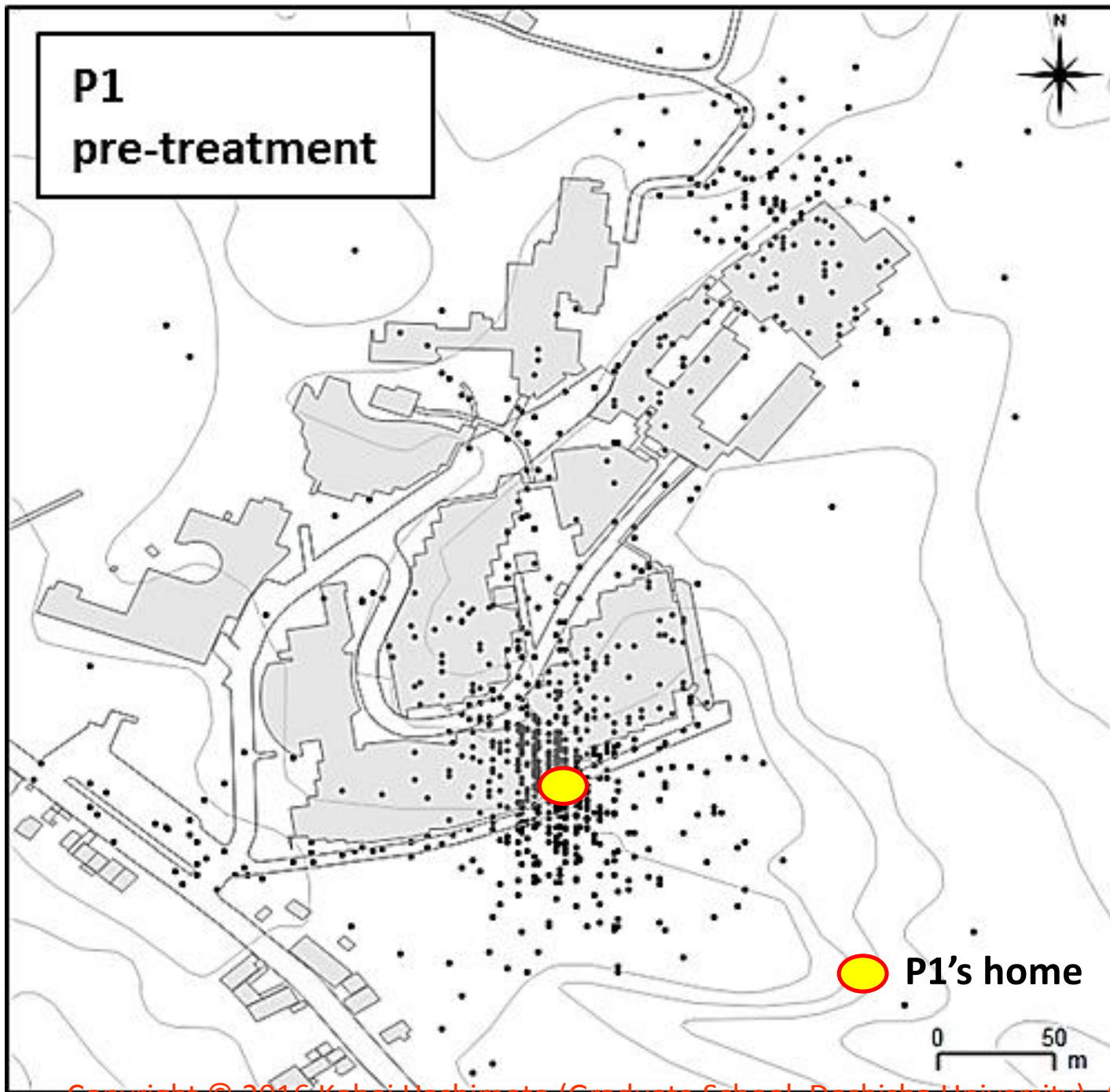
| Rec # | Date | Latitude | Longitude | Altitude | Temp | Status | Course | GPS Fix | Signal | Map Link |
|-------|------------------------|----------|-----------|----------|--------|--------------------|--------|---------|--------|-----------------------------|
| 2 | 07/06/2015 11:23:00 AM | | | 565.6 ft | 81.0°F | Stopped 16 min | NW | Y | 7 | Google Maps |
| 4 | 07/06/2015 11:39:00 AM | | | 624.0 ft | 80.4°F | 1 mph | N | Y | 4 | Google Maps |
| 5 | 07/06/2015 11:39:20 AM | | | 588.3 ft | 80.9°F | 3 mph | N | Y | 6 | Google Maps |
| 6 | 07/06/2015 11:39:40 AM | | | 551.5 ft | 81.4°F | 4 mph | N | Y | 4 | Google Maps |
| 7 | 07/06/2015 11:40:00 AM | | | 552.8 ft | 81.9°F | Stopped 7 min | N | Y | 5 | Google Maps |
| 9 | 07/06/2015 11:47:00 AM | | | 642.1 ft | 81.4°F | 0 mph | N | Y | 6 | Google Maps |
| 10 | 07/06/2015 11:48:00 AM | | | 528.9 ft | 81.4°F | Stopped 2 hr 0 min | N | Y | 6 | Google Maps |
| 13 | 07/06/2015 01:48:00 PM | | | 524.3 ft | 76.7°F | 1 mph | N | Y | 5 | Google Maps |
| 14 | 07/06/2015 01:49:00 PM | | | 565.3 ft | 77.4°F | Stopped 4 min | N | Y | 7 | Google Maps |
| 17 | 07/06/2015 01:53:00 PM | | | 532.2 ft | 78.8°F | 1 mph | N | Y | 6 | Google Maps |
| 18 | 07/06/2015 01:54:00 PM | | | 551.2 ft | 79.2°F | Stopped 2 min | NW | Y | 6 | Google Maps |
| 19 | 07/06/2015 01:56:00 PM | | | 490.8 ft | 79.2°F | 1 mph | NW | Y | 5 | Google Maps |

jintei(01) Locations

| | Rec # | Date | Latitude | Longitude | Altitude | Temp | Status | Course |
|---|-------|------------------------|----------|-----------|----------|--------|--------------------|--------|
| ▶ | 2 | 07/06/2015 11:23:00 AM | | 1187 | 565.6 ft | 81.0°F | Stopped 16 min | NW |
| | 4 | 07/06/2015 11:39:00 AM | | | 624.0 ft | 80.4°F | 1 mph | N |
| | 5 | 07/06/2015 11:39:20 AM | | | 588.3 ft | 80.9°F | 3 mph | N |
| | 6 | 07/06/2015 11:39:40 AM | | | 551.5 ft | 81.4°F | 4 mph | N |
| | 7 | 07/06/2015 11:40:00 AM | | | 552.8 ft | 81.9°F | Stopped 7 min | N |
| | 9 | 07/06/2015 11:47:00 AM | | | 642.1 ft | 81.4°F | 0 mph | N |
| | 10 | 07/06/2015 11:48:00 AM | | | 528.9 ft | 81.4°F | Stopped 2 hr 0 min | N |
| | 13 | 07/06/2015 01:48:00 PM | | | 524.3 ft | 76.7°F | 1 mph | N |
| | 14 | 07/06/2015 01:49:00 PM | | | 565.3 ft | 77.4°F | Stopped 4 min | N |
| | 17 | 07/06/2015 01:53:00 PM | | | 532.2 ft | 78.8°F | 1 mph | N |
| | 18 | 07/06/2015 01:54:00 PM | | | 551.2 ft | 79.2°F | Stopped 2 min | NW |
| | 19 | 07/06/2015 01:56:00 PM | | | 490.8 ft | 79.2°F | 3 mph | NW |

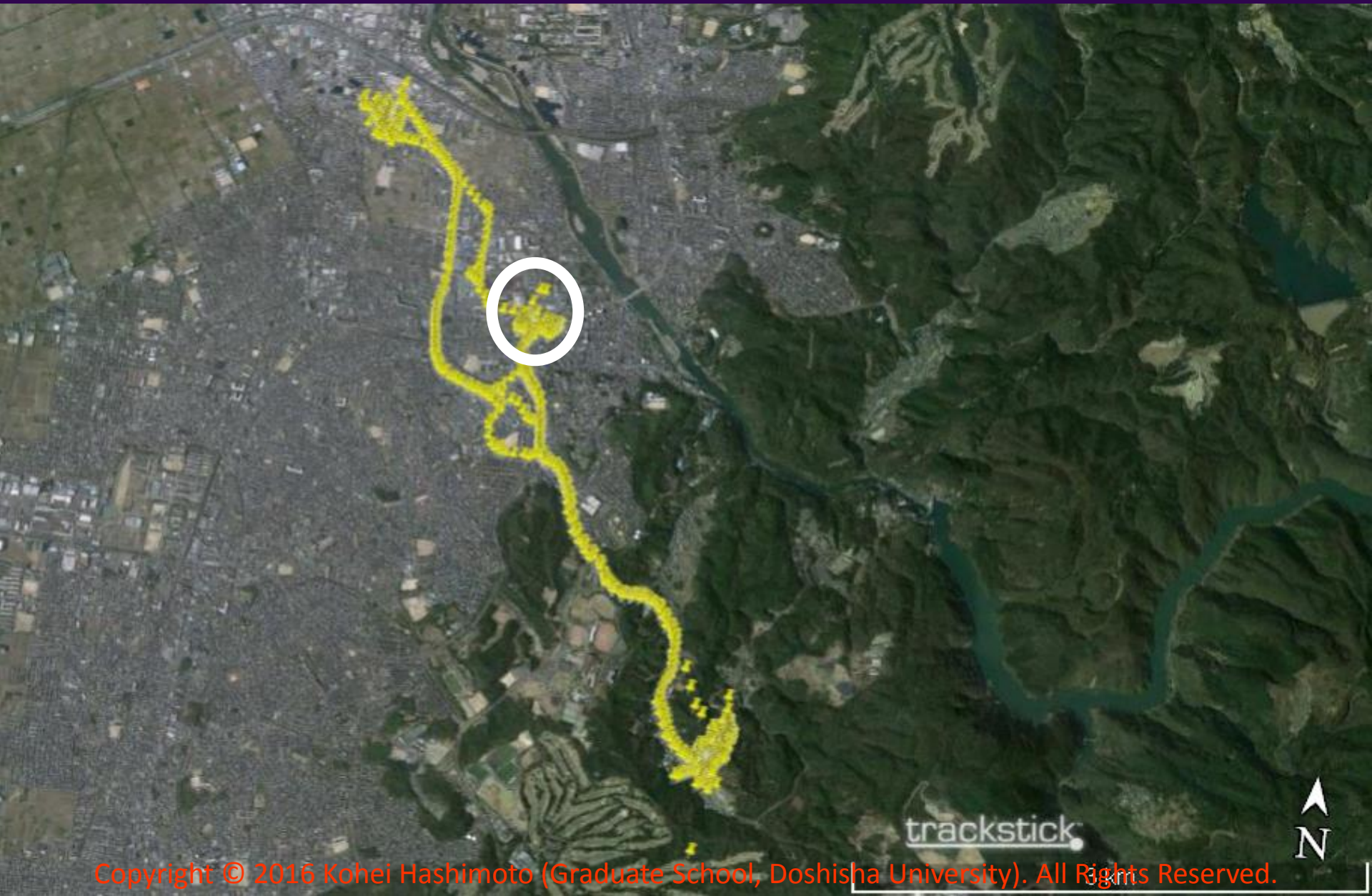


Plot the log data to a blank map



Note.
Participant's
positioning
information of
pre-treatment
in the
retirement
community
(Hashimoto &
Muto, 2016).

Out put to Google Earth



Out put to Google Earth



What can we measure?

- These are qualitative data.
We can measure the quantitative data from the raw data.

 **Moving distance**

Moving distance

Filters

Date Range: All Dates
From: 06/07/2016 01:35:35 午後 To: 06/07/2016 01:35:35 午後

Status: All
 Greater than 0
 Greater than or equal to 0
 Less than or equal to 0

Record Number: All Records
 Greater than or equal to 1
 Greater than or equal to 1
 Less than or equal to 1

Temperature: All Temperatures
 Greater than 0
 Greater than or equal to 0
 Less than or equal to 0

Update View

Photos

All Tracks Routes **Dates** Properties

jintei(01) Dates

| Date | Time Period | Record #'s | Total Duration | Distance |
|----------------------------|---------------------------|-------------|----------------|----------|
| 07/06/2015 | 11:23:00 AM - 12:00:00 AM | 2 - 69 | 12 hr 37 min | 0.78 mi |
| 07/07/2015 | 12:00:00 AM - 12:00:30 AM | 69 - 361 | 24 hr 0 min | 7.37 mi |
| 07/08/2015 | 12:00:30 AM - 12:00:30 AM | 361 - 361 | 24 hr 0 min | 0 mi |
| 07/09/2015 | 12:00:30 AM - 12:00:40 AM | 361 - 593 | 24 hr 0 min | 6.16 mi |
| 07/10/2015 | 12:00:40 AM - 12:00:00 AM | 593 - 829 | 24 hr 0 min | 3.69 mi |
| 07/11/2015 | 12:00:00 AM - 12:00:00 AM | 829 - 829 | 24 hr 0 min | 0 mi |
| 07/12/2015 | 12:00:00 AM - 12:00:00 AM | 829 - 829 | 24 hr 0 min | 0 mi |
| 07/13/2015 | 12:00:00 AM - 12:00:00 AM | 829 - 1150 | 23 hr 54 min | 7.02 mi |
| 07/14/2015 | 12:00:00 AM - 12:00:00 AM | 1150 - 1150 | 24 hr 0 min | 0 mi |
| 07/15/2015 | 12:00:00 AM - 12:00:40 AM | 1150 - 1654 | 24 hr 0 min | 9.11 mi |
| 07/16/2015 | 12:00:40 AM - 12:00:40 AM | 1654 - 1654 | 24 hr 0 min | 0 mi |
| 07/17/2015 | 12:00:40 AM - 04:10:30 PM | 1654 - 1817 | 16 hr 10 min | 2.72 mi |

Tab: Show data per days

Moving distance per days

Moving distance

| | Total Duration | Distance |
|--------|----------------|----------|
| ! - 69 | 12 hr 37 min | 0.78 mi |
| - 361 | 24 hr 0 min | 7.37 mi |
| - 361 | 24 hr 0 min | 0 mi |
| - 593 | 24 hr 0 min | 6.16 mi |
| - 829 | 24 hr 0 min | 3.69 mi |
| - 829 | 24 hr 0 min | 0 mi |
| - 829 | 24 hr 0 min | 0 mi |
| 1150 | 23 hr 54 min | 7.02 mi |
| 1150 | 24 hr 0 min | 0 mi |
| 1654 | 24 hr 0 min | 9.11 mi |
| 1654 | 24 hr 0 min | 0 mi |
| 1817 | 16 hr 10 min | 2.72 mi |

Moving distance
per days

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Some methodological challenges

Target behavior

often occur in their daily life

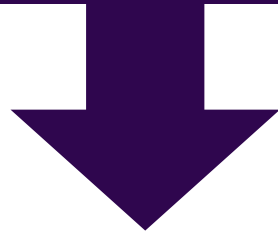
but not in the therapy room.

But...

In the **F**unctional **A**nalytic **P**sychotherapy

Target behavior
often occur in their daily life
and also in the therapy room.

Other methodological challenges



behavioral therapists are eager to
measure clients' behavior
in the therapy room

OUTLINE

1. What is measurement for researchers / practitioners?
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 - 3. Measuring clients' ~~daily~~ **in-session** behavior with high-tech devices**
 - 3-1. Triaxial accelerometer
 - 3-2. GPS logger
 - 3-3. Portable action camera**
-

Kodak PIXPRO SP360

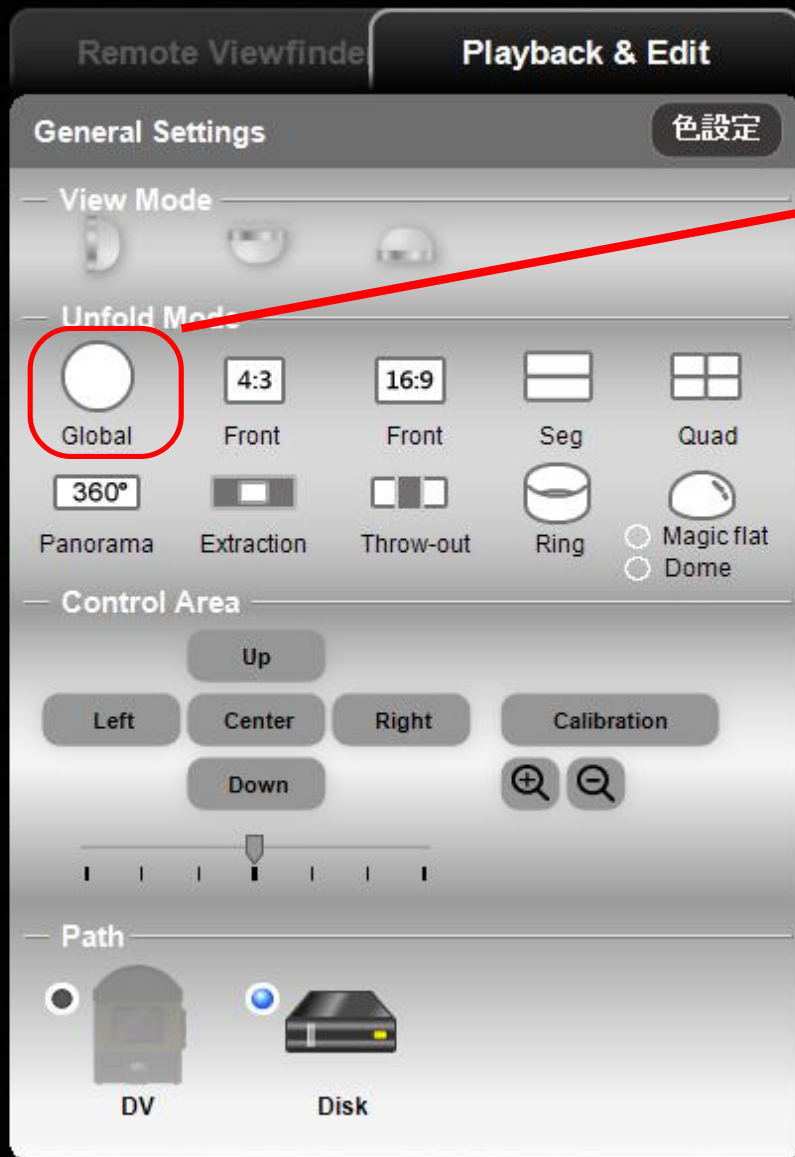


■ Made by Eastman Kodak Company (New York)

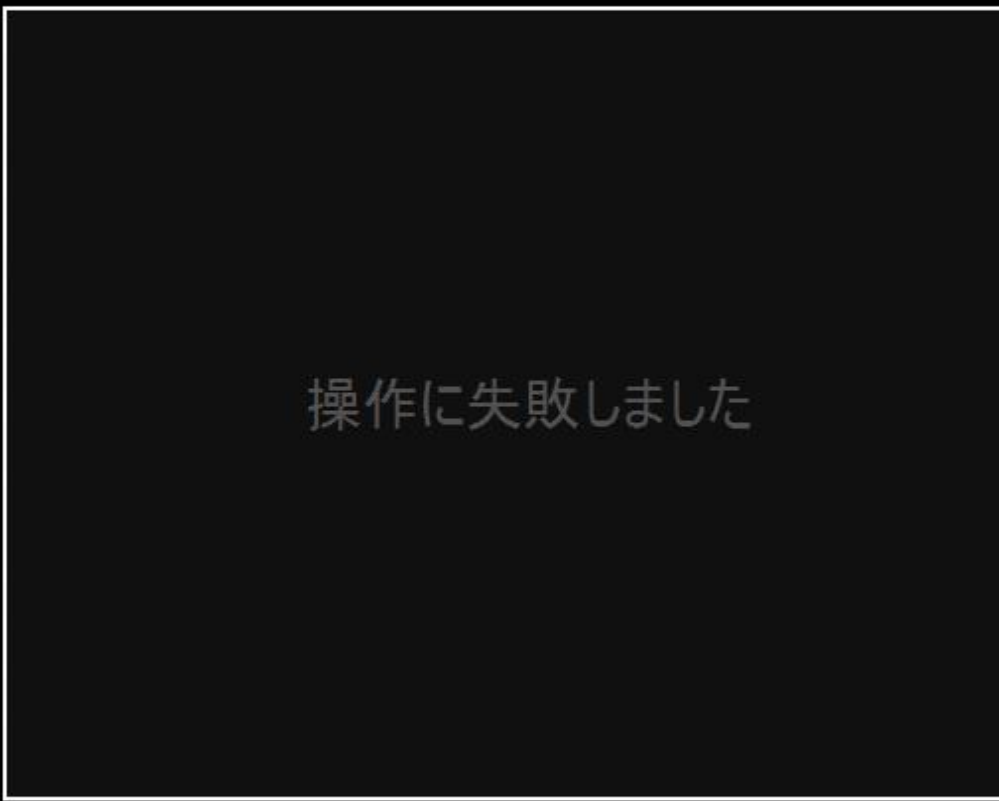
■ $50 \times 41.1 \times 38$ (mm), 103g

■ Battery type: Exclusive rechargeable battery

Battery life: More than 3hours

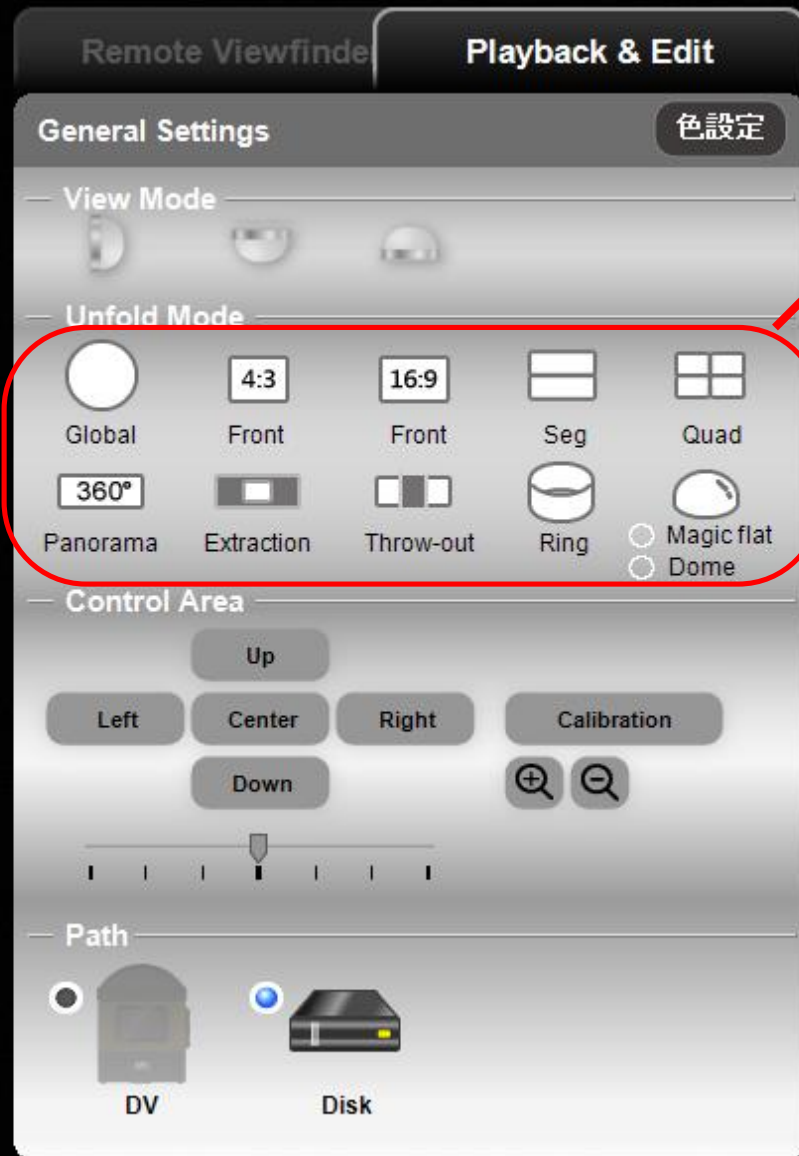


Raw data of movie.

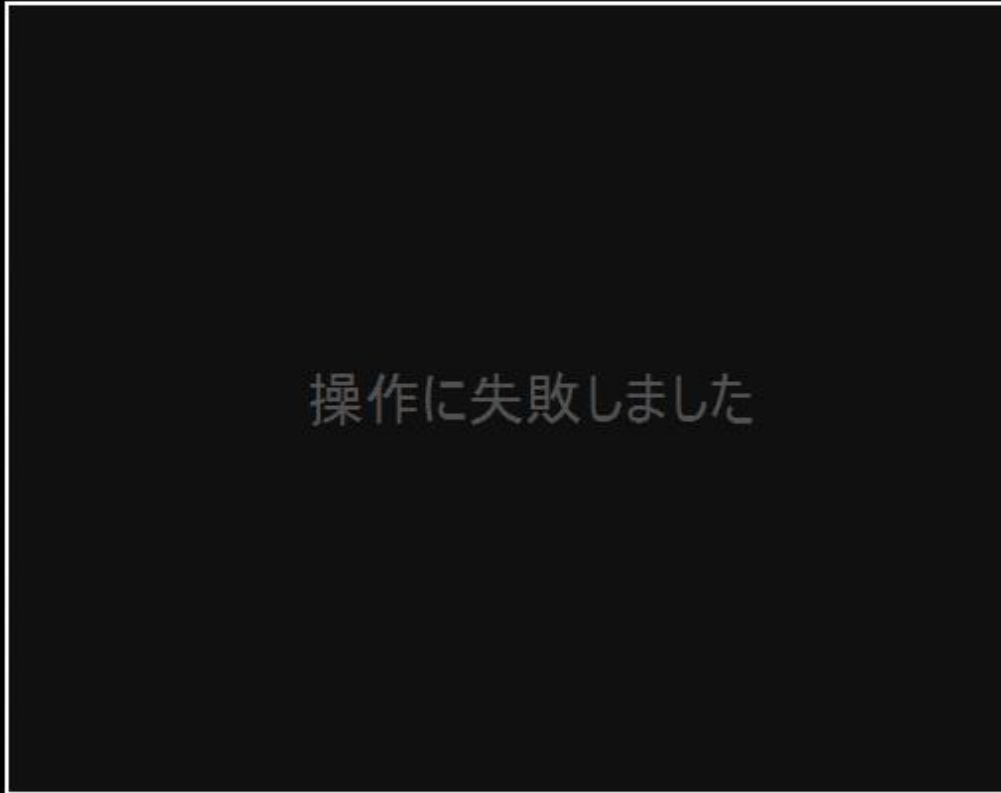


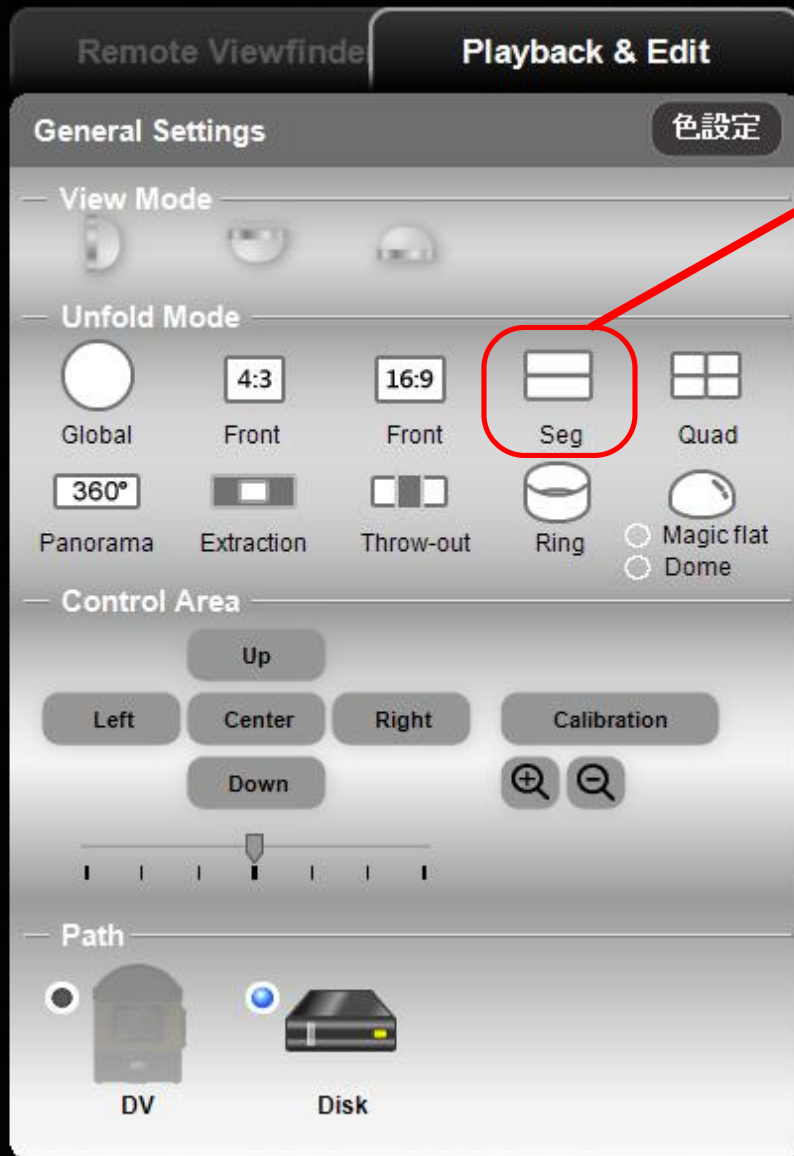
Global

CI

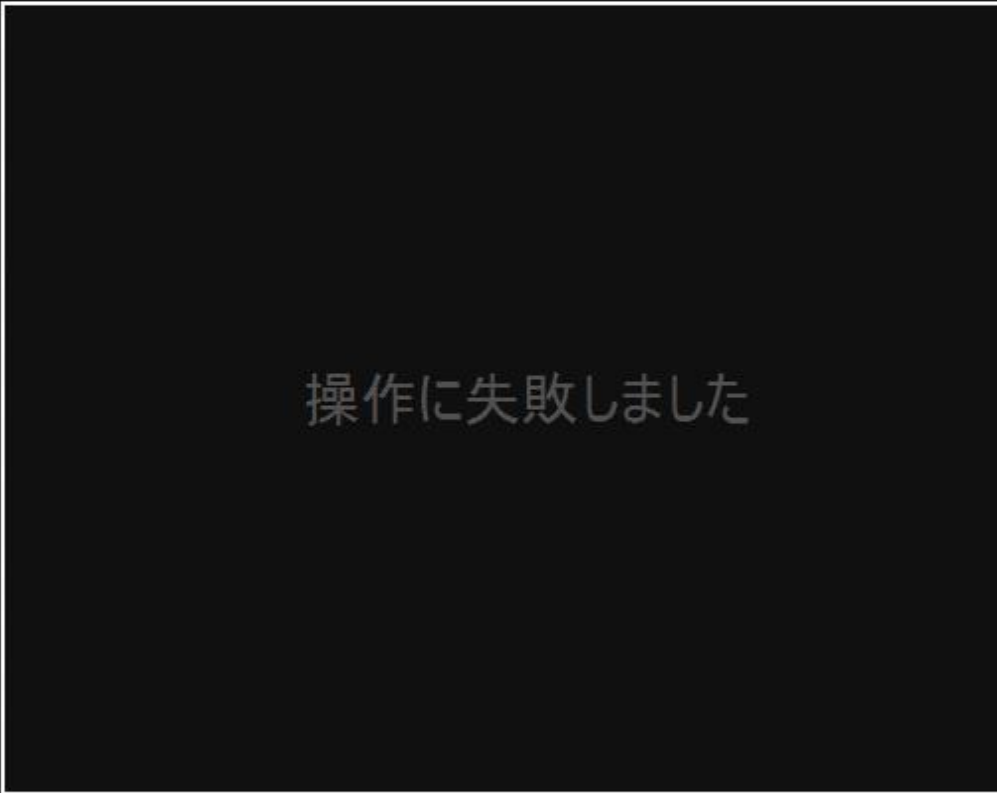


Unfold to 10 types of movie.





Useful for session movie



Segment



Merits & Demerits of high-tech devices

Merits

- Reliability
- Reduction of human costs
- Abundant amount of data

Demerit

- Feeling of monitored (GPS logger)

CONCLUSION

- **Practitioners should measure.**
- **Practitioners should always think out what to select for outcome measure.**
- **Practitioners should always think out how to measure the target.**

CONCLUSION

**New high-tech devices are
continued to develop.
Let's try at daily practice**

REFERENCES

Measurement in behavioral science

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Holman, G., & Koerner, K. (2014). Single case designs in clinical practice: A contemporary CBS perspective on why and how to. *Journal of Contextual Behavioral Science*, 3, 138-147.

Vilardaga, R., Bricker, J. B., & McDonell, M. G. (2014). The promise of mobile technologies and single case designs for the study of individuals in their natural environment. *Journal of Contextual Behavioral Science*, 3, 148-153.