# Research Instruments

# Types of data

**Behavioural:**

what people **do**, e.g.,

"P3 loaded the spreadsheet on their smartphone screen and compared its data values to the printout."

**Attitudinal:**

what people **say**, think, or feel, e.g.,

"I can't read on a computer screen for more than an hour. My eyes get all stingy."

# Behavioural research instruments

## Laboratory experiment

Measurement of user performance is conducted in a tightly controlled laboratory setting.

Great for **precision**.

## Observation

Researchers go into the wild and observe users in their usual environments.

Great for **realism** and **richness**.

# Attitudinal research instruments

## Questionnaire

Short-answer questions or scales that can be administered to many respondents.

Great for **generalizability**.

## Interview

Questions and conversations that can elicit detailed, qualitative data.

Great for **context** and **depth**.

# Questionnaires

# Questionnaires

Administered to large samples to answer clear and concise **attitudinal** questions: what they think, how much they like something, etc.

Can be administered in person or over the phone/Web/mail/e-mail

**Pros:** comparability across a wide range of users

**Cons:** inflexible, do not adapt to individual variations, hard to verify respondent identities

# Writing questions

Questions tend to be brief, concise and rely on rating scales to obtain quantitative data.

- Keep the number of questions low

- Avoid jargon, long sentences, cultural references

- Divide into pages and use a progress tracker

- Invite respondents to consider their answers carefully

# Question types

Checkboxes provide a quick and easy way to select one or more from a set of options.

☐ Undergraduate          ☐ Graduate

Variable quantities or answers can be provided in a short answer box:

Name: [                    ]

Phone: [                    ]

Age: [                    ]

# Question types

If a precise answer is not required or not desirable, ranged responses may be more appropriate:

| Age: | 0-17 | 18-30 | 31-50 | 51-70 | 71+ |
|------|------|-------|-------|-------|-----|

Rating scales are used to elicit information about an attribute along a continuum.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|

| Excellent | Good | Average | Poor | Terrible |
|-----------|------|---------|------|----------|

| Strong accept | Weak accept | Weak reject | Strong reject |
|---------------|-------------|-------------|---------------|

# Question types

A Likert (*LICK-art*) scale is a very common type of rating scale used to assess a series of declarative statements (Likert items).

Rate your agreement with the following statements:

*"Velian is the coolest ever."*

| Strongly disagree | Disagree | Undecided | Agree | Strongly agree |
|---|---|---|---|---|

*"Velian's examples are dorky."*
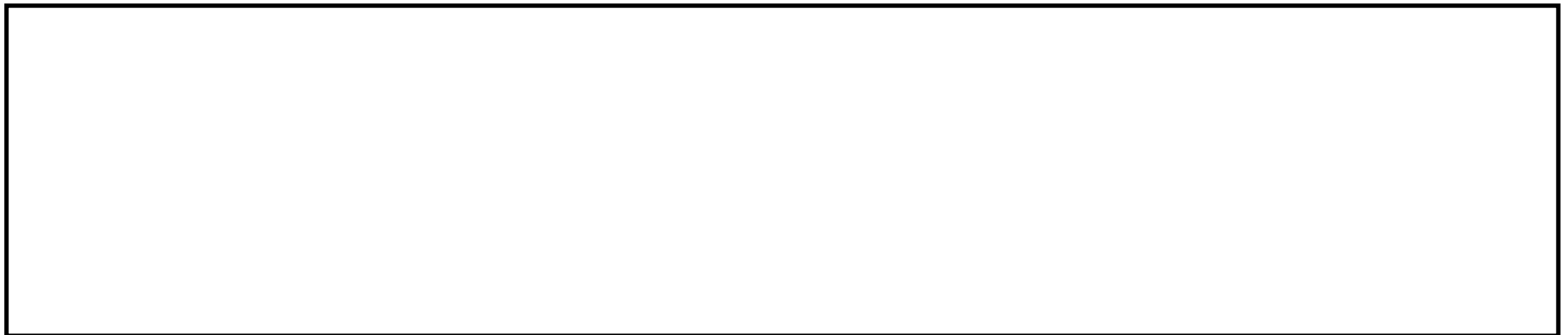
| Strongly disagree | Disagree | Undecided | Agree | Strongly agree |
|---|---|---|---|---|

# Question types

Open-ended questions can be used in questionnaires as they give participants a chance to expand on their answers.

However, they are hard to analyze, so pair them with a quantitative item.

*"Explain why Velian is the coolest ever."*

# Questionnaires

Questionnaires **can** measure:

- Data about users (demographics, traits)

- Prior knowledge (technical expertise)

- Attitudes and experiences (satisfaction, frustration)

Questionnaires **can't** measure:

- Speed, response time, error types, error rates

- How users learn to use interfaces

- Objective experiences

# Evaluate this question:

## **How many iPhones do you own?**

| 0-1 | 1-2 | 2-4 | 4-8 | 8+ |
|-----|-----|-----|-----|-----|

# Evaluate this question:

**The iPad 360 is a revolutionary device with an amazing set of features.**

**Indicate how much you like it on a scale of 1 to 5:**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|

# Evaluate this question:

**Which do you prefer: being able to call people while riding the subway, or having to wait?**

# Evaluate this question:

## **Do you feel tired while driving because your children are noisy?**

| Always | Sometimes | Sometimes, but it's not important | No, I don't | No, they are very quiet |
|---|---|---|---|---|

# Evaluate this question:

**The graduate courses I have taken in this department failed to be helpful in my academic career.**
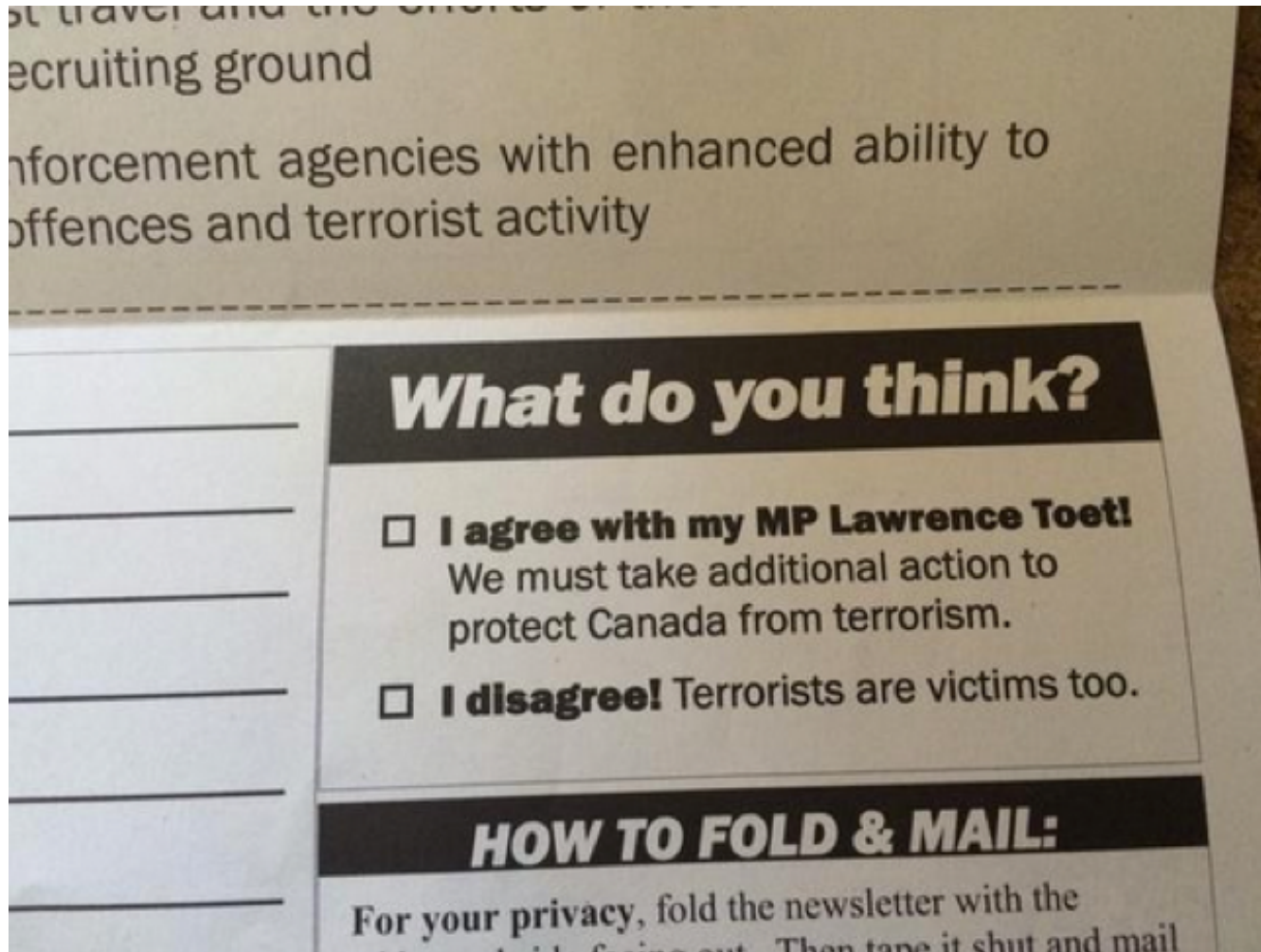
                          1  2  3  4  5  6  7

Strongly disagree  ◯ ◯ ◯ ◯ ◯ ◯ ◯  Strongly agree

# Evaluate this question:

# Evaluate this question:

## What is your gender?

☐ Male

☐ Female

# Gender and sex

If you need to ask about **gender or sex**, do so in an inclusive way:

I identify my gender as:

☐ Man

☐ Woman

☐ Trans*

☐ _____(fill in the blank)

☐ Prefer not to say

I identify my sex as:

☐ Male

☐ Female

☐ Intersex

☐ MtF Female

☐ FtM Male

☐ Prefer not to say

# Evaluate this question:

## I identify my gender as:

☐ _____(fill in the blank)

# Gender and sex

If you need to ask about **gender or sex**, do so in an inclusive way:

I identify my gender as:

- ☐ Man
- ☐ Woman
- ☐ Trans*
- ☐ _____ (fill in the blank)
- ☐ Prefer not to say

I identify my sex as:

- ☐ Male
- ☐ Female
- ☐ Intersex
- ☐ MtF Female
- ☐ FtM Male
- ☐ Prefer not to say

# Bias

# Bias

As researchers, we are always trying to avoid **bias** (skewing data based on how we think it should be).

We need real data that is not affected by our expectations, opinions, or beliefs.

How we phrase and construct our questions is crucial to data integrity.

# Confirmation bias

Avoid asking questions that signal to the participant what you would like the response to be:

*"How much do you like the iPad 360?"*

Prior judgment or consensus:

*"Some people think cola drinks are bad for you. What do you think?"*

Your own evaluation:

*"That was mean!"*

# Unanswerable question bias

Avoid asking about information that the participant wouldn't know or be able to give you reliably.

**Highly specific:**

*"What time did you have dinner 2 weeks ago?"*

**Foresight:**

*"How do you think you'd feel after using this for a year?"*

**Other people's experiences:**

*"What did your daughter think was the best game?"*

# Social acceptance bias

Be careful asking about socially desirable or undesirable topics. Participants are likely to skew their responses and you should take them with a grain of salt.

*"When was the last time you flossed?"*

*"Have you ever committed a crime?"*

In **central tendency bias**, participants are reluctant to give extreme answers.

In **acquiescence bias**, participants tend to agree with statements as presented.

# Moderator bias

Act professionally and politely, communicate your **open-mindedness** and desire for **frank responses**.

Avoid being **overly familiar**.

The participant may try to **please you** with their answers (make you laugh, make you like them, tell you what you want to hear) rather than being honest.

If a participant is having trouble responding, **let it go**.

Participants pushed to answer may make something up or take a guess, which leads to unreliable data.

# Interviews

# Interviews

Interviews provide detailed **attitudinal** data about individual participants, their context, and the challenges they encounter in their lives.

**Pros:** flexible and adaptable, rich qualitative data

**Cons:** Expensive, impossible to directly compare respondents, hard to generalize

**Types:** structured, semi-structured, unstructured

# Interview questions

Ask questions that elicit rich but accurate answers.

Avoid **yes/no** questions:

   *Do you underline text?*

Ask **open-ended** questions:

   *Tell me about how you underline text.*

Ask questions about specific **recent** occurrences:

   *Tell me about the last time you underlined text.*

# The interviewer's catchphrase

"Say more about that."

# Interview script

**Intro:** introduce yourself, explain goals, outline ethics, ask permission to record, present consent form.

**Warm-up:** first questions should be easy and non-threatening.

**Main body:** present questions in a logical order, follow-up on tangents but keep interviewee on topic.

**Cool-off period:** include a few easy questions to defuse tension at the end.

**Wrap-up/Closure:** thank interviewee, signal the end of the interview, stop recording, offer compensation.

# Interviewer challenges

- Build trust

- Follow the script

- Allow digression

- Avoid repetition

- Keep track of time

- Capture the interview

- Capture the interview another way

- Multitask: talk, listen, filter, take notes

- Avoid bias

# Cautions

Users remember:

- The **lowest** points, when the system frustrated or failed them

- The **highest** points, when things went exceptionally well and smoothly

- The **most recent** points, which are still fresh in their memory

Of these, the lowest points are the most salient and affect the user the most. [Baumeister 2001]

# Behavioural research instruments

# Observation

Observation aims to preserve context and environmental factors at the expense of performance fidelity.

**Direct:**

Observe users at the moment of accomplishing a task or using a technology.

**Indirect:**

Analyze documents or records of a past activity

# Indirect observation

**Diaries:**

Instruct your participants to fill out a short form at regular intervals or anytime they complete a particular task.

**Usage logs:**

Technology instrumented to log usage metrics (clicks, pageviews) can hold clues to user behaviour.

**Artifacts:**

Documentation, prototypes, or records from past activities.

# Naturalistic observation

| CONTEXT | CONTROL |
|---|---|

"Fly on the wall": **no control** over the activity observed

**No access** to thoughts or reasons

Observation changes the data (**Hawthorne effect**)

Naturalistic observation can be:

- **overt** (participants know they're being observed)

- **covert** (participants are unaware of the observer)

# Contextual inquiry

| CONTEXT | CONTROL |
|---------|---------|

Researcher **asks questions** about activities or thought processes while observing
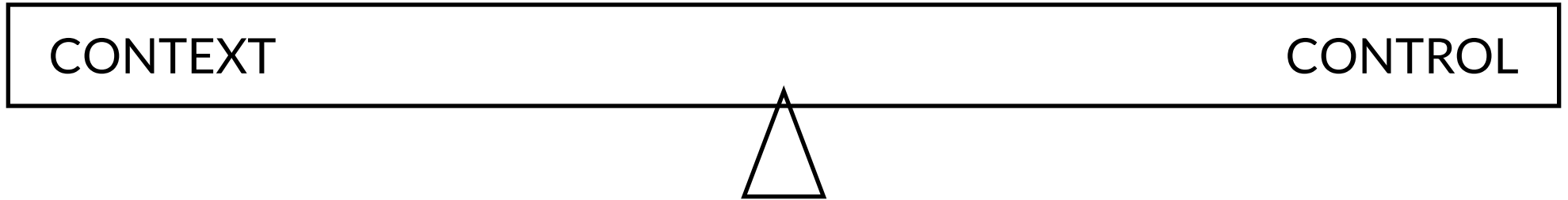
Provides better **insight** into the task being performed

Performance **degrades** and cannot be accurately measured

Participant is **distracted** answering questions

# Participatory observation
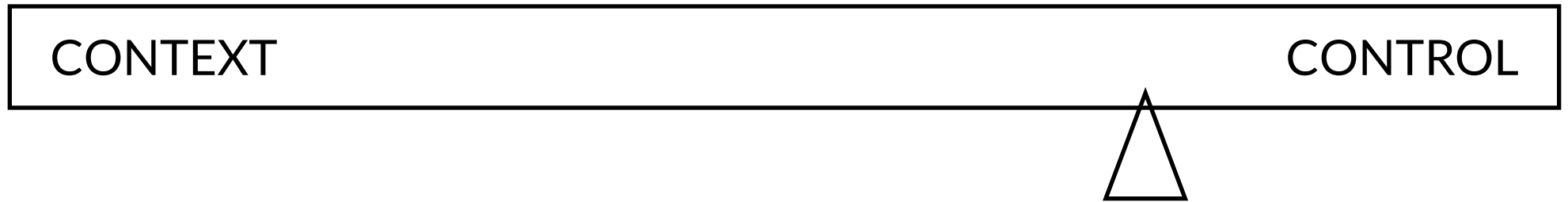
| CONTEXT | CONTROL |
|---------|---------|

Researcher **performs** the task alongside the participant

**Immersion** helps understand the task in greater detail

Researcher is **not a typical participant**, lacking background, experience, and training

Researcher's **objectivity** is challenged

# Scripted task observation

| CONTEXT | CONTROL |
|---------|---------|

Researcher selects **a list of tasks** that the participant would typically perform in their role

Participant performs these tasks, typically in **simulated** scenarios

**Infrequent but important** tasks can be observed

Greatly reduces the **ecological validity** of the data: is this how things would have happened "for real"?

# Laboratory experiment (observation)

| CONTEXT | CONTROL |

Precise **performance data** about highly scripted tasks

Isolate **one factor** or variable

All confounding factors are **controlled for** (environment, setup, hardware, task)

No relation to how task is performed in **the real world** or to the usual environments users work in

# Field observation

# Direct observation in the field

Things to focus on when observing:

**Person:**

- Who (broadly) is using the technology?
- What is their mental and emotional state?

**Place:**

- What are their surroundings like?
- Are they affecting their behaviour?

**Thing:**

- What are they doing?
- Are they having issues?

# What are some issues with covert observation?

# Covert observation and ethics

Covert observation can be done ethically if you:

- Do not manipulate the environment or task in any way

- Observe in a public place, not where people have a reasonable expectation of privacy

- Record no identifying information, including photographs or videos

- Focus on behaviours and tasks, not individuals.

# What is the best instrument for answering the following questions:

How far do users drive to the commuter station?

What steps do they go through to plan a route?

Do they prefer a touchscreen or voice commands?

# Acknowledgments & References

This course has been developed with iterations by:

Velian Pandeliev, Ilona Posner, Katie Seaborn, Olivier St-Cyr

This course uses materials from the following books:

- *Interaction Design* (4 ed.) by Rogers, Sharp & Preece
- *Don't Make Me Think (revisited)* by Steve Krug
- *The Design of Everyday Things* by Don Norman
- *100 Things Every Designer Needs To Know About People* by Susan Weinschenk