



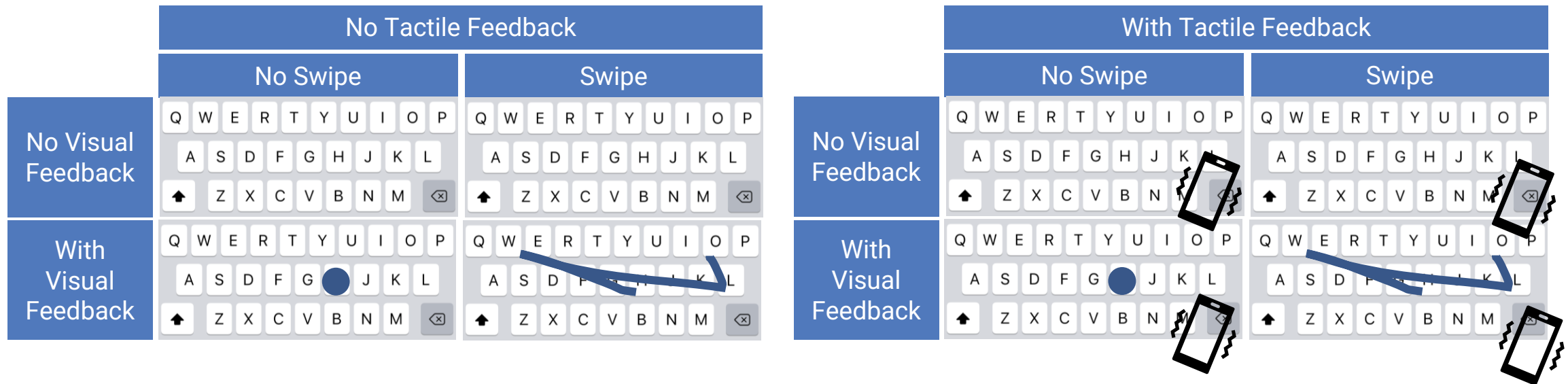
How to Conduct a User Study

Human-Computer Interaction Exercise

Image: Frankfurt University of Applied Sciences

Remember Your Method

- **How do you want to answer the research question?**
 - › **Why** is it the „best“ method to answer the research question?
- Understand **how your data must be collected**
- Planning needs:
 - › **Study Design** (the important thing)
 - › **Stimuli/System/Prototype Creation** (based on the factors changed)
 - › **Apparatus** (the implemented testing system)
 - › **Tasks** (hopefully a standardized one)
 - › **Procedure** (the narrative of your plan)
 - › **Participants** (this part can only be finished when the study is over)
 - › **Data Analyzes** (filtering, transcription, etc.)



Recap: Swipe × Visual Feedback × Tactile Feedback

Quantitative or Qualitative?

Exercise: Plan your Study

- Think about your independent and dependent variables
- If you have some, use our tool to find your study plan
 - › <https://hci-studies.org/study-design-planner/>
 - › Enter your IVs and DVs
 - › Adapt your number of conditions if necessary
- What is your plan? How many participants do you need at least?



Balanced Latin Square Generator

A [Latin square](#) is "an $n \times n$ array filled with n different symbols, each occurring exactly once in each row and exactly once in each column". Latin squares are useful to reduce order-effects when designing empirical experiments with multiple conditions. For example, in an experimental design comparing a prototype A vs B vs C, if all participants test A first, then B, then C, we might observe poor results for C because of participants' fatigue and not because C is worse than A or B. Instead, we can order conditions based on a Latin square like this:

Number of conditions / Square size

Subject	1	2	3	4	5	6	7	8
#1	None-None	None-None	None-Tactil	None-Tactil	Swipe-None	Swipe-None	Swipe-Tactil	Swipe-Tactil
#2	None-None-Visual	Swipe-None-Visual	None-None-None	Swipe-Tactile-None	None-Tactile-Visual	None-Tactile-None	Swipe-Tactile-Visual	Swipe-None-None
#3	Swipe-None-Visual	Swipe-Tactile-None	None-None-Visual	None-Tactile-None	None-None-None	Swipe-None-None	None-Tactile-Visual	Swipe-Tactile-Visual
#4	Swipe-Tactile-None	None-Tactile-None	Swipe-None-Visual	Swipe-None-None	None-None-Visual	Swipe-Tactile-Visual	None-None-None	None-Tactile-Visual
#5	None-Tactile-None	Swipe-None-None	Swipe-Tactile-None	Swipe-Tactile-Visual	Swipe-None-Visual	None-Tactile-Visual	None-None-Visual	None-None-None
#6	Swipe-None-None	Swipe-Tactile-Visual	None-Tactile-None	None-Tactile-Visual	Swipe-Tactile-None	None-None-None	Swipe-None-Visual	None-None-Visual
#7	Swipe-Tactile-Visual	None-Tactile-Visual	Swipe-None-None	None-None-None	None-Tactile-None	None-None-Visual	Swipe-Tactile-None	Swipe-None-Visual
#8	None-Tactile-Visual	None-None-None	Swipe-Tactile-Visual	None-None-Visual	Swipe-None-None	Swipe-None-Visual	None-Tactile-None	Swipe-Tactile-None

Note: You can quickly insert your conditions using copy-paste (separated by lines) | [Download .csv](#)

A condition will precede another exactly once (or twice, if the number of conditions is odd). This page uses the method that James V. Bradley proposed and mathematically proved [1].

Bradley, J. V. (1958). Complete counterbalancing of immediate sequential effects in a Latin square design. *Journal of the American Statistical Association*, 53(282), 525-528.

[Source code at github](#), Original [tool](#) and source code by Damien Masson <https://cs.uwaterloo.ca/~dmasson/>

How to Conduct a User Study

Prof. Dr. Valentin Schwind

4

Exercise: Plan only the order (optional)

- **Think about your conditions**
- If you have some, use our tool to **find your condition order**
 - › <https://hci-studies.org/balanced-latin-square>
 - › Just enter your condition
 - › Adapt your number of conditions if necessary
- What is your plan? How many participants do you need at least?
 - › Odd numbers need 2 latin squares
- Save the plan
 - › Download the CSV



Balanced Latin Square Generator

A [Latin square](#) is "an $n \times n$ array filled with n different symbols, each occurring exactly once in each row and exactly once in each column". Latin squares are useful to reduce order-effects when designing empirical experiments with multiple conditions. For example, in an experimental design comparing a prototype A vs B vs C, if all participants test A first, then B, then C, we might observe poor results for C because of participants' fatigue and not because C is worse than A or B. Instead, we can order conditions based on a Latin square like this:

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#3	Swipe-None-Visual	Swipe-Tactile-None	None-None-Visual	None-Tactile-None	None-None-None	Swipe-None-None	None-Tactile-Visual	Swipe-Tactile-Visual
#4	Swipe-Tactile-None	None-Tactile-None	Swipe-None-Visual	Swipe-None-None	None-None-Visual	Swipe-Tactile-Visual	None-None-None	None-Tactile-Visual
#5	None-Tactile-None	Swipe-None-None	Swipe-Tactile-None	Swipe-Tactile-Visual	Swipe-None-Visual	None-Tactile-Visual	None-None-Visual	None-None-None
#6	Swipe-None-None	Swipe-Tactile-Visual	None-Tactile-None	None-Tactile-Visual	Swipe-Tactile-None	None-None-None	Swipe-None-Visual	None-None-Visual
#7	Swipe-Tactile-Visual	None-Tactile-Visual	Swipe-None-None	None-None-None	None-Tactile-None	None-None-Visual	Swipe-Tactile-None	Swipe-None-Visual
#8	None-Tactile-Visual	None-None-None	Swipe-Tactile-Visual	None-None-Visual	Swipe-None-None	Swipe-None-Visual	None-Tactile-None	Swipe-Tactile-None

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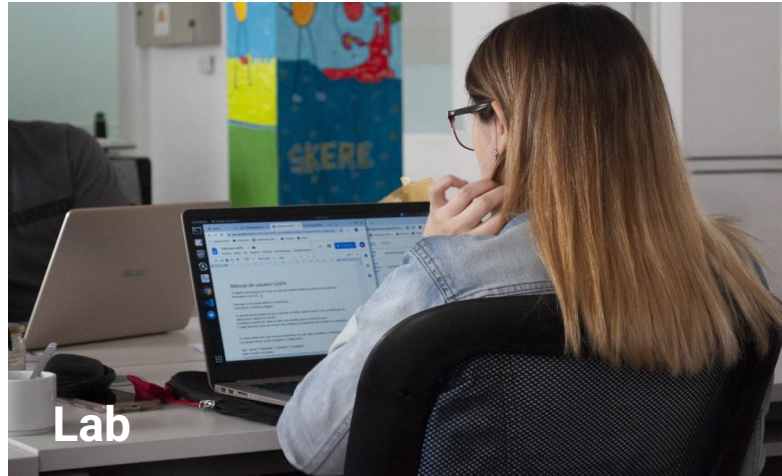
Bradley, J. V. (1958). Complete counterbalancing of immediate sequential effects in a Latin square design. *Journal of the American Statistical Association*, 53(282), 525-528.

[Source code at github](#), Original [tool](#) and source code by Damien Masson <https://cs.uwaterloo.ca/~dmasson/>

More about Planning

- Latin Square Assignments:
https://cs.uwaterloo.ca/~dmasson/tools/latin_square/
- Block Plan (Permutation/Random) Assignments :
<http://www.jerrydallal.com/random/randomize.htm>
- More information on how to assign subjects:
<https://www.scribbr.com/methodology/experimental-design/>

The Location



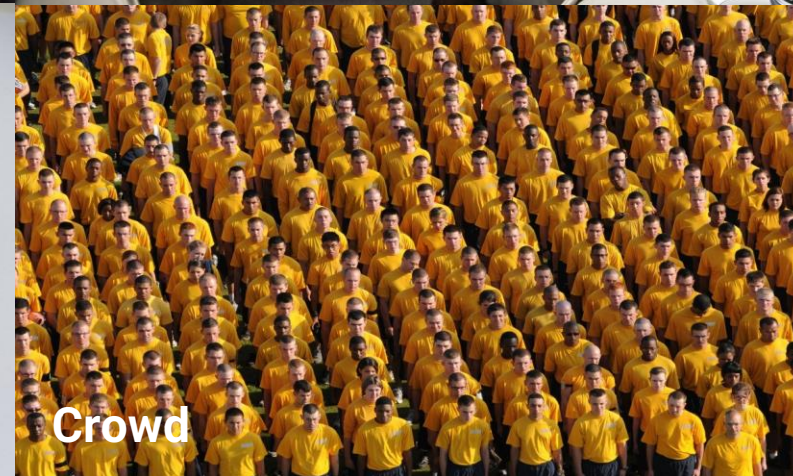
Lab



In Situ



Remote



Crowd

Images from: <https://pxhere.com> ID: 1599048, 718703, 802607, 700764

The Preparations

- When **we have a study design and a location**, we can prepare the study...
- There are 3 preparation phases:
 1. **Material (and location) check**: final implementations, final setup, make sure that you have everything to run the experiment or survey, ...
 2. **Pilot**: test your apparatus with non-involved users (your supervisors, exercise members), final parameters, ...
 3. **Recruitment phase**: organization of participants, booking, invitation letter, ...

Image from <https://pxhere.com/de/photo/652278>



1. Material Check



- **Check everything. Make things fix and safe. Be aware:** after starting your experiment once, nothing can be changed anymore.
 - › Ensure that the material of your study, system, or device are **functioning properly**
 - › Finish your interview questions, questionnaires, material...
- Make sure the **location** is **safe** and **available**
- **Last stakeholder meeting**
 - › Discuss fallback scenarios when things/users do random stuff
 - › Discuss when the experimenter is supposed to intervene when the users are in trouble
 - › Discuss inclusion/exclusion criteria for your participants with respect to your system/test/study

2. Pilot



- The „**dress rehearsal**“ (dt. „Generalprobe“) of your study and carried out before large-scale research
 - › A critical insight to the study design, recruitment, and sample size of participants
 - › You can assess the statistical power and number of your participants needed
 - › G-Power <https://www.psychologie.hhu.de/arbeitsgruppen/allgemeine-psychologie-und-arbeitspsychologie/gpower>
 - › **Test everything (Intro, Experiment, Debriefing)** and assume that you have a real participant
- After the pilot (and the feedback) you can adjust parameters
 - › e.g., volume sound, length of the trials, parameters of your system
- Pilot participants cannot participate in the study

3. Recruitment



- Find your **participants**
 - › course forum, advertising, mailing lists, social networks, crowdfunding (e.g., prolific.co)...
- Find **appointments**
 - › Book the Lab/Co-Working-Space/Printer
 - › <https://hci-studies.org/lab-booking-calendar/>
 - › Password + PIN on demand (write us!)
 - › If not the lab:
 - › <https://doodle.de> / <https://terminplaner.dfn.de>
- Write your **invitation letter**

Finding Participants

Booking a user study or development time? ☒ development ☐ user study

Drag your research project into a free slot:

Schwind Sehrt Resch Malech Voeltz Schneider MA Rafati MA Weyers
MA Amir Laborführung 23 - MR Agility Ladder Projekt Inf: AI in VR MA Röll

MR Lab (PC1) MR Lab (PC2) 3D-Printer (SR)

< > today Monday, Dec 4, 2023 - Friday, Dec 8, 2023 month week day

	Mon 12/4	Tue 12/5	Wed 12/6	Thu 12/7	Fri 12/8
09:00					
10:00		10:00 - 18:00 Sehrt		10:00 - 18:00 Sehrt	10:00 - 18:00 Projekt Inf: AI in VR
11:00					
12:00			12:00 - 18:00 Projekt Inf: AI in VR		
13:00					
14:00					
15:00					
16:00					
17:00					
18:00					
19:00					
20:00					
21:00					

The Invitation Letter



Hi,
we are Tim, Malte, Jan und Isabela and we would like to invite you to participate in our **research study on integration of EMG Bio-Feedback in Virtual Reality (VR)**!

WHAT?

Our study consists in measuring the muscle response using EMG electrodes attached to the arm. The signals are used as input for a VR mini game to test different biofeedback methods (audio, visual and tactile).

HOW LONG?

The study duration is approximately **40 minutes for each participant (depending on your skill level 😊)**.

WHERE?

The study will take place in the **House of Science and Transfer (HoST) building, second floor. However, you will be picked up at the entrance.**

Address: Hungener Str. 6, 60389 Frankfurt am Main

Google-Maps: <https://goo.gl/maps/wfBUJr6myFHGqyRt7>

WHEN?

One slot between **27.07 and 06.08 between 10 AM and 6 PM** - however, you can pick your own appointment in the Doodle poll provided below.

HOW TO REGISTER?

Please register in Doodle: <https://doodle.com/meeting/participate/id/eElmGNNd>

Please book only one appointment per person. Please try to not leave any gaps, if possible - book appointments close to others.

Further details about the event will be sent to you one week before the first appointment.

BIG REWARD!!!

As reward you will get **1 CP for the HMI lecture!!!!11eleven**

If you have any further questions, please reply on this post!
Thank you very much! And see you in our study!

The Study



- There are 3 study phases:
 1. **Introduction**: Your participants are here! Give them
 1. An explanation of the study
 2. Their informed consent
 3. Their demographic questionnaire
 2. **Experiment/Survey**: Main part of your data collection...
 3. **Debriefing**: Final question and answers, end of all records, participation confirmation...



Image from <https://pxhere.com/de/photo/652278>

1. Introduction



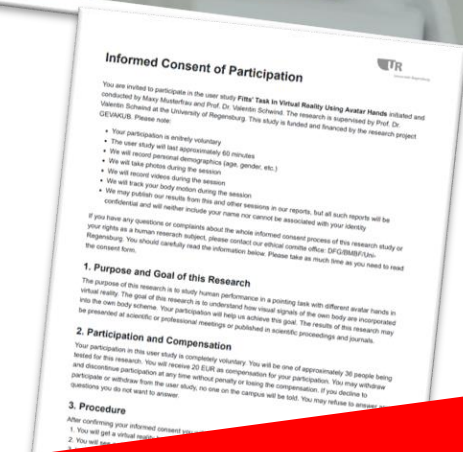
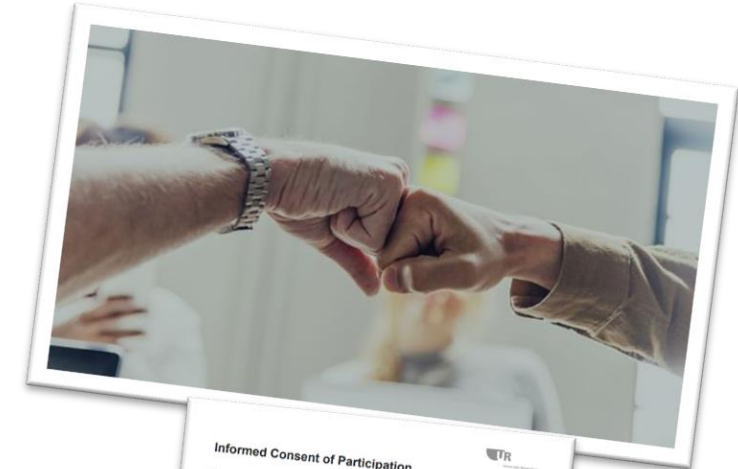
1. Welcome the participant

- › „Only happy participants provide happy data“
- › In the lab: Inform about house rules, hygiene rules,...
- › Explain the purpose of the study

2. Give your subject the informed consent of participation

3. Give your subject the demographics questionnaire ...

- › See Demographics: <https://hci-studies.org/methods-and-measures/>
- › Ask for the confounds...
- › Explain your study again, if necessary...



INFORMED WHAT???

Informed Consent



- A **principle of science in ethics and law**, that every subject (the user) must have sufficient information and understanding before making decisions about participating in a study
- Valid informed consent in medicine has three components:
 - › **Disclosure** requires the researcher to supply each prospective subject with the information necessary to make an autonomous decision and also to ensure that the subject adequately understands the information provided
 - › **Capacity** pertains to the ability of the subject to both understand the information (signature)
 - › **Voluntariness** refers to the subject's right to freely exercise his/her decision

INFORMED WHAT???

Informed Consent



■ Use the informed consent generator

- <https://hci-studies.org/informed-consent-generator/>
- Fill in all fields
- Click on generate
- Read the result
- Check and adapt if necessary
- Proceed...

Demographics



- **Gender:** male, female, other, do not want to specify
- **Nationality:** Afghanistan ... Zimbabwe → [Click here](#), if you like to have all countries
- **Academic degree:** None, Primary, Secondary, High school, Vocational, Bachelor, Master, Doctoral
- **Occupation:** Management, Natural Sciences, Engineering, Health, Law & Order, Clerical, Health, Spiritual, Humanities, Services & Sales, Agriculture & Food, Craft, Military, Others
- **Age:** Numbers (not groups!)
- **What could be relevant for your research? Discuss your covariates...**

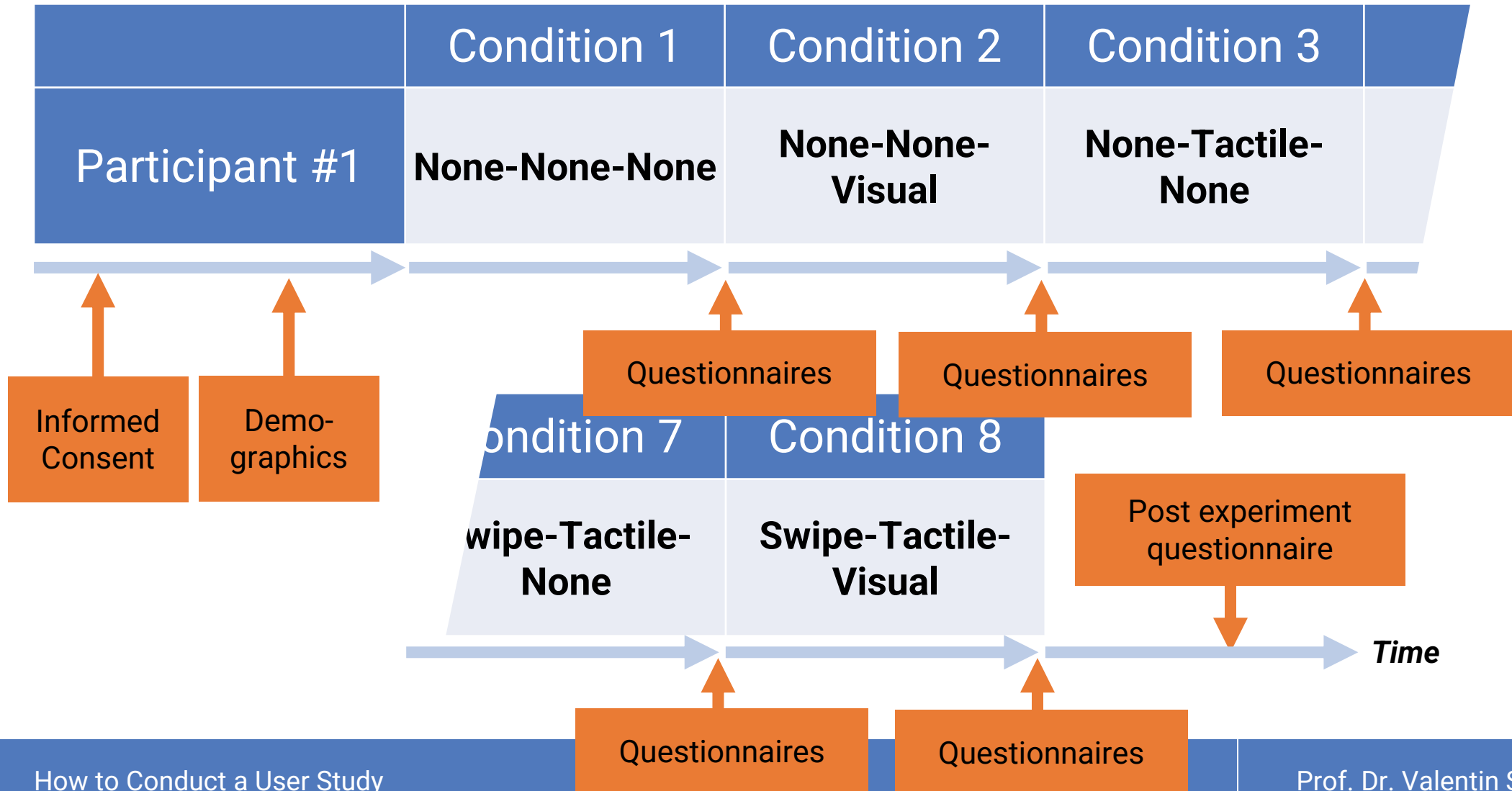
2. Experiment/Survey



	Condition 1	Condition 2	Condition 3	Condition 4	Condition 5	Condition 6	Condition 7	Condition 8
Participant #1	None-None-None	None-None-Visual	None-Tactile-None	None-Tactile-Visual	Swipe-None-None	Swipe-None-Visual	Swipe-Tactile-None	Swipe-Tactile-Visual
Participant #2	None-None-Visual	None-Tactile-Visual	None-None-None	Swipe-None-Visual	None-Tactile-None	Swipe-Tactile-Visual	Swipe-None-None	Swipe-Tactile-None
Participant #3	None-Tactile-Visual	Swipe-None-Visual	None-None-Visual	Swipe-Tactile-Visual	None-None-None	Swipe-Tactile-None	None-Tactile-None	Swipe-None-None
Participant #4	None-Tactile-None	None-Tactile-Visual	None-Tactile-Visual	Swipe-Tactile-None	None-None-Visual	Swipe-None-None	None-None-None	None-Tactile-None
Participant #5	None-Tactile-Visual	Swipe-Tactile-None	Swipe-None-Visual	Swipe-None-None	None-Tactile-Visual	None-Tactile-None	None-None-Visual	None-None-None
Participant #6	Swipe-Tactile-None	Swipe-None-None	Swipe-Tactile-Visual	None-Tactile-None	Swipe-None-Visual	None-None-None	None-Tactile-Visual	None-None-Visual
Participant #7	Swipe-None-None	None-Tactile-None	Swipe-Tactile-None	None-None-None	Swipe-Tactile-Visual	None-None-Visual	Swipe-None-Visual	None-Tactile-Visual
Participant #8	None-Tactile-None	None-None-None	Swipe-None-None	None-None-Visual	Swipe-Tactile-None	None-Tactile-Visual	Swipe-Tactile-Visual	Swipe-None-Visual

Repeat X-times

Procedure



Custom Questionnaires



- Questionnaires are **subjective measures** to get information about attitudes of people. They provide **important qualitative and quantitative data**:
- **Quantitative** (“closed-ended”)
 - › **Dichotomous Items**: Yes/No, True/False, Agree/Disagree ☑
 - › **Rank Order Items**: e.g., sort from best to worst, 📄
 - › **Rating Items**:
 - › Semantic scales
 - › Visual/Numeric rating scales
 - › Likert scales
- **Qualitative** (“open-ended”)
 - › Open-ended responses („What do you see as more positive about the device?”)

Custom Questionnaires



- Questionnaires are **subjective measures** to get information about attitudes of people. They provide **important qualitative and quantitative data**:
- **Quantitative** (“closed-ended”)
 - › **Dichotomous Items**: Yes/No, True/False, Agree/Disagree ☑
 - › **Rank Order Items**: e.g., sort from best to worst, 📄
 - › **Rating Items**:
 - › **Semantic scales**
 - › **Visual/Numeric rating scales**
 - › **Likert scales**
- **Qualitative** (“open-ended”)
 - › Open-ended responses („What do you see as more positive about the device?”)

Not recommended for
statistical evaluation

Recommended for
statistical evaluation

Dichotomous Items



Please check, if yes

I would be concerned if the device would turn on the camera at any time

☐

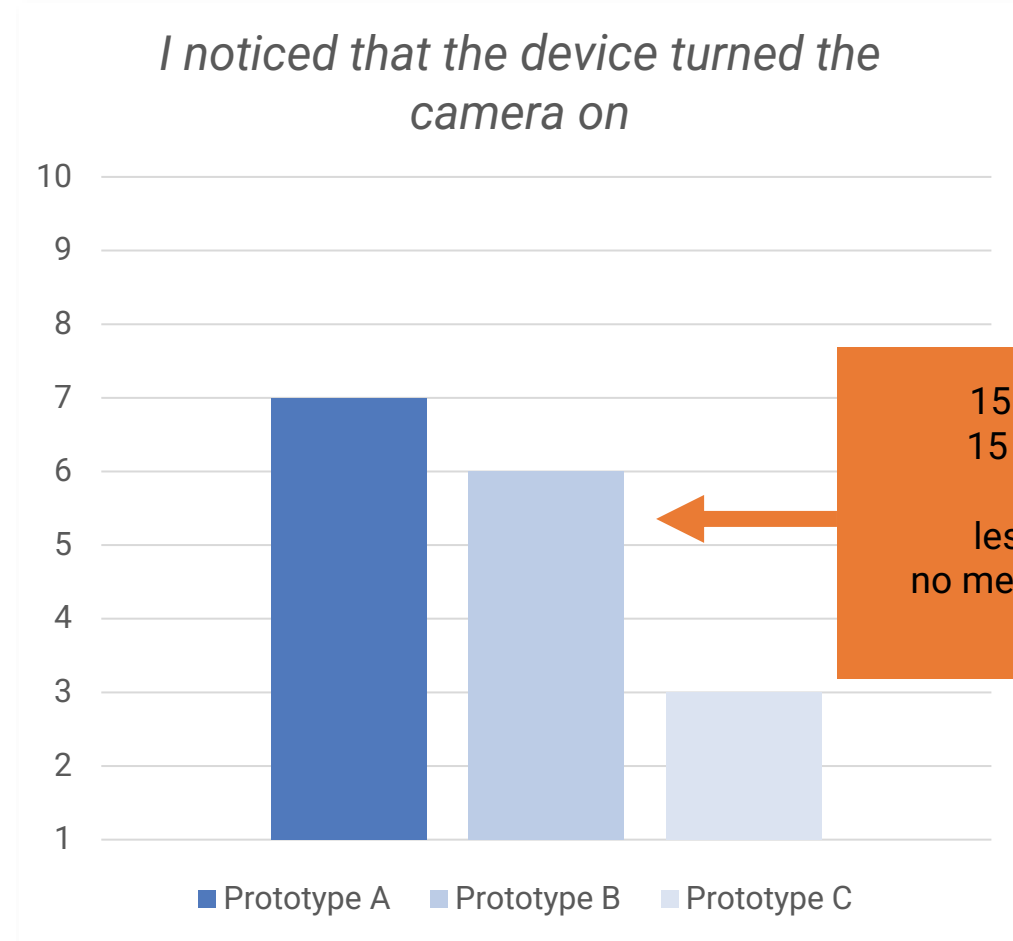
I noticed that the device turned the camera on

☐

I would benefit from more training to learn how to use the device

☐

I am skilled enough to use the device

☐

15 participants =
15 data samples:

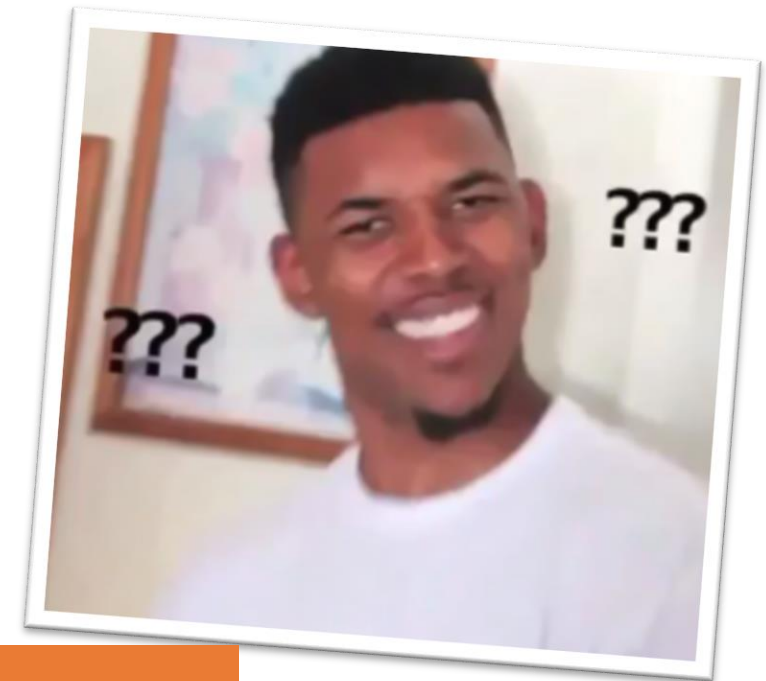
less meaningful,
no measure of variance,
low validity.

Rank Order Items



Please rank the following aspects of your mobile phone in order of importance to you, with 1 being the most important and 5 being the least important

1. Battery Life	↓
2. Camera Quality	↑↓
3. Storage Capacity	↑↓
4. Screen Size	↑↓
5. Processor Speed	↑

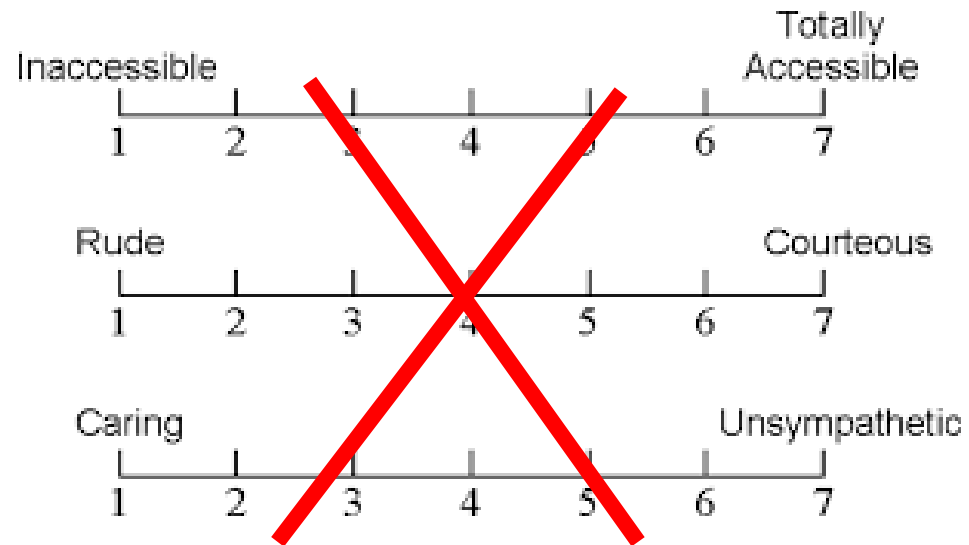


Too many possibilities of sorting.
No way to evaluate that.

Semantic Differentials



Please evaluate the characteristics of the device by placing a mark on the line closest to your experience:



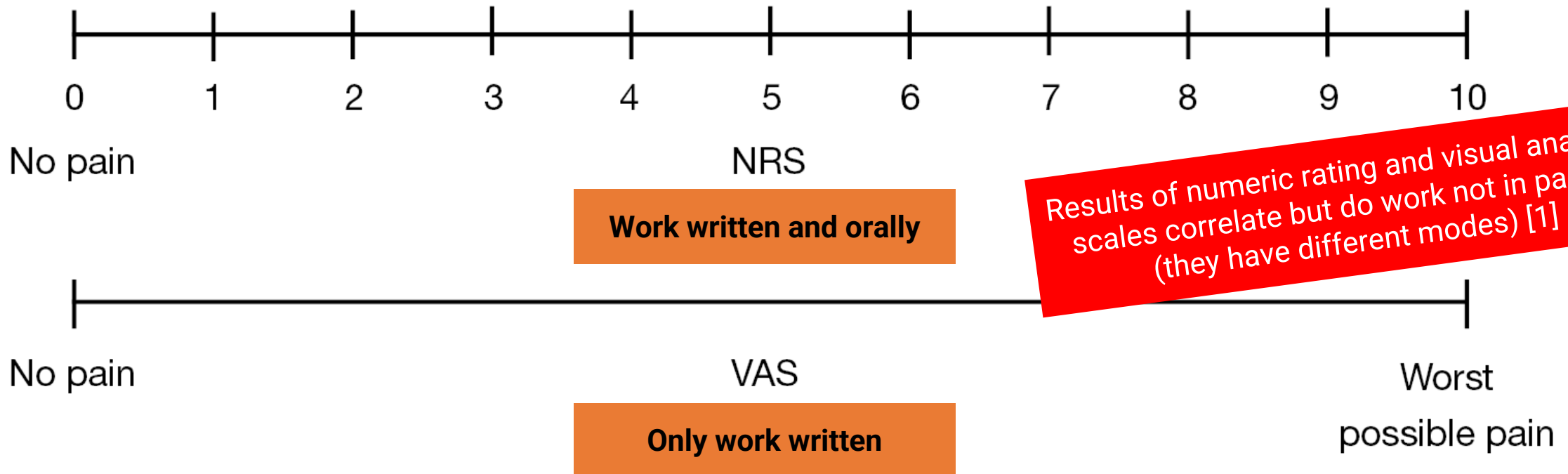
Don't do it by yourself

uncaring? cruel?

NRS/VAS Items



Numeric rating scales (NRS) and **visual analogue scales (VAS)**, example: pain



Bielewicz, J., Daniluk, B., & Kamieniak, P. (2022). VAS and NRS, same or different? Are visual analog scale values and numerical rating scale equally viable tools for assessing patients after microdiscectomy?. Pain Research and Management, 2022.

Likert Scale Items



- Psychologists found that the least biased way to **obtain a subjective measure** on a rating scale is **providing a set of statements** based on **response anchors**
- The most famous rating scales is the **Likert scale** [1]

If an app could turn on the camera at any time, I would be:

[] Not at all concerned, [] Slightly concerned, [] Somewhat concerned, [] Moderately concerned, [] Extremely concerned

- ...or better:

To which extend to you agree with the statement that you would be concerned if an app could turn on the camera at any time:

[] I strongly disagree, [] I disagree, [] Neither agree nor disagree, [] I agree, [] I strongly agree

- ...the more points you have, the easier to evaluate:
 - **We prefer 7-point Likert scales asking for extent and agreement!**

Likert, Rensis (1932). "A Technique for the Measurement of Attitudes". Archives of Psychology. 140: 1–55.

Likert Scale Items



To which extent do you agree or disagree with the statement:	I completely disagree	I disagree	I somewhat disagree	Neither agree nor disagree	I somewhat agree	I agree	I completely agree
<i>I would be concerned if the device would turn on the camera at any time</i>	☐	☐	☐	☐	☐	☐	☐
<i>I noticed that the device turned the camera on</i>	☐	☐	☐	☐	☐	☐	☐
<i>I would benefit from more training to learn how to use the device</i>	☐	☐	☐	☐	☐	☐	☐
<i>I am skilled enough to use the device</i>	☐	☐	☐	☐	☐	☐	☐

Likert Scale Items



To which extent do you agree or disagree with the statement:

I completely disagree I disagree I somewhat disagree Neither agree nor disagree I somewhat agree I agree I completely agree

I would be concerned if the device would turn on the camera at any time

☐☐☐☐☐☐☐

Response anchors

I noticed that the device turned the camera on

☐☐☐☐☐☐☐

I would benefit from more training to learn how to use the device

☐☐☐☐☐☐☐

I am skilled enough to use the device

☐☐☐☐☐☐☐

Likert Scale Items



To which extent do you agree or disagree with the statement:

I completely disagree I disagree I somewhat disagree Neither agree nor disagree I somewhat agree I agree I completely agree

I would be concerned if the device would turn on the camera at any time

1	<	2	<	3	<	4	<	5	<	6	<	7
---	---	---	---	---	---	---	---	---	---	---	---	---

I noticed that the device turned the camera on

☐

The scale has an order and every anchor can have a numeric value!

☐

I would benefit from more training to learn how to use the device

☐
☐
☐
☐
☐
☐
☐

I am skilled enough to use the device

☐
☐
☐
☐
☐
☐
☐

Likert Scale Items



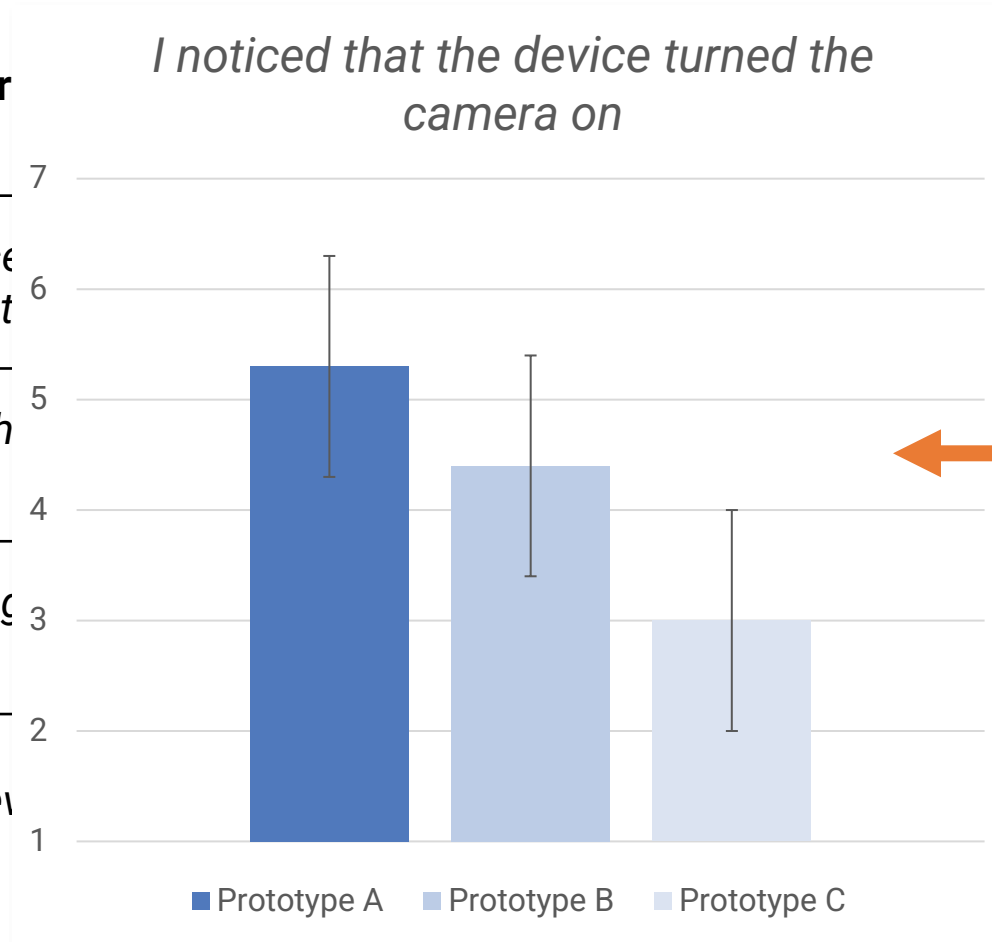
To which extent do you agree or disagree with the statement:

I would be concerned if the device would turn on the camera at any time

I noticed that the device turned the camera on

I would benefit from more training to learn how to use the device

I am skilled enough to use the device



	I somewhat agree	I agree	I completely agree
<i>I would be concerned if the device would turn on the camera at any time</i>	☐	☐	☐
<i>I noticed that the device turned the camera on</i>	☐	☐	☐
<i>I would benefit from more training to learn how to use the device</i>	☐	☐	☐
<i>I am skilled enough to use the device</i>	☐	☐	☐

Thus, You can easily compare and evaluate them!

Likert Scale Items



To which extent do you agree or disagree with the statement:	I completely disagree	I disagree	I somewhat disagree	Neither agree nor disagree	I somewhat agree	I agree	I completely agree
<i>I am satisfied with using the product.</i>	☐	☐	☐	☐	☐	☐	☐
<i>I enjoyed using the product.</i>	☐	☐	☐	☐	☐	☐	☐

Concept: **Agreement in Satisfaction**

Concept: **Agreement in Enjoyment**

You always need a concept
(here: agreement in something)

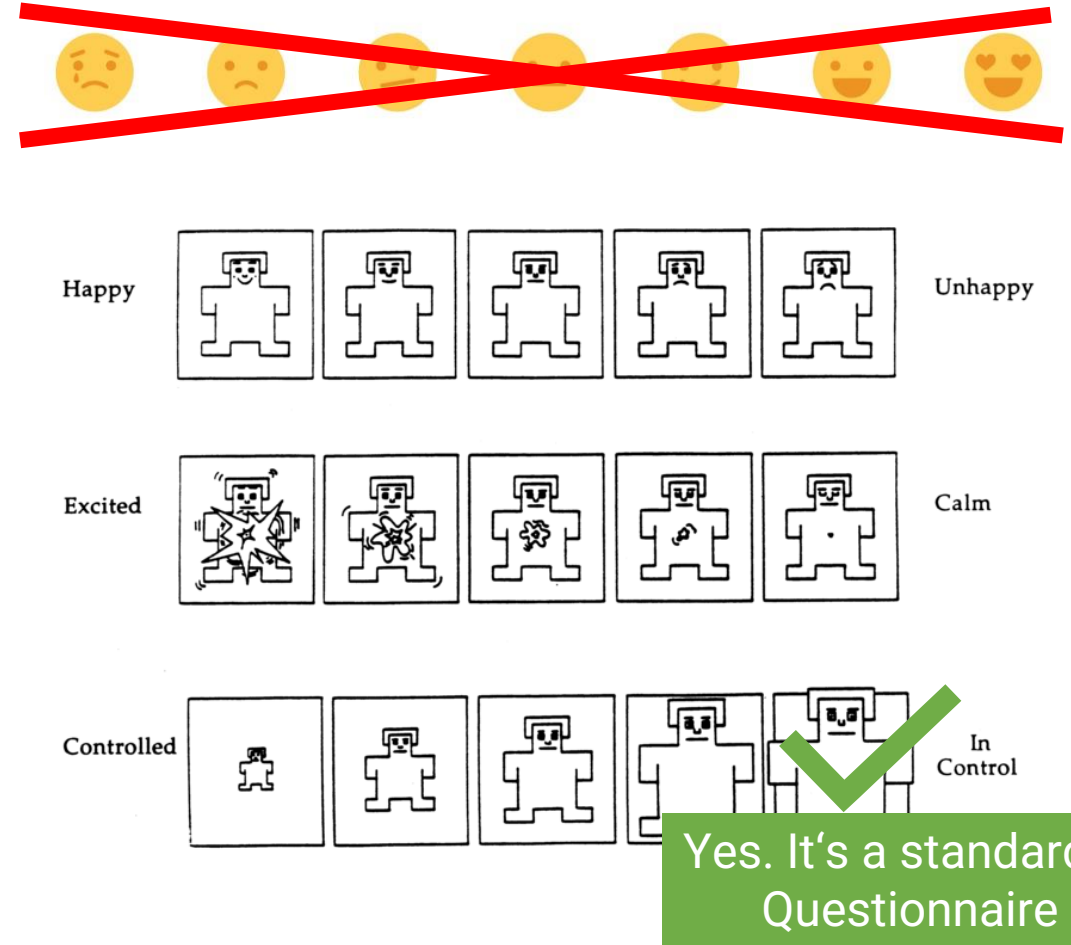
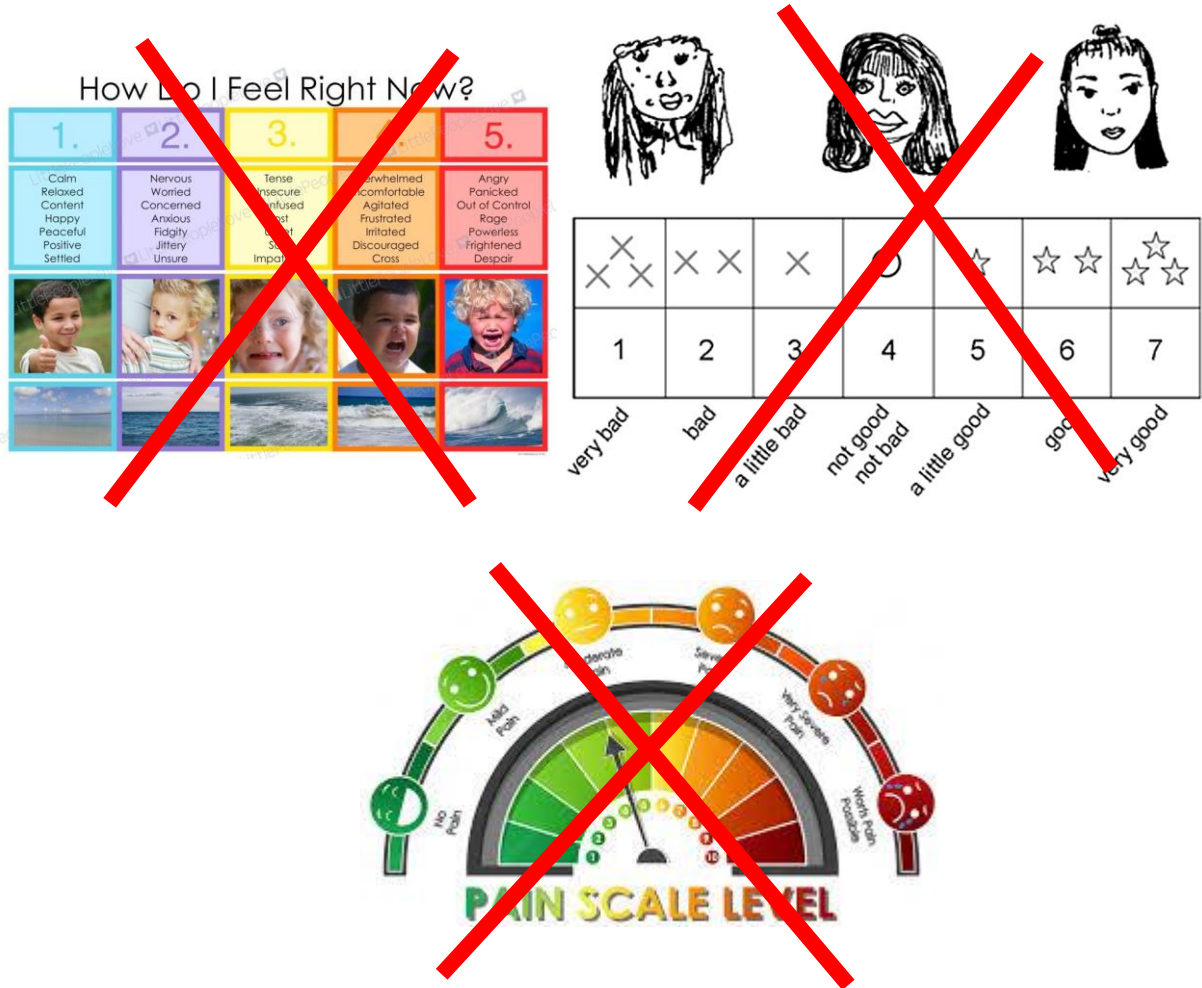
Likert Scale Items



- Likert scales are most useful when you are measuring **subjective concepts**
- In addition to measuring the level of **agreement on something**, Likert scales can also measure other spectrums, such as **frequency**, **satisfaction**, or **importance**.

Agreement	Frequency	Satisfaction	Difficulty	Importance	Quality	Reflection
1. Strongly disagree	1. Never	1. Very dissatisfied	1. Very easy	1. Very unimportant	1. Very poor	1. Very untrue of me
2. Disagree	2. Rarely	2. Dissatisfied	2. Easy	2. Unimportant	2. Poor	2. Untrue of me
3. Somewhat disagree	3. Occasionally	3. Slightly dissatisfied	3. Somewhat easy	3. Rather unimportant	3. Below average	3. Somewhat untrue of me
4. Neither agree nor disagree	4. Sometimes	4. Neutral	4. Neutral	4. Neutral	4. Average	4. Neutral
5. Somewhat agree	5. Frequently	5. Slightly satisfied	5. Somewhat hard	5. Rather important	5. Above Average	5. Somewhat true of me
6. Agree	6. Usually	6. Satisfied	6. Hard	6. Important	6. Good	6. True of me
7. Strongly agree	7. Always	7. Very satisfied	7. Very hard	7. Very important	7. Excellent	7. Very true of me

Other Items



Standardized Questionnaires



- Our all-time favs:

NASA Task Load Index

Hart and Staveland's NASA Task Load Index (TLX) method assesses work load on five 7-point scales. Increments of high, medium and low estimates for each point result in 21 gradations on the scales.

Name	Task	Date

Mental Demand How mentally demanding was the task?

Very Low | | | | | | | Very High

Physical Demand How physically demanding was the task?

Very Low | | | | | | | Very High

Temporal Demand How hurried or rushed was the pace of the task?

Very Low | | | | | | | Very High

Performance How successful were you in accomplishing what you were asked to do?

Perfect | | | | | | | Failure

Effort How hard did you have to work to accomplish your level of performance?

Very Low | | | | | | | Very High

Frustration How insecure, discouraged, irritated, stressed, and annoyed were you?

Very Low | | | | | | | Very High

NASA-TLX

System Usability Scale Questionnaire

Strongly Disagree | Strongly Agree

1. I think that I would like to use this product frequently.

1 | 2 | 3 | 4 | 5

2. I found the product unnecessarily complex.

1 | 2 | 3 | 4 | 5

3. I thought the product was easy to use.

1 | 2 | 3 | 4 | 5

4. I think that I would need the support of a technical person to be able to use this product.

1 | 2 | 3 | 4 | 5

5. I found the various functions in the product were well integrated.

1 | 2 | 3 | 4 | 5

6. I thought there was too much inconsistency in this product.

1 | 2 | 3 | 4 | 5

7. I imagine that most people would learn to use this product very quickly.

1 | 2 | 3 | 4 | 5

8. I found the product very awkward to use.

1 | 2 | 3 | 4 | 5

9. I felt very confident using the product.

1 | 2 | 3 | 4 | 5

10. I needed to learn a lot of things before I could get going with this product.

1 | 2 | 3 | 4 | 5

SUS

Ich hatte nicht das Gefühl, in dem virtuellen Raum zu sein.

hatte nicht das Gefühl | | | | | | | hatte das Gefühl

-3 -2 -1 0 +1 +2 +3

Wie sehr glich Ihr Erleben der virtuellen Umgebung dem Erleben einer realen Umgebung?

überhaupt nicht | | | | | | | vollständig

-3 -2 -1 0 +1 +2 +3

etwas

Ich hatte das Gefühl, in dem virtuellen Raum zu handeln statt etwas von außen zu bedienen.

trifft gar nicht zu | | | | | | | trifft völlig zu

-3 -2 -1 0 +1 +2 +3

Wie real erschien Ihnen die virtuelle Umgebung?

vollkommen real | | | | | | | gar nicht real

-3 -2 -1 0 +1 +2 +3

weder noch

Ich hatte das Gefühl, daß die virtuelle Umgebung hinter mir weitergeht.

trifft gar nicht zu | | | | | | | trifft völlig zu

- - - - -

IPQ

We love standardized questionnaires. Why?

```

graph LR
    A[Study Start] --> B[1. Introduction]
    B --> C[2. Experiment/ Survey]
    C --> D[3. Debriefing]
  
```

- Our all-time favs:

[illegible]

```

graph LR
    A[Study Start] --> B[1. Introduction]
    B --> C[2. Experiment/ Survey]
    C --> D[3. Debriefing]
  
```

NO!!

How to Conduct a User Study

```

graph LR
    A[Study Start] --> B[1. Introduction]
    B --> C[2. Experiment/ Survey]
    C --> D[3. Debriefing]
  
```

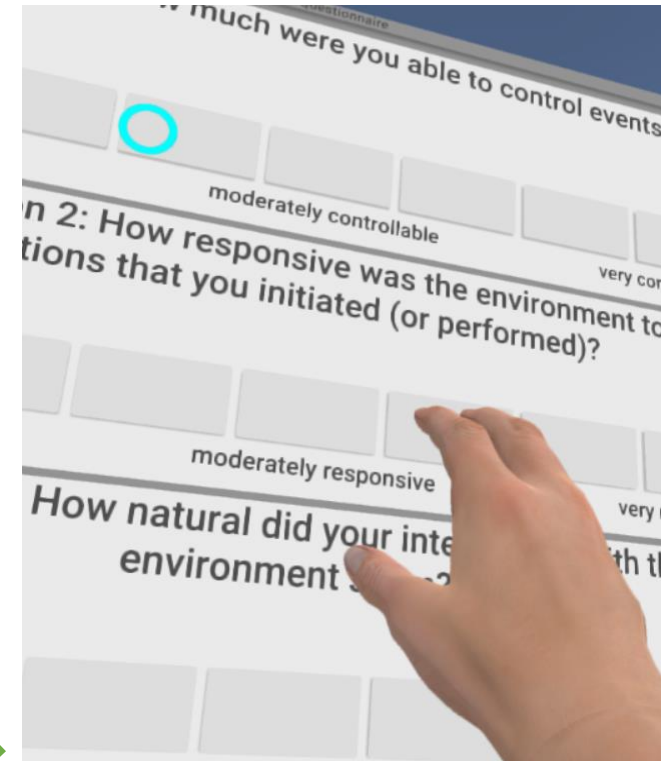
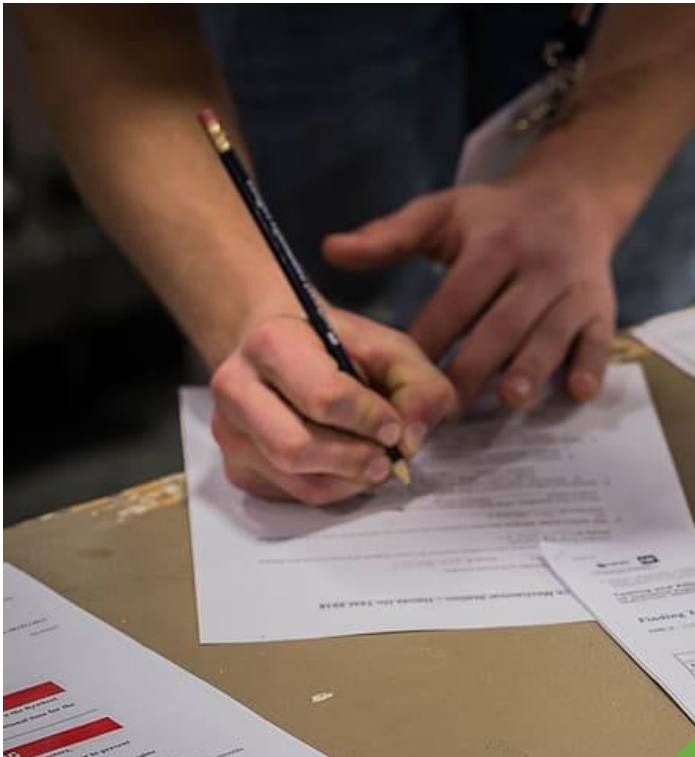
NO!!

How to Conduct a User Study

Questionnaires



- Allowed hand-out devices



Surveying



■ Survey Systems

LimeSurvey

<https://hci-studies.org/limesurvey/>

Admin Usability



Features



Google Forms

<https://docs.google.com/forms>

Admin Usability



Features



VR Questionnaire Toolkit [1]

<https://github.com/MartinFk/VRQuestionnaireToolkit>

Admin Usability

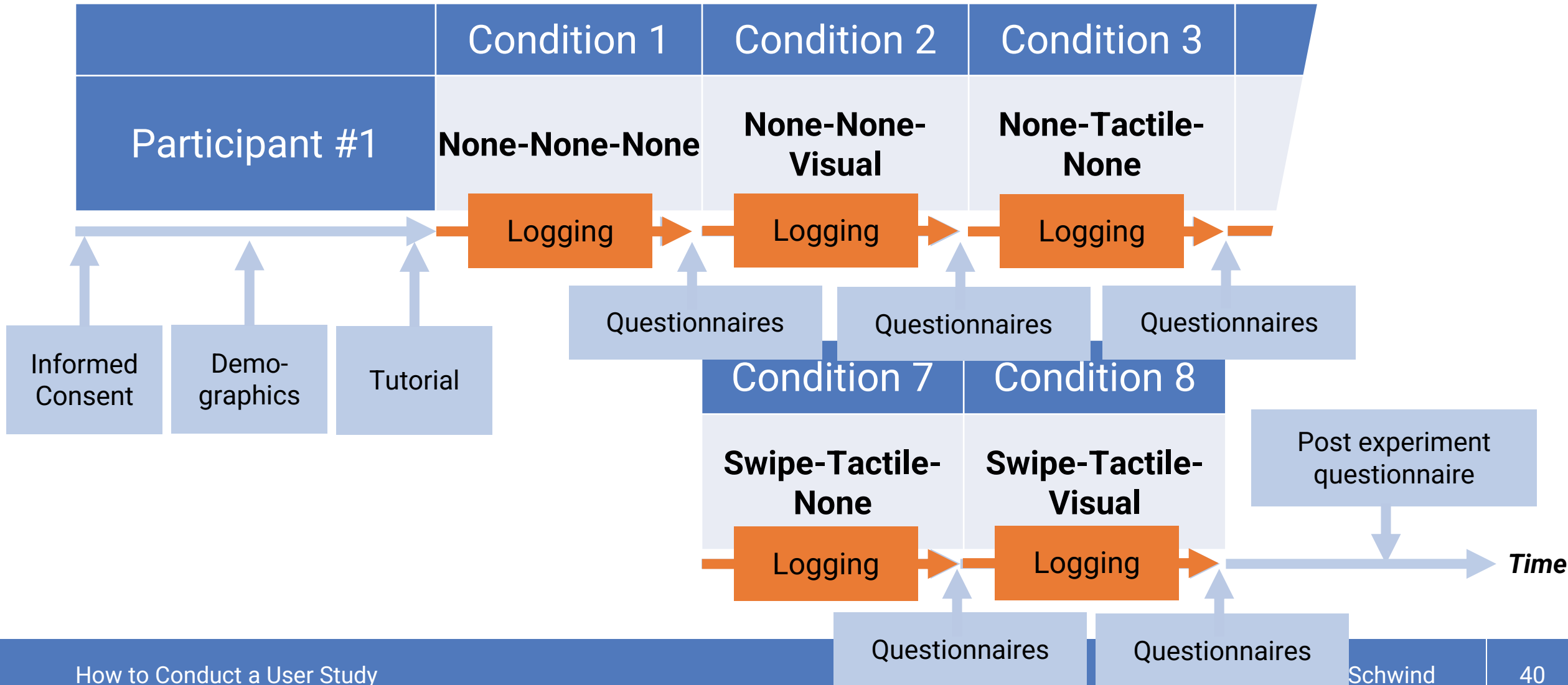


Features



Feick, M., Kleer, N., Tang, A., & Krüger, A. (2020, October). The Virtual Reality Questionnaire Toolkit. UIST EA (pp. 68-69).

Objective Measures



Logging



- The purpose of **logging is to track objective data** in your experiment
 - › The term “logging” can refer both to the practice of event logging or to the actual log files
- Log files can contain **continuous or discrete events over time** during application or system in your experiment:
 - › Implies that you log the time (time stamp)
- **Think about:**
 - › What objective data can I log?
 - › How can I log the data?
 - › Important: Logging must not affect the user!
 - › In which intervals do I log?
 - › Can I evaluate the data (e.g., is it a table?)

Logging Types



- **Discrete logging**

- › only the events are recorded
- › fast and easy to evaluate
- › useful to count stuff (e.g., events, button clicks,...)

- **Continuous logging**

- › useful to measure stuff over time (e.g., motions, tracks, audio,...)
- › you need a (constant) sampling rate
- › can be lot of data

- **Every sample needs a time stamp**

- › A number – not a date

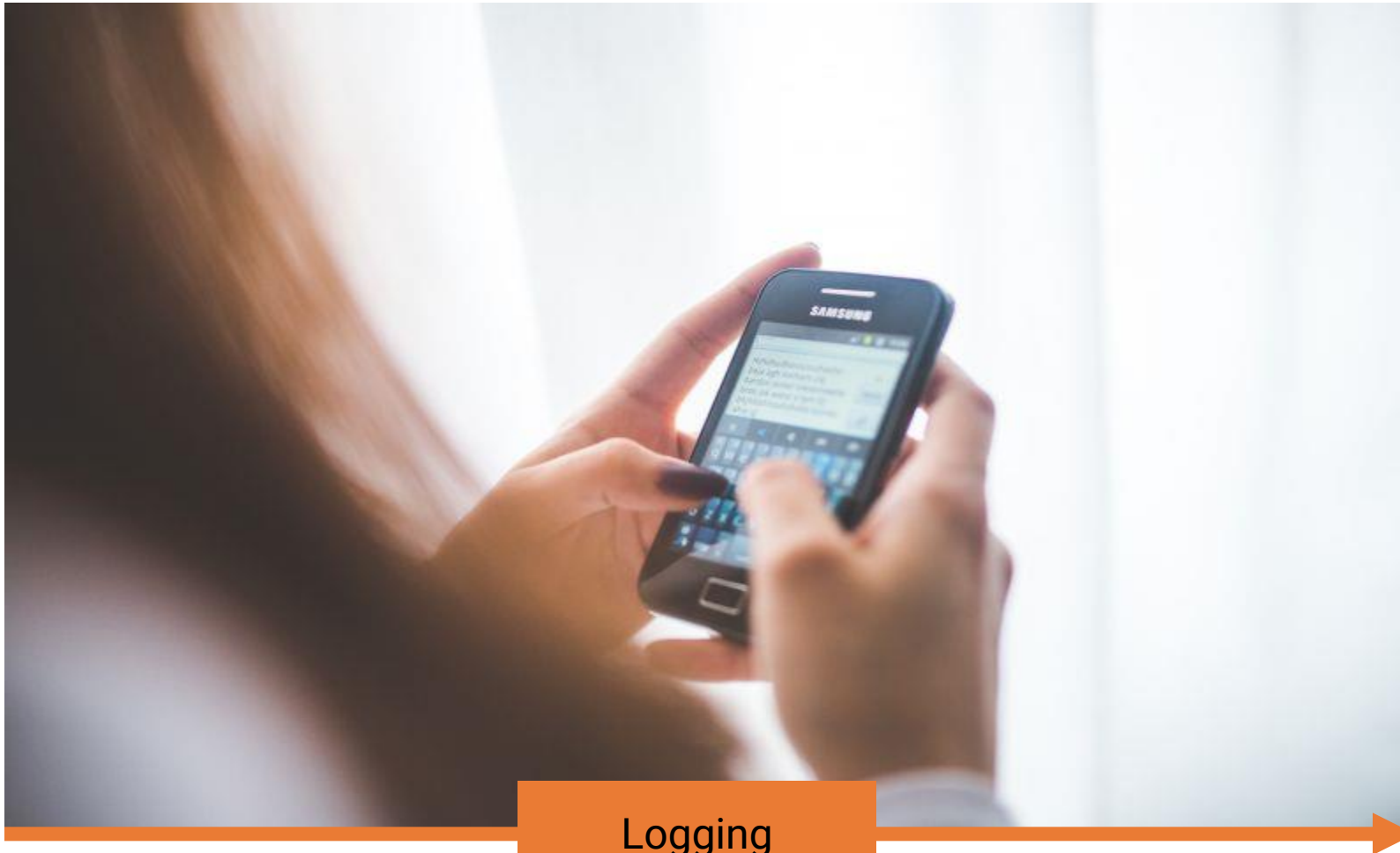


Example: Discrete events
(Accuracy, Precision)



Example: Continuous events
(Speed, movement)

Logging: Example



Logging: Example

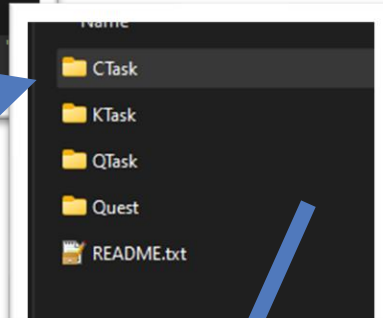
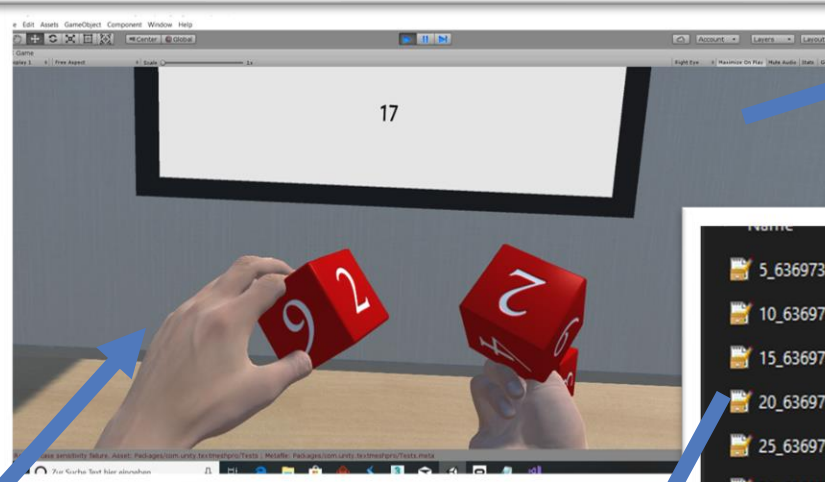
Study Start

1. Introduction

2. Experiment/
Survey

3. Debriefing

```
public void onTriggerExit(Collider fingerCollider, FingerCollision objectCollider)
{
    if (objectCollider.name.Contains("ICube"))
    {
        swcubes.WriteLine(latinHand.Participant + ";" + latinHand.CurrentGroup + ";" + latinHand.GroupNames[latinHand.CurrentGroup].ToString() + ";" + tasktime.ElapsedMilliseconds + ";" + fingerCollider.ToString() + ";" + objectCollider.ToString() + ";" + value1.value + value2.value + value3.value + ";" + number1 + number2 + number3);
    }
}
```



Name	Änderungsdatum	Typ	Größe
5_636973263225775359_CubeTask.txt	28.06.2019 14:37	TXT-Datei	10.774 KB
10_636975684122975267_CubeTask.txt	01.07.2019 09:49	TXT-Datei	10.972 KB
15_636975888744831571_CubeTask.txt	01.07.2019 15:32	TXT-Datei	8.411 KB
20_636976714920298654_CubeTask.txt	02.07.2019 14:34	TXT-Datei	8.249 KB
25_636979199878596714_CubeTask.txt	05.07.2019 11:28	TXT-Datei	8.067 KB
30_636979369611242688_CubeTask.txt	05.07.2019 16:10	TXT-Datei	6.703 KB
35_636982653209304458_CubeTask.txt	09.07.2019 11:23	TXT-Datei	9.750 KB
40_636983588298796983_CubeTask.txt	10.07.2019 13:20	TXT-Datei	10.304 KB

```
5;0;Abstract_Hand_Ring;4840;L_ring_02 (UnityEngine.BoxCollider);ICube1 (FingerCollision);155;235
5;0;Abstract_Hand_Ring;4840;L_middle_02 (UnityEngine.BoxCollider);ICube1 (FingerCollision);155;235
5;0;Abstract_Hand_Ring;4840;L_index_02 (UnityEngine.BoxCollider);ICube1 (FingerCollision);155;235
5;0;Abstract_Hand_Ring;4840;L_index_02 (UnityEngine.BoxCollider);ICube1 (FingerCollision);155;235
5;0;Abstract_Hand_Ring;4840;Contact Fingerbone (UnityEngine.CapsuleCollider);ICube1 (FingerCollision);155;235
5;0;Abstract_Hand_Ring;5212;R_index_02 (UnityEngine.BoxCollider);ICube1 (FingerCollision);155;235
5;0;Abstract_Hand_Ring;5212;P_index_02 (UnityEngine.BoxCollider);ICube1 (FingerCollision);155;235
5;0;Abstract_Hand_Ring;5256;L_ring_02 (UnityEngine.BoxCollider);ICube1 (FingerCollision);155;235
5;0;Abstract_Hand_Ring;5257;L_ring_02 (UnityEngine.BoxCollider);ICube1 (FingerCollision);155;235
5;0;Abstract_Hand_Ring;5257;L_pinky_02 (UnityEngine.BoxCollider);ICube1 (FingerCollision);155;235
```

Time Stamps /
Stopwatches
EVERYWHERE!

`DateTime.Now.Ticks`

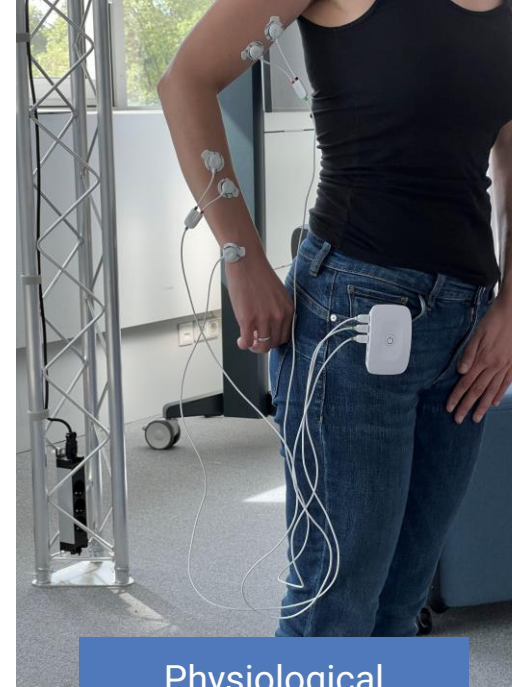
Other Measures...



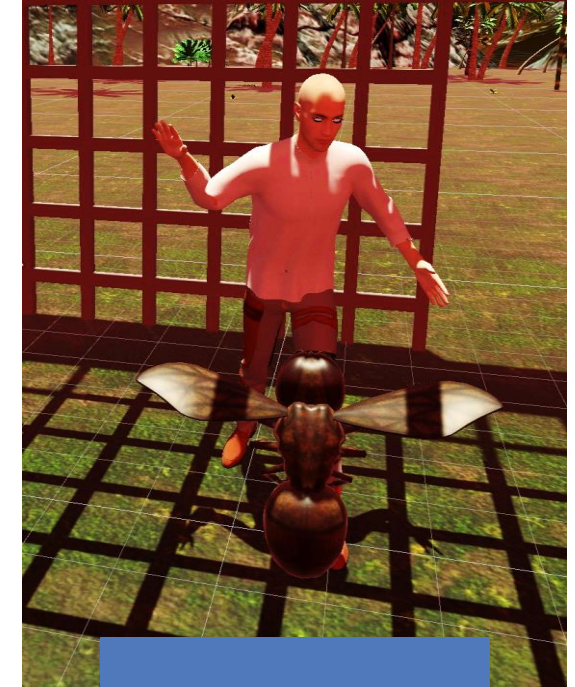
Grip Strength
(Dynamometer)



Task Completion
Time (Stopwatch)



Physiological
Sensors (Electrodes)



Game Scores

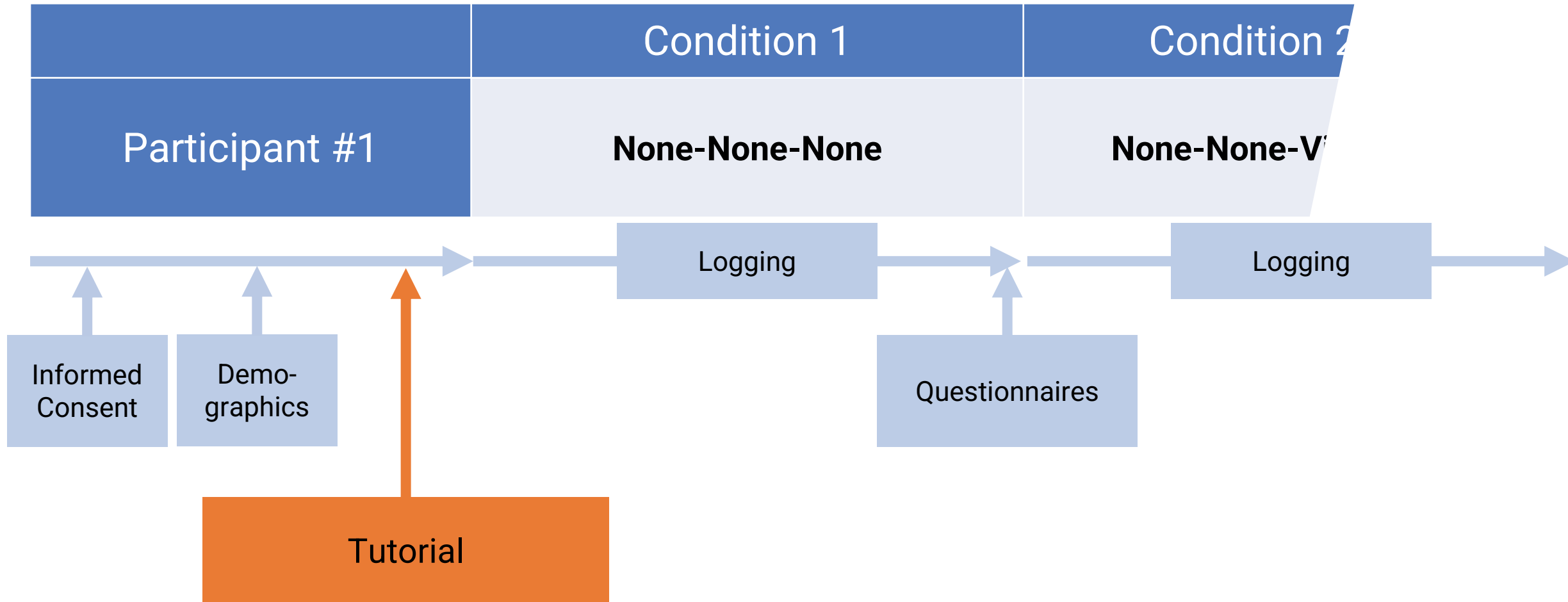
There are thousands of methods, tasks, and measures to obtain objective data! We will talk about that later...

About Measures



**BUT: NEVER FORGET
THE MEASURE(S)
ANSWERING YOUR
RESEARCH QUESTION(S)**

Experiment



Experiment

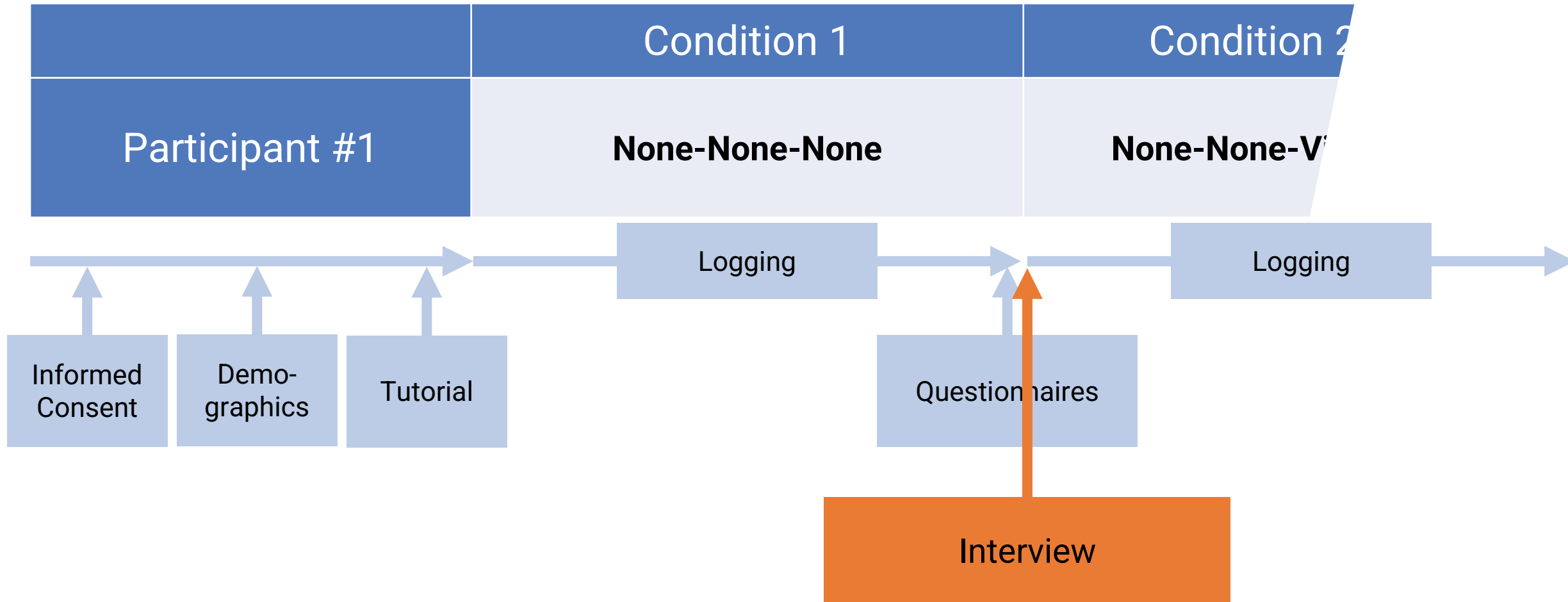


■ Think about

- › a „**tutorial**“ or unbiased „training“ to make participants familiar with their task
- › a „**warm-up phase**“ before you start with the experiment (e.g., physiological sensors)
- › **explanations** during the trial
- › **automated instructions** and integrated questionnaires
 - › e.g., InVR-Questionnaires <https://github.com/MartinFk/VRQuestionnaireToolkit> [1]
- › **instructions** that help participants to do the next step without your help
- › **randomness** (e.g., random assignments)
- › **fatigue** of the participants
- › keeping participants **motivated** without killing the study

[1] Martin Feick, Niko Kleer, Anthony Tang, and Antonio Krüger. 2020. The Virtual Reality Questionnaire Toolkit. In Adjunct Publication of the 33rd Annual ACM Symposium on User Interface Software and Technology (UIST '20 Adjunct). Association for Computing Machinery, New York, NY, USA, 68–69. <https://doi.org/10.1145/3379350.3416188>

Experiment



Qualitative Research Questions



- Example: “[...] we present the findings from multiple design sessions [...] exploring the placement and form factor possibilities for input and output on a power wheelchair.” [1]
 - › General question, design aspects should be explored
- Example: „We describe a qualitative study investigating the acceptability of Google Glass eyewear computer to People with Parkinson`s disease (PD.)” [2]
 - › Study on the possible uses and acceptance of Google Glass in Parkinson's patients



[1] Patrick Carrington, Amy Hurst, and Shaun K. Kane. 2014. Wearables and chairables: inclusive design of mobile input and output techniques for power wheelchair users. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '14). Association for Computing Machinery, New York, NY, USA, 3103–3112. <https://doi.org/10.1145/2556288.2557237>

[2] McNaney, R., Vines, J., Roggen, D., Balaam, M., Zhang, P., Poliakov, I., & Olivier, P. (2014). Exploring the Acceptability of Google Glass As an Everyday Assistive Device for People with Parkinson's Images from: <https://pxhere.com/de/photo/732815> and <https://movingthroughglass.org/>

Planning Qualitative Research



- **Unravel your research question**

- › What are the related questions that could be answered with qualitative methods?
- › **Who, When, What, Why** or **How** questions (= open questions)
- › **Make a protocol!!!!**

- **Choose data collection method**

- › Textual feedback, audio (for text transcript), video (behavioral observations)

- **Determine a sampling approach**

- › Feedback/Observation method, target group, location and time frame

- **Integrate comparative aspects**

- › Discussions arise when there is disagreement



Conducting an Interview



- **Central instrument of qualitative research**
- **Various forms of interviews** depending on the specification of the questions/content of the interview:
 - › Unstructured (candid) interview
 - › **Semi-structured interview** (we highly recommend that)
 - › Structured interview (no follow-up questions)
- **Advantages and disadvantages** of structure:
 - › + Comparability of the interviews in terms of length, topics, ...
 - › + Easier to evaluate
 - › - Biasing the responses
 - › - Restriction of perspective (instead of extension)

The Semi-Structured Interview



- Interview based on a **predefined protocol (a list of questions or topics to cover)**
 - › Ensures that the same general areas are covered with each participant
 - › Makes the data and analysis more comparable than fully unstructured interviews
- **Interviewers are free to deviate** based on the interviewee's responses
 - › **Ask follow-up questions** to clarify or expand on points made by the interviewee (probing)
 - › The format enables interviewers to probe **interesting areas that emerge during the interview**, which are not in the protocol.
 - › Allow deep exploration of the interviewee's thoughts, feelings, and beliefs, providing rich qualitative data.
 - › Questions can be adapted to suit the context of the conversation or the specific respondent
 - › Interviewers can gain a better understanding of the context
 - › Can reveal inconsistencies within the interviewee's thoughts

The Semi-Structured Interview



- **Establish a connection** with the participant to facilitate open communication
- **Establish common ground** and provides context (events, situations) and initial questions
 - › “Image you are in a park with a new fitness tracker...”
- **Open-ended questions around the research question**
 - › Questions are designed to encourage detailed and expansive answers
 - › Allows interviewees to express their perspectives and experiences
- Enables **“active listening”**
 - › More questions to go deeper
- Repeat the interview with all conditions/concepts/scenarios...

How to go deeper...



- **Active listener** tries to grasp the content of the answers and to establish the connection to research questions & to clarify inconsistencies or ambiguities
- **Expand what has been said** with "Can you tell us more about it?", "Can you give an example?"
- **Find out** why with "Can you tell me why you reacted?" "Why do you think you reacted that way"
- **Ask for effects/consequences** with "What happened next?" "What effect did that have on you?"
- **Underlying values** experienced with "Why was that important to you?" "Why did you react so strongly to it?"

Focus Groups



- **An interview with group of participants** (3-10) directed by one or more researchers
 - › Typically, you have 3-4 focus groups per study
- **Participants typically have common goals**, traits, experiences, etc.
- **Goals** is to...
 - › improve a prototype
 - › solve problems
 - › explore design options



By NSaad (WMF) - Own work, CC BY-SA 4.0,
<https://commons.wikimedia.org/w/index.php?curid=67092238>

Focus Lenses (Examples)



- **Designs Exploration**

- › Explore the design spaces/design options with your focus group
- › Brainstorm solutions

- **Prototype Test**

- › Test the concept for a product
- › Test reactions to a mock-up physical or digital

- **Opinion Gathering**

- › After a product is already out in the world
- › Determine how people feel about it or how they make use of it

Slides adapted from Dr Kami Vaniea https://www.inf.ed.ac.uk/teaching/courses/hci/1718/lects/Lecture11_focus_groups.pdf

Pros/Cons of Focus Groups



■ Pros

- › Get group opinion about issues
- › Efficient way to test early ideas/designs
- › Good way to identify issues or areas of conflict
- › Multi-constituent discussion

■ Cons

- › Can be taken over by assertive individuals
- › Focus on people's opinions not actual behaviors
- › Limited sample size

Slides adapted from Dr Kami Vaniea https://www.inf.ed.ac.uk/teaching/courses/hci/1718/lects/Lecture11_focus_groups.pdf

Plan and Discussion Stimuli



- Goal is to **get valuable information** about the potential and design spaces of an artifact
 - › To encourage the members to talk more freely early prototype (discussion stimuli) can be presented
- In HCI, focus groups have typically **brainstorming phases Explain what is going to happen to the participants** (example)
 - › 1. Explain **what is going to happen** to the participants
 - › 2. **Ask the attendees to introduce** themselves and share their last app experience
 - › 3. Hand out **discussion stimuli** and associated questions
 - › 4. Ask participants to **try and use the stimuli** to answer the questions silently by themselves
 - › 5. Ask participants to **discuss the answers and explore options**
 - › 6. Ask participants **how they would improve the discussion stimuli** (brainstorming session)

Slides adapted from Dr Kami Vaniea https://www.inf.ed.ac.uk/teaching/courses/hci/1718/lects/Lecture11_focus_groups.pdf

Example: Qualitative Studies



■ Survey methods

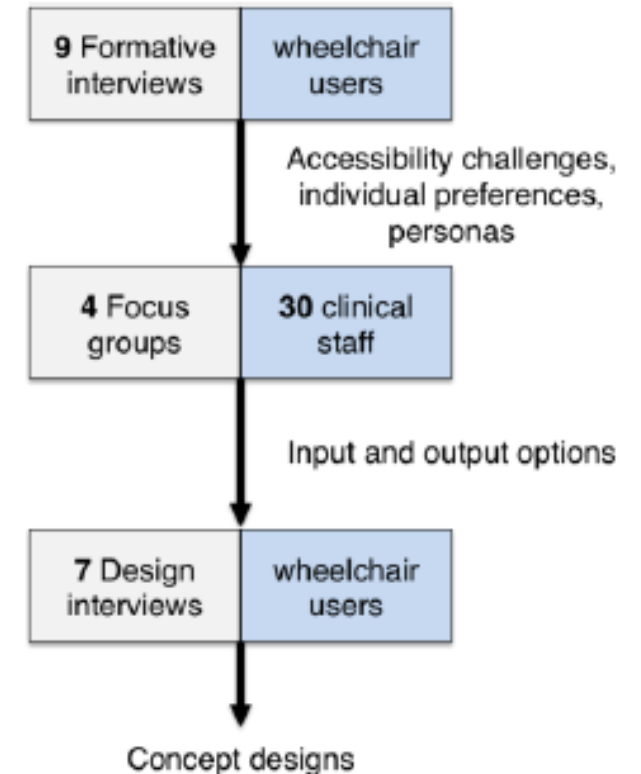
- › 3 different methods: interviews, focus groups, design interviews

■ Sample

- › Heterogeneous sample of a certain group
- › Wheelchair users and clinical staff

■ Time frame

- › Period studied: habits, problems in using systems
- › Several examination times to further process & check results



[1] Patrick Carrington, Amy Hurst, and Shaun K. Kane. 2014. Wearables and chairables: inclusive design of mobile input and output techniques for power wheelchair users. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '14). Association for Computing Machinery, New York, NY, USA, 3103–3112.

<https://doi.org/10.1145/2556288.2557237>



<https://pxhere.com/de/photo/1447013>

Data Collection

- Interview protocols
- Live protocol
- Focus group output
- Video observations
- Audio records
- Existing data: Ethnography
- Diaries
- Textual feedback forms



Record & Log Events



■ Event Log

- › Recorded and observed events during the study
- › Key data of the interview: interviewer, ID of the subject, location of the interview, start and end times of the interview

■ Transcription

- › in audio-recorded interviews, what is said is written down true to its meaning = transcribed



1 hour audio/video =
8 hours transcription

Or you use youtube.com –
auto comment detection

Transcript Example



1	Transkript „Usability von Alltagsgeräten“	Context Data
2	Interviewer: Manfred Muster	
3	Befragter-ID: TP3	
4	Ort: FIL, Uni Regensburg	
5	Datum/ Zeit: 20.05.2014, 18:40-18:45 Uhr	
6	I: Wie alt sind Sie?	
7	B:27 Jahre.	
8	I: Ihr Geschlecht?	
9	B:Weiblich.	
10	I: Was ist ihr Beruf/ Ausbildung?	
11	B:Softwareentwickler.	
12	I: Wie groß ist ihr Interesse an Technik zum Beispiel Smartphones, PC, Tablets, Digitalkamera?	
13	B:Sehr groß.	
14	I:Welche Alltagsgeräte nutzen Sie?	
15	B:Ja, mein Geschirrspüler. Und den Herd, die Kaffemaschine. (...) Wasserkocher.	

Time is Value



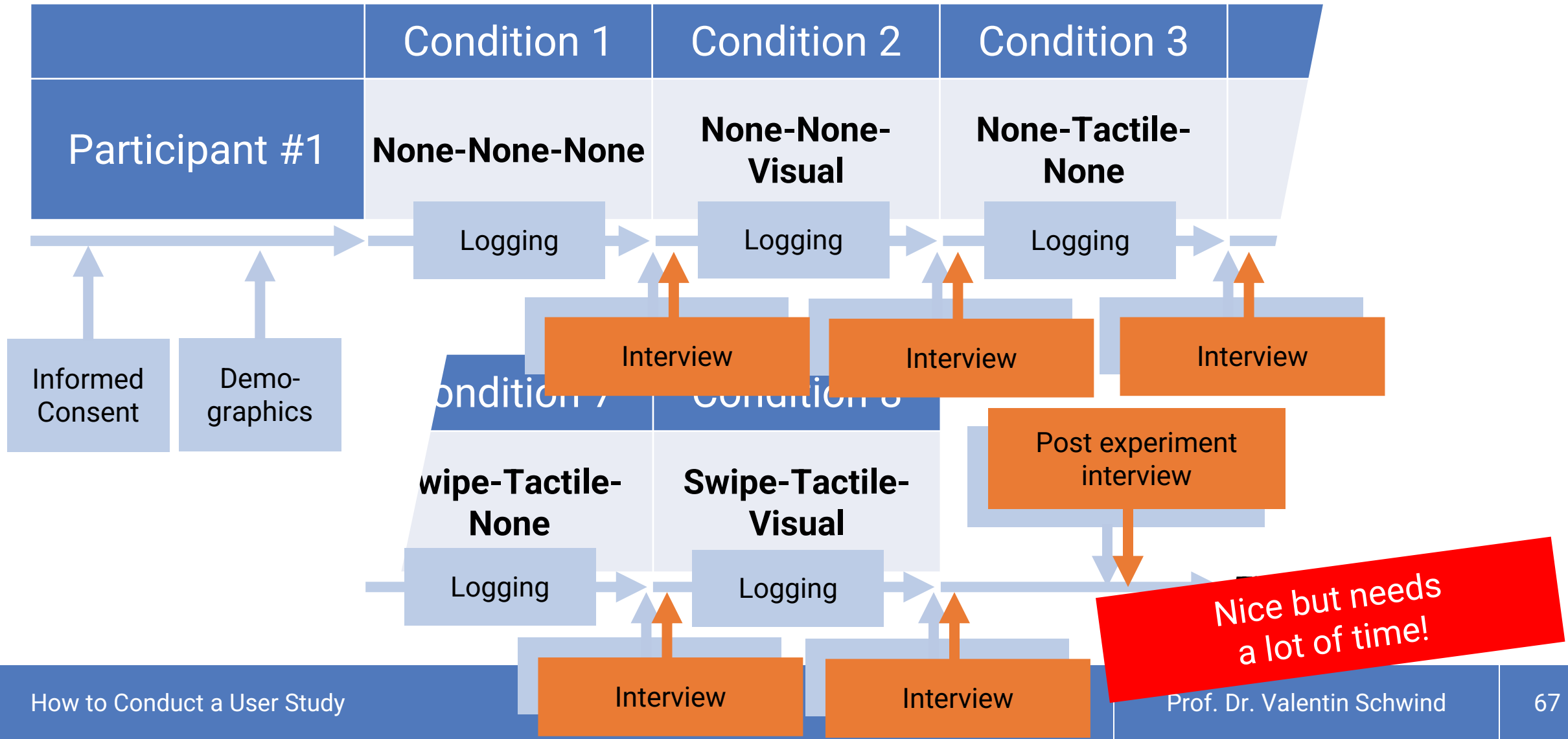
- **You can use time** as “**object of investigation or manipulation**”
 - › Before/during/after an event (e.g., before, while, or after using a system)
 - › The order determines biases (counter-balance if required)
- **Study Episodes**
 - › Single Episode
 - › Multiple Episodes
 - › Capture different points in time
 - › Use of different methods to capture different aspects (context, frequency of use, emotions, problems)
 - › Example: Diary study to capture the user experience of a streaming platform

Example: Streaming Platform

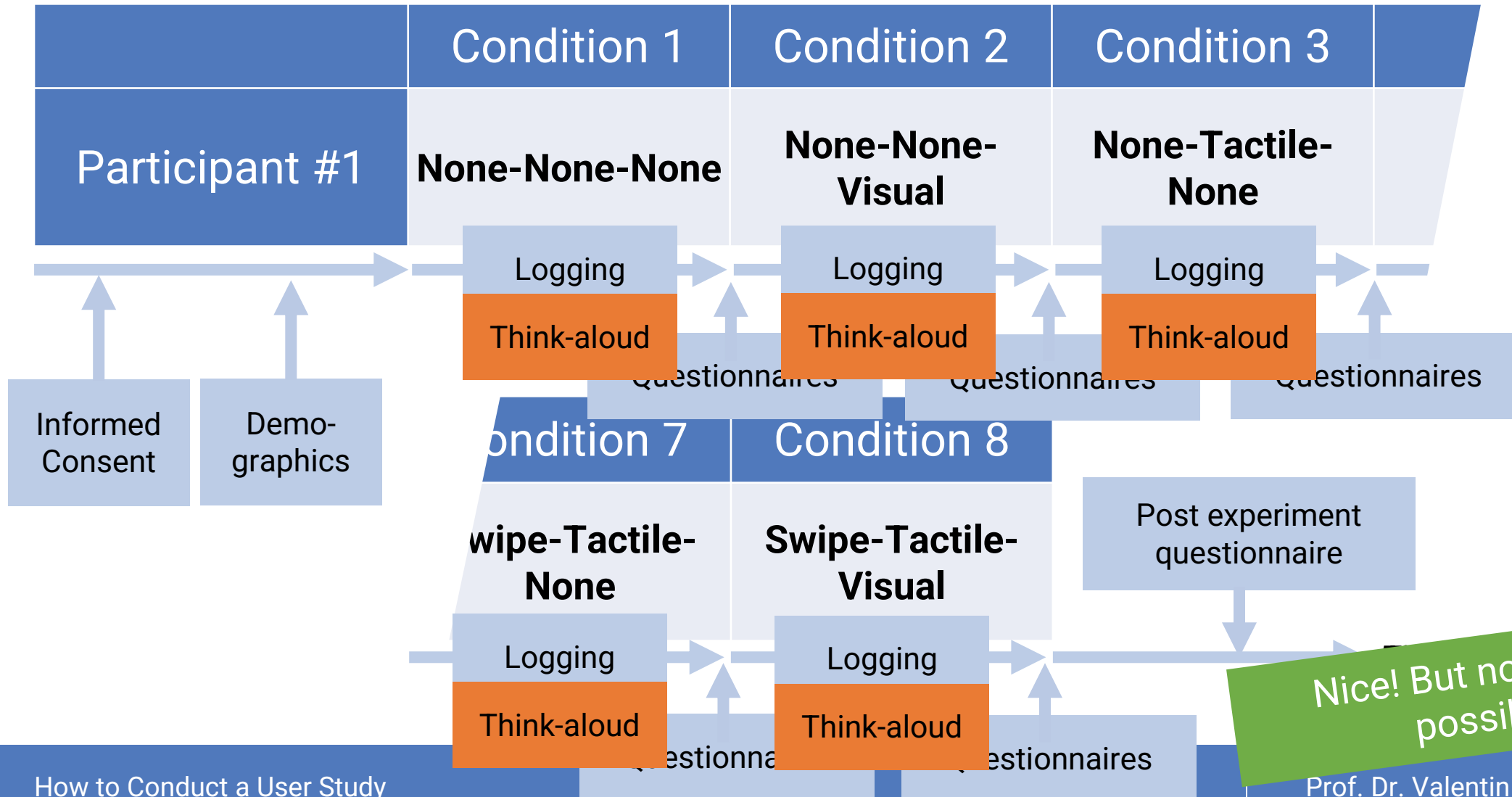
- **A diary study** capturing the UX of an online streaming platform
 1. **First contact** interview
 - › “Your expectations?”
 - › “Your first impression of the start page?”
 2. **Diary** study on the use of the system
 - › “What are your entries in weblog (tabular, free text)”
 - › More questions about usability
 3. **Post follow-up** interviews
 - › Summary
 - › Perceived user experience curves



Mixed Methods



Mixed Methods



Think-Aloud



- Involve participants **thinking aloud while** they are **performing** a set of specified **tasks**
- Participants are **asked to say whatever comes into their mind** as they complete the task
- Include **open-ended** and allows **follow-up questions** (semi-structured)
- Include what participants are
 - › looking at
 - › thinking
 - › doing
 - › feeling
- **Very efficient**, but not always possible (e.g., audio tasks)



Task-Centered User Interface Design: A Practical Introduction, by Clayton Lewis and John Rieman.

More Qualitative Research



- Ethnography
 - › Technology Biography
 - › Rapid Ethnography (Guerilla Sampling)
- Case Studies
- Diaries / Longterm Studies

Ethnography

- „[...] the art and science of describing a human group – its institutions, interpersonal behaviors, material productions, and beliefs“ [1]
- Emerged from the field of anthropology that served the study of non-Western cultures field research
 - › Researcher shares (actively) the everyday life of the people
 - › Researchers observe them, make field notes,
 - › from which patterns and meanings are then deductively evaluated
 - › See the work by e.g. Bronisław Malinowski
- Other methods: photography, videos, audio,...



<http://hilobrow.com/2012/04/07/bronislaw-malinowski/>

[1] Angrosino, M. (2007). Doing ethnographic and observational research. SAGE Publications Ltd, <https://dx.doi.org/10.4135/9781849208932>

Ethnography = Technology Biography

- “Technology Biography”: hardly “real” ethnography in the sense of long-term field research
 - › Example: a field study into technology use by three households was examined [1]
- Method used: **Technology Biography**
 - › Technology Tour: devices are shown
 - › Last Time Questions: Questions e.g., “When was a household task fun?”
 - › Personal History: “How did habits develop?”
 - › Three wishes for new products
- Results
 - › Enjoyability
 - › Recodification-Gendered Design
 - › Inclusivity

Blythe, M., & Monk, A. (2002). Notes Towards an Ethnography of Domestic Technology

Rapid Ethnography (Guerilla Sampling)

- Real ethnography is too “expensive”, broad spectrum of observation, long duration of observation
 - › **Let's shorten it: guerrilla sampling**
- Guerilla sampling:
 - › Refer to a specific question and find information **in the field**
 - › Can be in-situ: e.g., asking habits of car drivers at parking slots
 - › Use as many digital recording methods as possible (audio, video, photos, etc.)
 - › Collaborative evaluation (possibly also tool-supported)



David R. Millen. 2000. Rapid ethnography: time deepening strategies for HCI field research. In Proceedings of the 3rd conference on Designing interactive systems: processes, practices, methods, and techniques (DIS '00). Association for Computing Machinery, New York, NY, USA, 280–286. <https://doi.org/10.1145/347642.347763>

Case Study

- „The essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result.“ [1]
- Detailed and in-depth analysis of one or more occasions
- Research questions are how and why
 - › when a topical phenomenon is examined (in our case: a new device, domain, application, form of interaction)
 - › certain factors or events cannot be controlled (e.g., due to realism or novelty)
 - › mostly for innovative developments, new methods

[1] Schramm, W. (1971). Notes on Case Studies of Instructional Media Projects.

Case Study: „Quantified Cats“ [1]

- Example: Quantification of Pets
 - › Discussing fiction and speculative prototypes (websites) in focus groups with pet owners & animal behavior experts
 - › Prototypes, descriptions and websites for various products
- Pet owners want to understand their pet:
 - › „Sometimes you think is she just barking to protect me. But then sometimes you're not 100% sure...if you knew she wasn't a threat [with EmotiDog], you'd probably be more relaxed“ [1]

EmotiDog

The EmotiDog Smart Collar reveals the emotional state of your canine companions

Every dog owner has experienced what their dog was thinking. EmotiDog gives owners a unique insight into the complex emotional state through the use of a innovative combination of proprietary algorithms, sensors embedded in a smart dog collar.

The collar is comfortable, easy to fit, and opens up an entirely new mode of communication between dogs and their human companions.

AN OVERVIEW OF FEATURES
Features in the works for the consumer version of EmotiDog

- SAFE:** We want safety to be our number one concern. The collar is comfortable, easy to wear, and designed to be as safe as possible.
- ADAPTIVE:** We know that all dogs are different. The EmotiDog algorithms are adaptive and learn more about the dog as it is used. For example, the unique pulse range of the collar is determined and allows for more accurate calculations.
- EASY TO USE:** The EmotiDog collar attaches like a normal collar, with a plastic safety clip. The device charges using a standard USB charge cable, and battery life is over 48 hours depending on use.
- CONFIDENCE:** EmotiDog will be available in a wide range of colors and sizes to suit all dogs, and is designed to be as safe as possible. The collar can be configured to show when it is on, and when it is not on, so you can be sure it is always on.
- PLUGGED:** We know that some dogs love to get up to mischief. This consumer version of the EmotiDog collar is designed to be rugged, water resistant and durable enough to last with you on the way.
- SUPPORT:** As with our other products, we strive for perfection. All EmotiDog collars are supported by a lifetime hardware guarantee, plus free lifetime updates and access to our 24/7 customer support team.
- SCIENTIFIC:** EmotiDog's advanced algorithms are based on extensive scientific research around dog play, energy, behavior and mood. Advances in the power of microchips have made these scientific calculations possible.
- PRO:** EmotiDog is a fun way to learn more about your dog's life, behavior and general emotional state. It's the best way to understand your dog and will change your relationship.

Sign up for more information: We are currently in the prototyping stage and will be releasing the final product soon. If you would like to be kept informed about the development and release of EmotiDog, please enter your email address here.

EmotiDog

t-a-Log The Cat-A-Log system is used to track the movement of cats and other micro-chipped animals around your property.

Special wire is buried around the edge of your garden or yard, connected to a recorder inside the house.

The wire can detect when pet identification chips pass nearby. The system uses triangulation to work out the exact location of the animal. The system requires no special collar attachments, and works with the vast majority of existing identification chips. The system is completely invisible to the animal, and they do not feel anything during detection. You can use a website and smartphone app to browse historical maps of your property, viewing movement of all chipped animals within the area.

CAT-A-LOG Recorder stores data and transmits map to smartphone app.

SmartWire is simply installed around the edge of property.

CAT-A-LOG detects pet microchip and records accurate cat location.

CAT-A-LOG tracks cat movement, triangulating cat location in area.

[1] Lawson, S., Kirman, B., Linehan, C., Feltwell, T., & L. Hopkins (2015) Problematising Upstream Technology through Speculative Design: The Case of Quantified Cats and Dogs

The Art of Case Studies: Drawing Conclusions

- *“Beyond the human-animal relationship, our study suggests implications for the quantified-self movement more generally. As mentioned, our participants were fascinated by the utility offered by our products, without any concern for how they worked. This issue goes beyond our own case study: if there is little incentive for ensuring a consistent level of scientific accuracy in quantified data interpretation, it seems unlikely that companies would bother to engage in the expensive and time consuming trials necessary to demonstrate this.” [1]*

[1] Lawson,S., Kirman,B., Linehan,C., Feltwell,T., & L. Hopkins (2015) Problematising Upstream Technology through Speculative Design: The Case of Quantified Cats and Dogs

Diaries

- Fill the gap between direct observation & interrogation
- Form
 - › Paper, digital via blogs, email, mobile app, online account etc.
 - › Open questions/entries versus tabular form
 - › With additional media such as photo, video, comments
 - › Elicitation Diary
- Notes on use (e.g., in the form of photos and comments)
 - › Follow-up interviews clarify questions about usage
 - › Feedback Diary
 - › Answer usage questions (at the end of each tag or usage)



Why Diaries?

- Advantages

- › Phenomena can be captured in context & with a personal view
- › Participants are less disturbed than with an observation/ethnography

- Disadvantages

- › Accuracy of recording can be highly variable (motivation, time resources of participants)
- › Interpretability of described phenomena ☒ Interviews for clarification, method. Triangulation

Avoiding Biases in Qualitative Research

- **Use multiple people to transcribe and code the data**

- › If there is consistency between your interpretation and that of others, it is more likely that there is some truth by agreement in your interpretations

- **Have participants review your results**

- › Ask the people who provided the data whether your interpretations seem to reflect their opinions

- **Verify data sources (Triangulation)**

- › If you can find other sources of data that support your interpretations, then you can have more confidence that what you've found is legitimate

- **Check for alternative explanations**

- › Consider whether there are other reasons why you obtained your data. If you can rule out or account for alternative explanations, your interpretations will be stronger.

- **Review findings with peers**

- › Ask others to review your conclusions. Sometimes others will see things that you missed or can identify gaps in your argument that need to be addressed

Summary

- **A good research question**
 - › Can be answered, is clear, and has a verifiable goal
 - › Formulated to fit the method
- **Research methods answer your research question**
 - › Distinguish research from practice: valid, reliable and dependable results
 - › Should correspond to one of the three research approaches:
 - › Quantitative, qualitative, mixed methods
- **Less is more**
 - › The aim is not to explore as many aspects as possible or as generally as possible
 - › Examine a few specific aspects very thoroughly and closely
- **Read, read, read**
 - › Good examples provide clues for interesting questions, methodologies, study designs,...

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Task Next Time

- **Update your problem statement (PDF)**
 - › There should be 3 sections now: 1. Introduction, 2. Related Work, 3. Method
 - › **Update if necessary and make the 3 sections consistent**
- **Update and upload your presentation (PDF)**
 - › **Add/Change your slides according to the things you want to change**
 - › Your update research question(s)
 - › Describe your method. Depending on your research method ...
 - › The picture of your thingy
 - › **Your experimental/survey procedure!**
- **Next time: Intermediate Presentation**