

Psychophysics

(1) Welcome

Jiří Lukavský

Instructors

- Jiří Lukavský, Ph.D.
 - jiri.lukavsky@ff.cuni.cz
- Filip Děchtěrenko, Ph.D.
 - filip.dechterenko@ff.cuni.cz
- Josef Mana, Ph.D.
 - mana@psu.cas.cz



Where and When

- Thursday 12:30 – 14:00
- Room 351
- Moodle

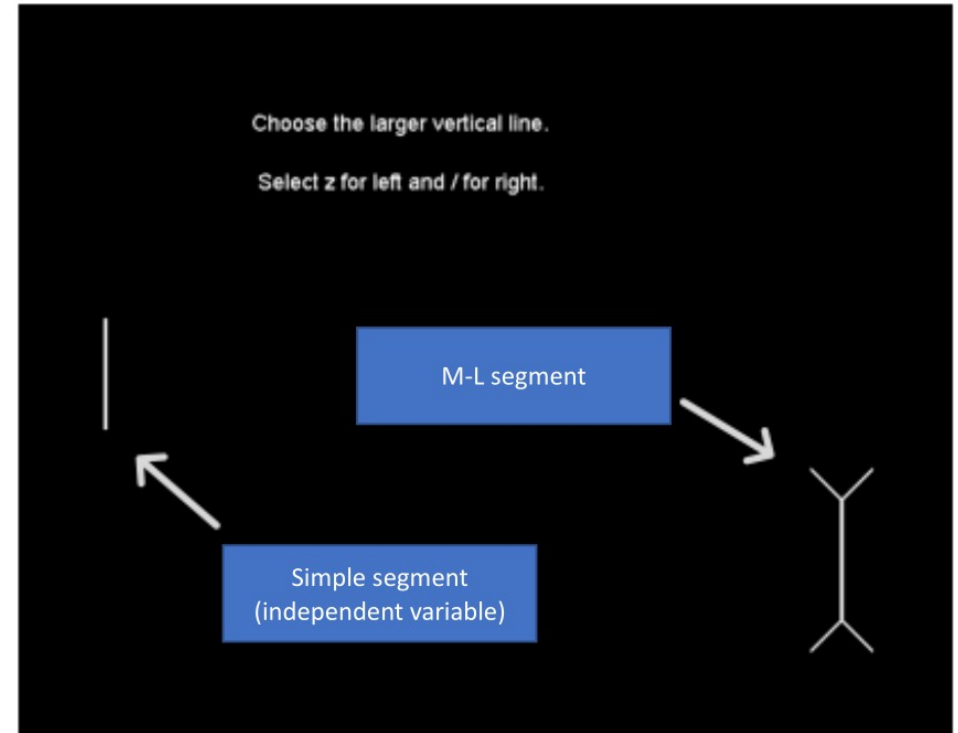
<https://dl1.cuni.cz/course/view.php?id=11781>

Course objectives

- Introduce modern psychophysics and its methods
- Learn main underlying principles
- How to apply principles on your own questions
 - Designing and evaluating your own experiment

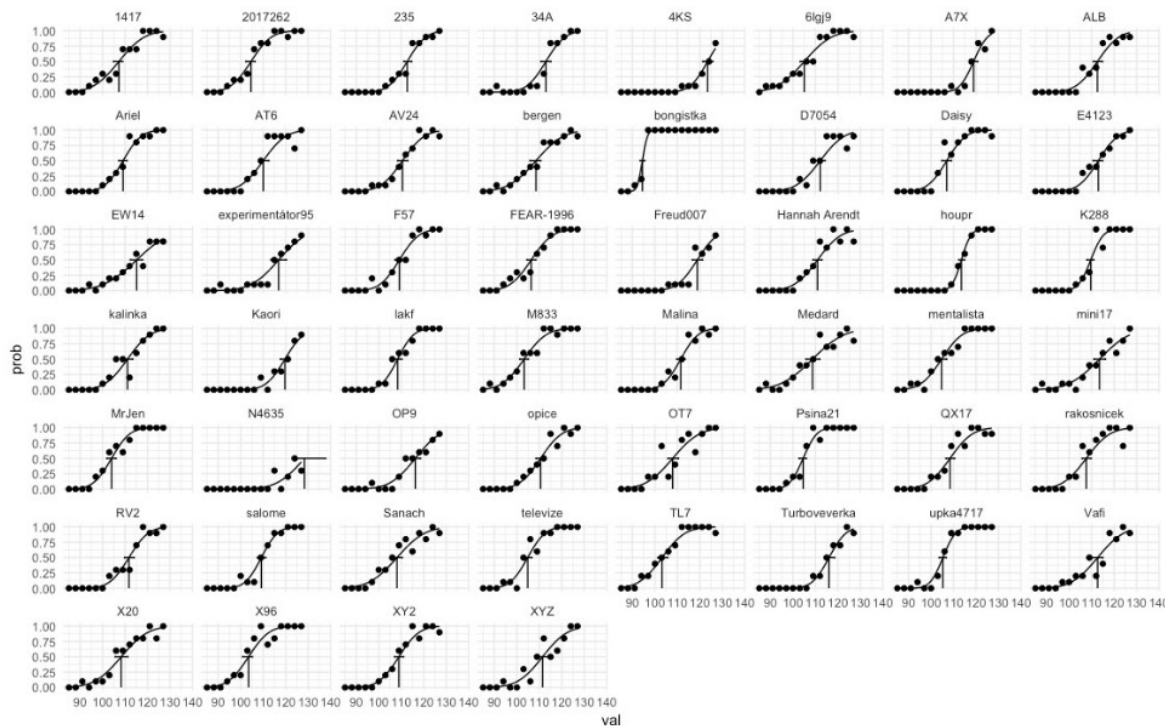
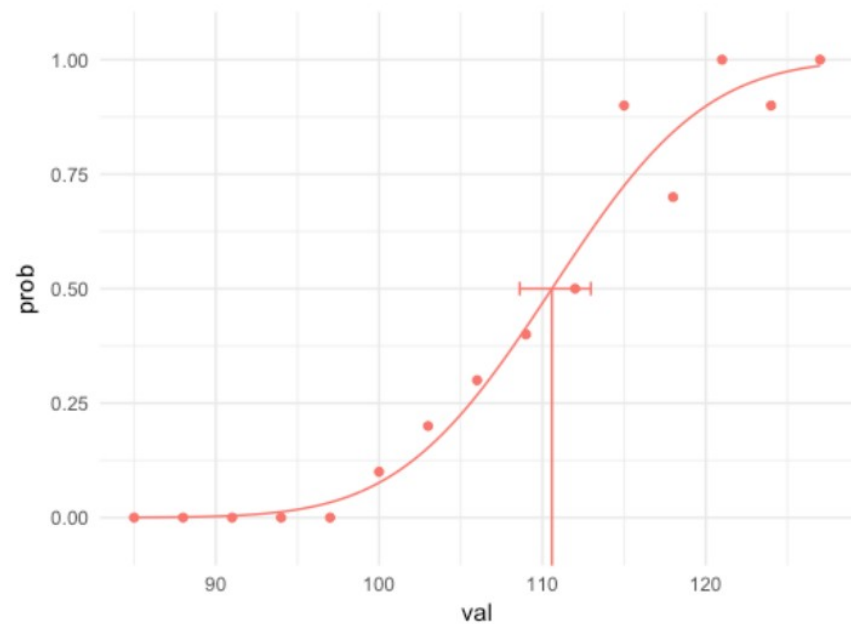
Example (ObPs seminar)

- Müller-Lyer illusion



Ratio of "M-L is longer" responses (dependent variable)

Example (ObPs seminar)



Why psychophysics

- Good foundation for experimental work
- Measurement theories from psychophysics can be applied in other domains (psychometrics)

Semester overview

- 1) Feb 26 – Welcome, Introduction (FD, JL)
- 2) Mar 5 – Psychophysics, methods. (JM)
- 3) Mar 12 – Psychometric function (FD).
- 4) Mar 19 – Adaptive methods (JM).
- 5) Mar 26 – Psychometric function - practice (JL).
- 6) Apr 9 – Signal detection theory (SDT). (FD)
- 7) Apr 16 – Signal detection theory - practice (SDT). (FD)
- 8) Apr 23 – Scaling and similarity measures (FD)
- 9) Apr 30 – Plans for project (JL)
- 10) May 7 – consultations
- 11) May 14 – Project presentation (JL, FD, JM)

Prerequisites

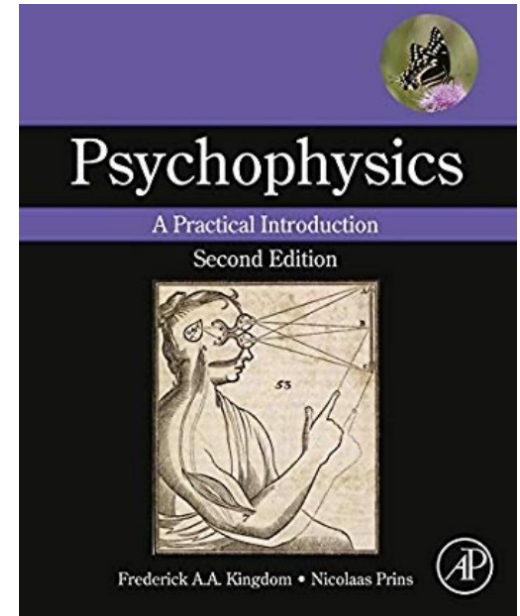
- Not afraid of mathematics and computers
- Basic understanding of statistics (regression),
R basics
- No formal prerequisites, it's up to you

Course completion requirements

- “Zápočet” / Grade
- Miniproject
 - In small groups (pairs)
 - Collect your own data, evaluate results, write short report
 - Important dates
 - Apr 30 – introduce your topic in class
 - May 14 – presentation and brief report (Rmarkdown)

Literature

- Kingdom, F. A. A., & Prins, N. (2016).
Psychophysics: A Practical Introduction.
Academic Press.



Why should I care about psychophysics?

“It is more useful to study one animal for 1000 hours
than to study 1000 animals for one hour”

— B. F. Skinner

Science

Only 36%
of studies
replicated!!

RESEARCH

RESEARCH ARTICLE

PSYCHOLOGY

Estimating psychological

Open Science Collaboration

Reproducibility is a defining feature of current research is unknown. We conducted replications of 100 experimental and correlational studies published in three psychology journals using high-powered designs and original materials when available. Replication effects were half the magnitude of original effects, representing a substantial decline. Ninety-seven percent of original studies had statistically significant results. Thirty-six percent of replications had statistically significant results; 47% of original effect sizes were in the 95% confidence interval of the replication effect size; 39% of effects were subjectively rated to have replicated the original result; and if no bias in original results is assumed, combining original and replication results left 68% with statistically significant effects. Correlational tests suggest that replication success was better predicted by the strength of original evidence than by characteristics of the original and replication teams.

of the process and main-
d project resources. Repli-
data were required to be
order to maximize transpar-
and reproducibility of the
(ezcu).

tations were completed by
hues. There were many dif-
ficulties and analysis strategies
diff. Through consultation
with, obtaining original mate-
rial, replications maintained
original designs. Analyses com-
mon effect size metric (cor-
relation) with confidence intervals

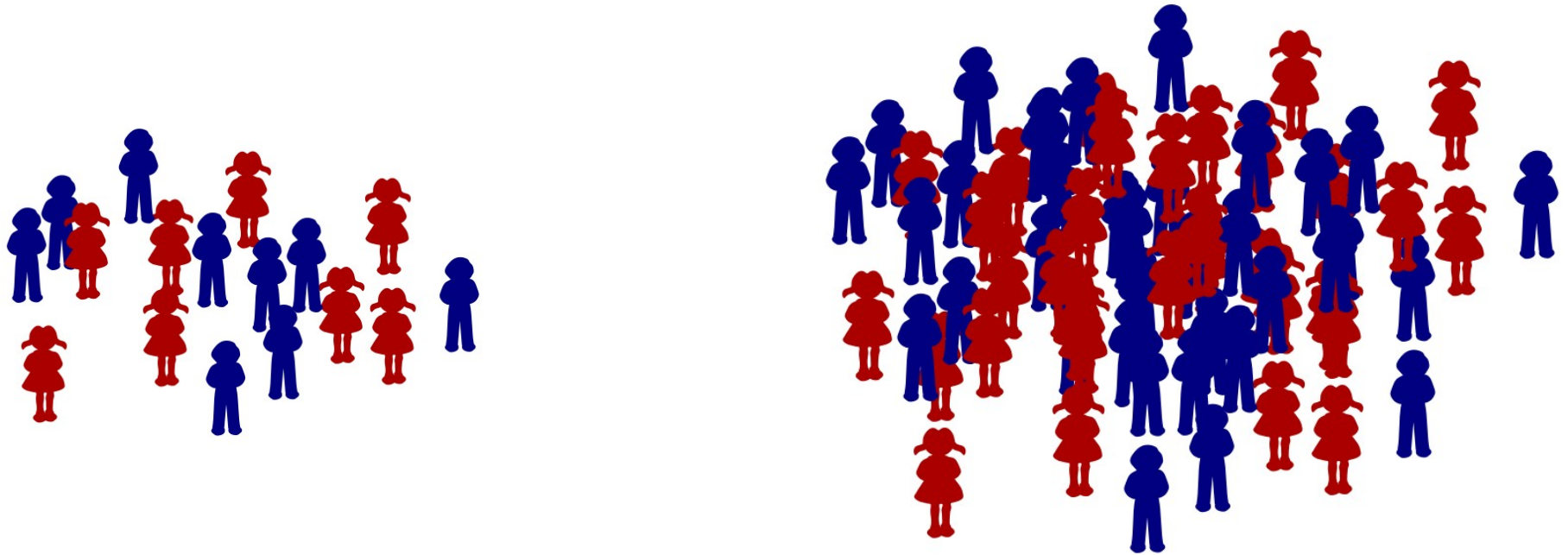
(CIs). The units of analysis for inferences about
reproducibility were the original and replication
study effect sizes. The resulting open data set
provides an initial estimate of the reproducibility
of psychology and correlational data to support
development of hypotheses about the causes of
reproducibility.

Sampling frame and study selection

We constructed a sampling frame and selection

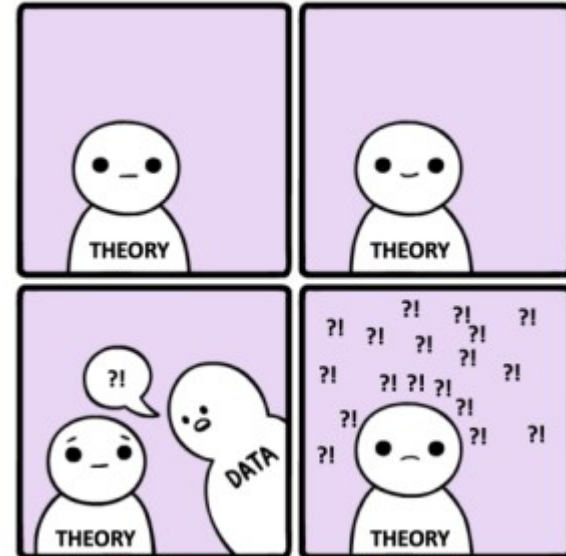
Large samples

- To increase the power of the test, the sample size can be increased



Large samples in research

- In research, we often have
 - Weak theories and models:
"group A will score lower than group B"
 - Weak measurement methods
(questionnaire)
 - Poor experimental
control of variability



Psychophysics I.

- Strong measurement
 - Ratio scales
 - exposure duration, luminance contrast, chromatic contrast, summation area, summation time, motion direction, motion speed, motion coherence, spatial frequency, and orientation
 - Individual thresholds, mappings (psychometric function)
 - Not ordinal (Likert)

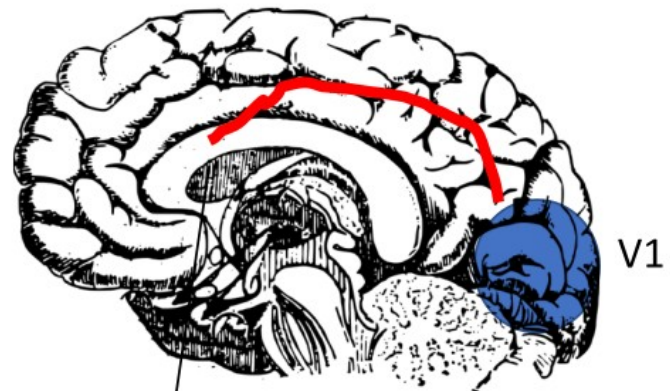
Psychophysics II.

- Strong theories
 - Strong quantitative models
 - e.g., linear systems theory
 - Theoretical concepts for behavioral link
 - threshold, choice probability, sensitivity index
 - Model fitting > Significance testing
 - “does performance in these two conditions differ significantly?” ==> “does my model agree with my data within the limits of my measurement precision?”

Psychophysics III.

- Effective control of error variance
 - Practiced, experienced observers over groups of naive observers
 - We know perceptual learning exists, but we are interested in different things (better within-observer variability)
 - Put all observers at a particular, criterion level of performance in a baseline or reference condition
 - We know people are different, so make the stimuli individually suited

Visual perception



Ha, that's a tree!

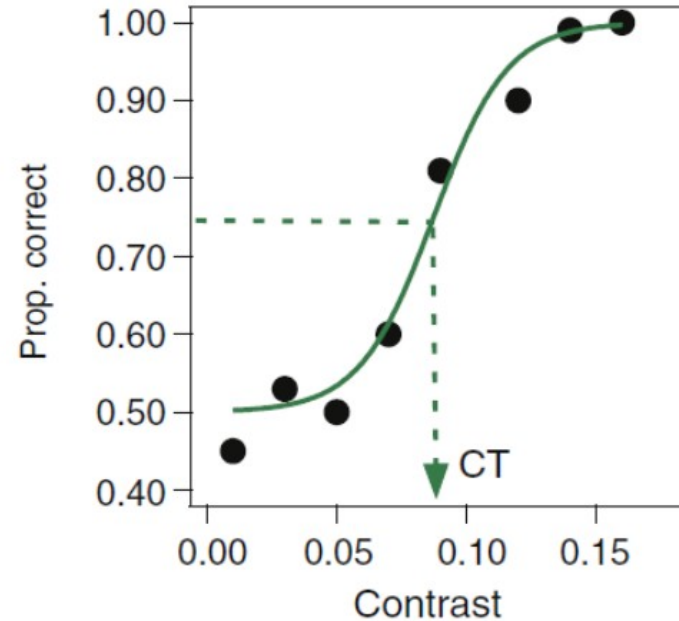
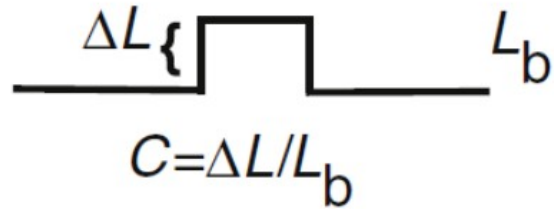


Example - contrast measurement

- You will be presented with a grey screen on which a lighter circle may appear for 100 ms
- Your task is to decide whether or not the circle was present



Example - contrast measurement



Detection and Sensitivity

- **Covid detection**
How to describe the detection abilities of dogs to distinguish between people with and without covid-19?



The dogs trained to sniff out Covid-19

Could specially trained sniffer dogs soon be used to detect coronavirus at airports?

According to a French-Lebanese research team, the animals can detect Covid-19 in almost 100% of cases, after smelling human sweat.

Now they are training 20 dogs belonging to Lebanon's security forces to screen arrivals at Beirut airport.

If the trial is successful, the researchers hope it could be rolled out at airports around the world.

Video by Colm O'Molloy. Producer Hour Matraji.

© 12 October 2020 | [BBC News](#) | [Middle East](#)

Another application



Mistakenly Seeking Solitude

Nicholas Epley and Juliana Schroeder
University of Chicago

Connecting with others increases happiness, but strangers in close proximity routinely ignore each other. Why? Two reasons seem likely: Either solitude is a more positive experience than interacting with strangers, or people misunderstand the consequences of distant social connections. To examine the experience of connecting to strangers, we instructed commuters on trains and buses to connect with a stranger near them, to remain disconnected, or to commute as normal (Experiments 1a and 2a). In both contexts, participants reported a more positive (and no less productive) experience when they connected than when they did not. Separate participants in each context, however, expected precisely the opposite outcome, predicting a more positive experience in solitude (Experiments 1b and 2b). This mistaken preference for solitude stems partly from underestimating others' interest in connecting (Experiments 3a and 3b), which in turn keeps people from learning the actual consequences of social interaction (Experiments 4a and 4b). The pleasure of connection seems contagious: In a laboratory waiting room, participants who were *talked to* had equally positive experiences as those *instructed* to talk (Experiment 5). Human beings are social animals. Those who misunderstand the consequences of social interactions may not, in at least some contexts, be social enough for their own well-being.

Epley, N., & Schroeder, J. (2014). *Mistakenly seeking solitude*.
Journal of Experimental Psychology: General, 143(5), 1980.

How to know the other is interested?

- There are different strategies:
 - “If he blinks and smiles, he's interested.”
 - “I don't want to be wrong, so I'd rather assume he's not interested.”
 - “He's breathing, so he's obviously interested.”

For this type of analysis we can use
Signal Detection Theory (SDT)

What will be the content of this course?

Theory

Applied

Psychophysics

SDT

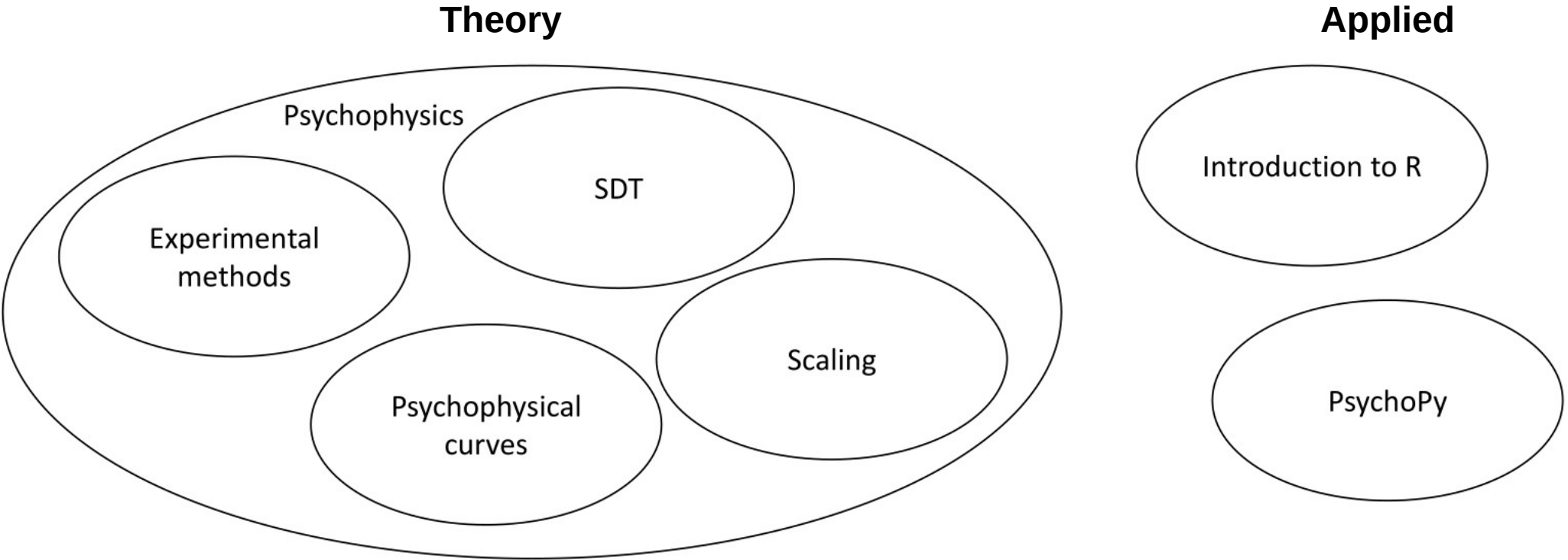
Experimental
methods

Psychophysical
curves

Scaling

Introduction to R

PsychoPy



What about you?

- Expectations?
- What do you want to learn?