Towards cumulative evidence and reproducible meta-analyses

Introduction and demonstration of PsychOpen CAMA

Research Synthesis Conference, May 20th, 2021

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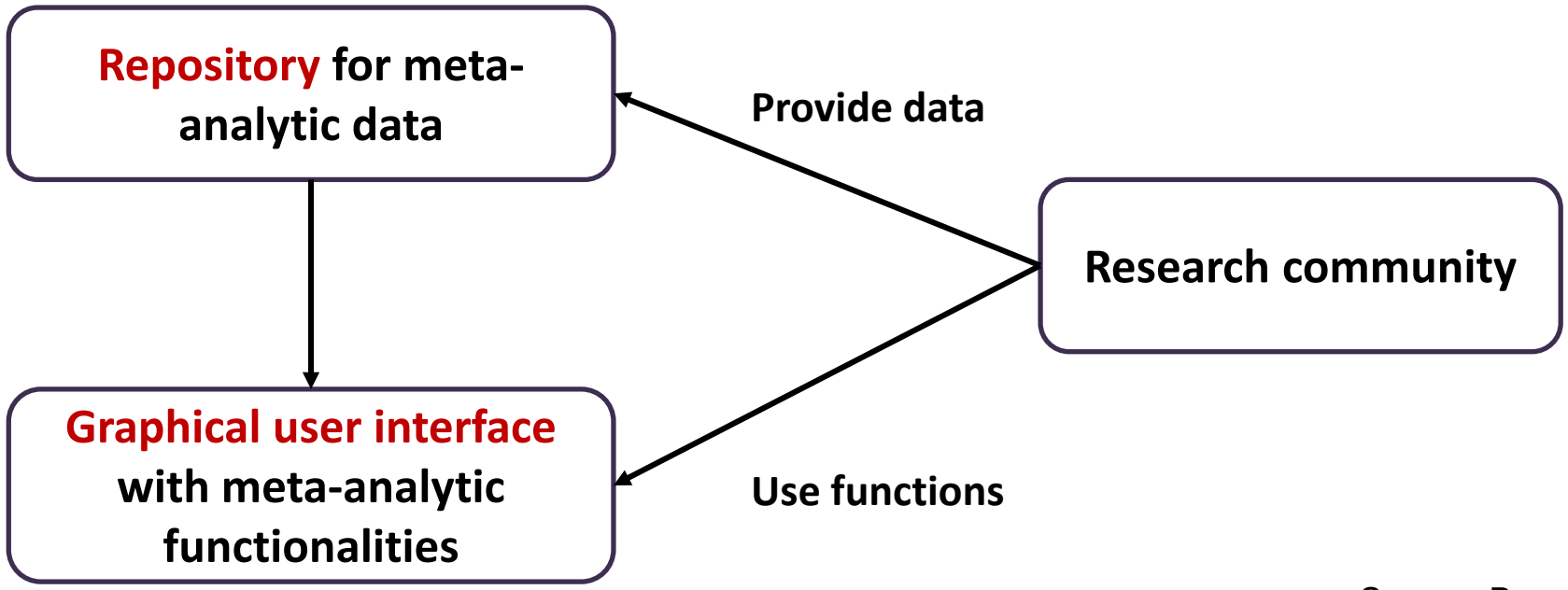
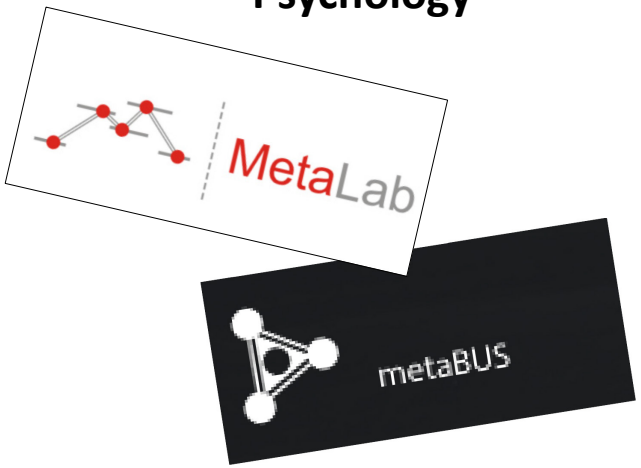
The basic concept of CAMA

CAMA = Community **A**ugmented **M**eta-**A**nalysis

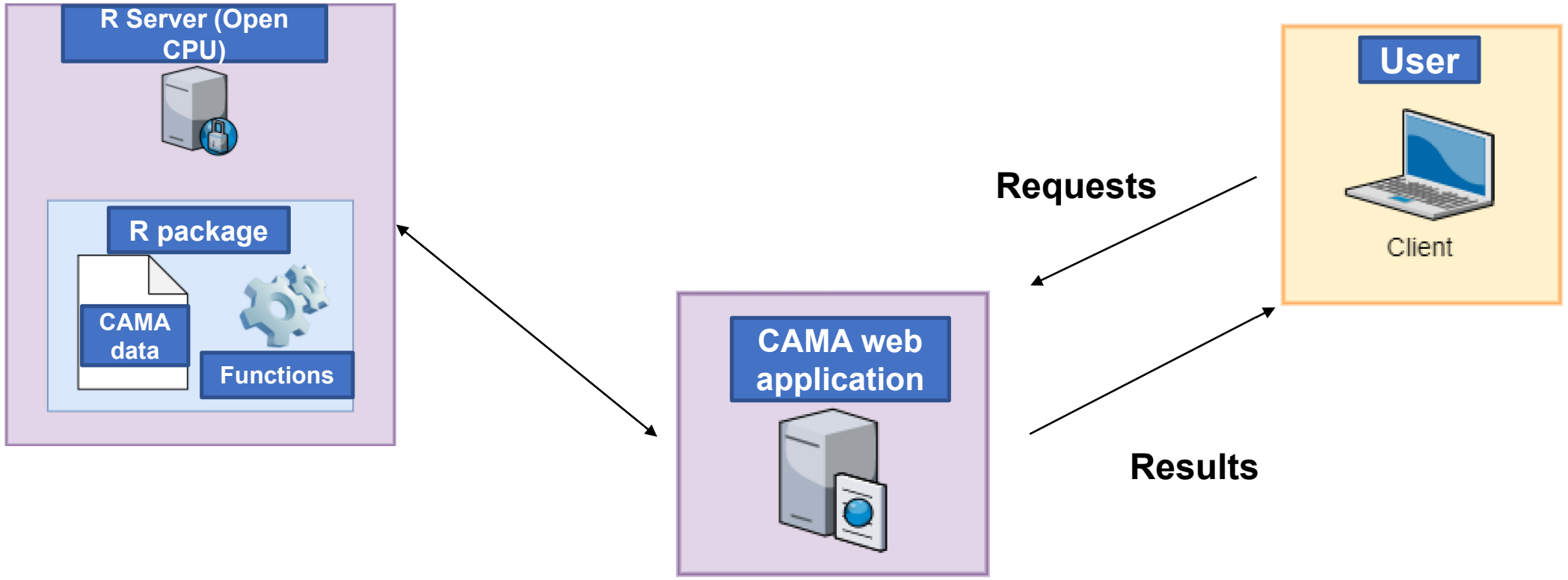


Other CAMA systems in Psychology



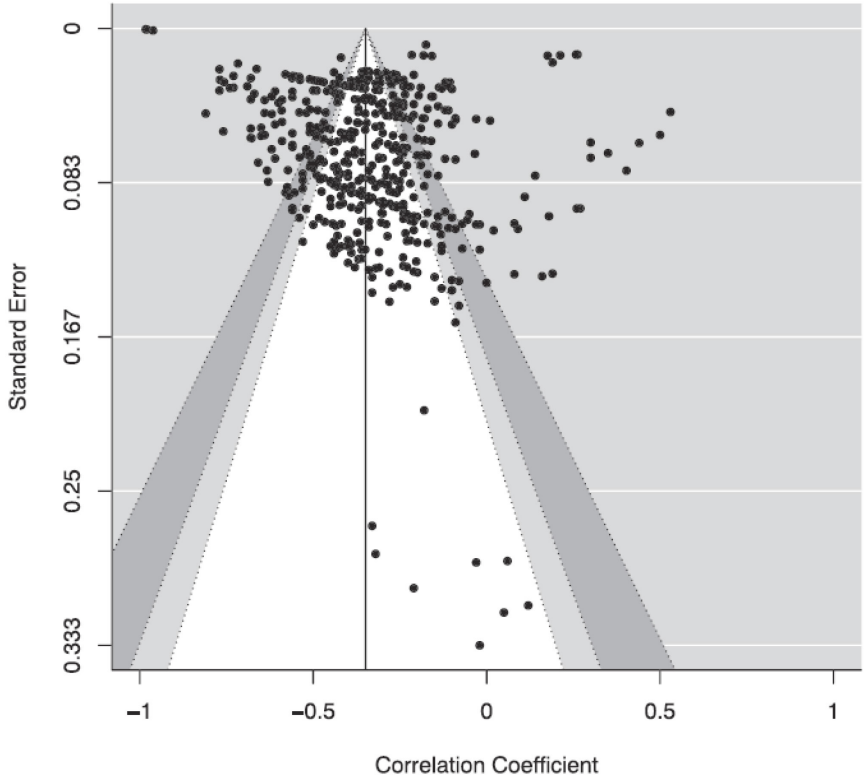
Source: Burgard, Bosnjak, & Studtrucker (2021), Tsuji, Bergmann, & Cristia (2014)

The architecture of PsychOpen CAMA



Source: Burgard, Bosnjak, & Studtrucker (under review)

Starting point: Print publication and results



Source: Emmer, Bosnjak, & Mata (2020)

Received: 14 March 2019 | Revised: 26 June 2019 | Accepted: 14 July 2019
DOI: 10.1111/obr.12935

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The association between weight stigma and mental health: A meta-analysis

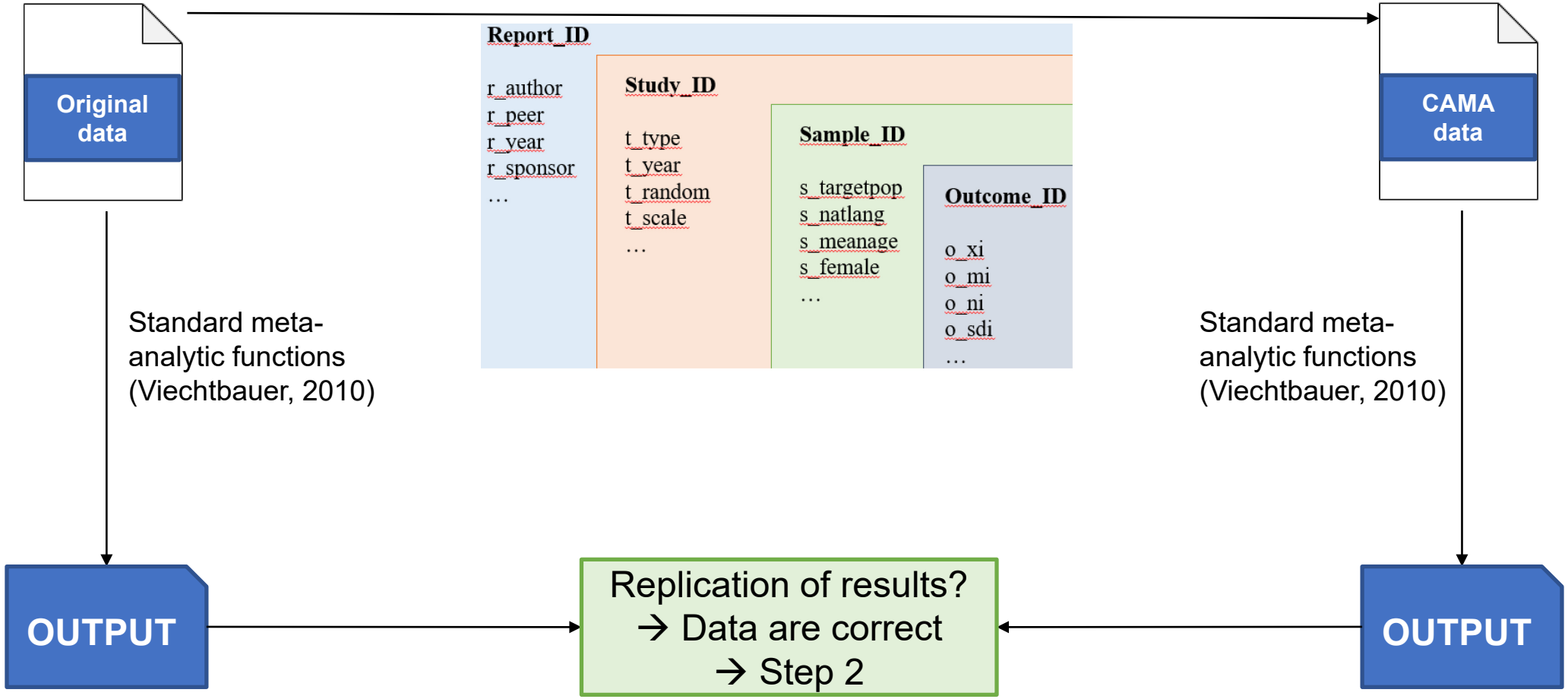
Christine Emmer[1] | Michael Bosnjak[2] | Jutta Mata[1]

Separate Three-Level Meta-Analyses Under Random Effects Assumption for the Types of Weight Stigma and Mental Health

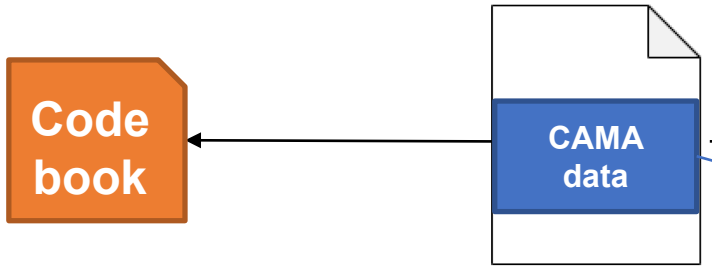
Stigma type	*r*	*k*	95% CI	σ^2_1	σ^2_2	ρ	Residual heterogeneity
Self-stigma	-.39***	222	[-.43, -.34]	.18	.12	.69	$Q(221) = 4{,}492.51$***
Public stigma	-.33***	241	[-.36, -.29]	.09	.12	.37	$Q(240) = 57{,}537.80$**
Structural stigma	-0.28***	8	[-.37, -.19]	.08	.00	1.00	$Q(7) = 18.26$**
Implicit stigma	-0.17***	11	[-.24, -.09]	.00	.00	.29	$Q(10) = 6.00$

Note. To investigate the exploratory Research Question 1, separate meta-analyses were conducted for the different types of weight stigma and mental health outcomes: for (1) self-stigma, (2) public stigma, (3) structural stigma, and (4) implicit stigma. *r* = Pearson's product moment correlation; *k* = number of effect sizes; CI = confidence interval; σ^2 variance within studies (Level 2); σ^2_2 = variance between studies (Level 3); ρ = intraclass correlation coefficient. * $p < .05$; ** $p < .01$; *** $p < .001$.

Implementation in PsychOpen CAMA: Step 1



Implementation in PsychOpen CAMA: Step 2



Codebook for the CAMA dataset: Weight Stigma

Name	Label
report_ID	uniquely identifies a report
r_author	Name of first author
r_year	publication year
r_peer	Peer-reviewed publication
r_sponsor	Study funding
study_ID	uniquely identifies a study
t_design	research design of the study
sample_ID	uniquely identifies a sample
s_size	number of subjects
s_country	country of data collection

Json-file

```
"datensatz": {
  "name": "Weight stigma and mental health",
  "data_name": "CAMA_Weight",
  "domain": "Social Psychology",
  "metaanalysis_type": "standard",
  "moderators": [
    {"type": "num", "value": "s_BMI","label": "Mean BMI
```

+ Type of effect size
+ Analysis levels
+ Primary studies included

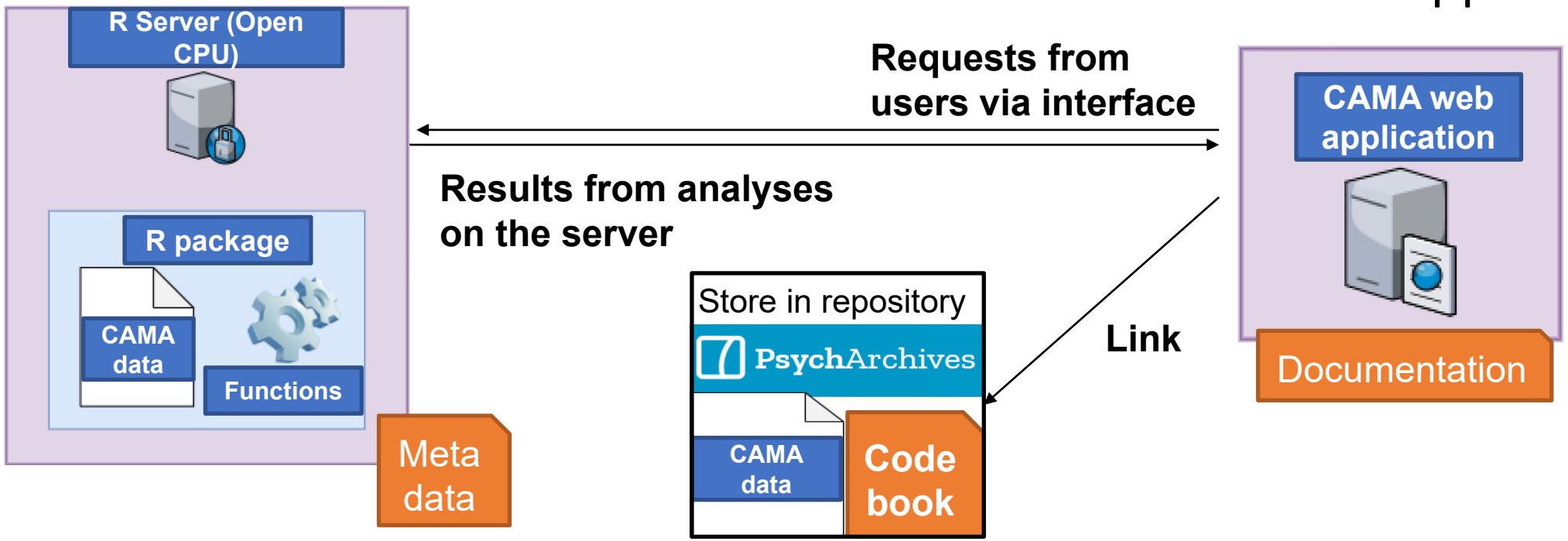
```
funnelPLot <- function(yi,vi,measure,d,effectName="Effect") {

  library(metafor)
  dat<-get(d)

  rma_model <- rma.uni(yi=dat[,yi],vi=dat[,vi],measure=measure)
```

The metadata information is necessary to make the function generic for multiple datasets

Implementation in PsychOpen CAMA: Step 3

Data and metadata
→ package

Documentation
→ Webapp



Replication in the webapp

→ Live Demonstration

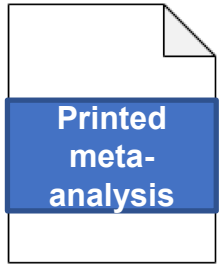
Further Challenges

- Automation of data implementation and update
  - Relies on cooperation of the research community
  - Data submission via Submission Assistant in PsychArchives
  - Quality control needed!
- Implementation of further methodological approaches with different data structures
  - Network Meta-analysis
  - AD-IPD
  - MASEM

Recommended further reading

- Bastian, H., Glasziou, P., & Chalmers, I. (2010). Seventy-five trials and eleven systematic reviews a day: How will we ever keep up? *PLoS Medicine*, *7*(9), e1000326. https://doi.org/10.1371/journal.pmed.1000326
- Burgard, T., Bosnjak, M., & Studtrucker, R. (2021). Community-Augmented Meta-Analyses (CAMAs) in Psychology. Potentials and Current Systems. *Zeitschrift für Psychologie,* 229, 15-23. https://doi.org/10.1027/2151-2604/a000431
- Burgard, T., Bosnjak, M., & Studtrucker, R. (under review). PsychOpen CAMA: Publication of Community-Augmented Meta-Analyses in Psychology. *Research Synthesis Methods.*
- Emmer, C., Bosnjak, M., & Mata, J. (2020). The association between weight stigma and mental health: A meta-analysis. Obesity reviews : an official journal of the International Association for the Study of Obesity, 21(1), e12935. https://doi.org/10.1111/obr.12935
- Haddaway, N. R. (2018). Open synthesis: On the need for evidence synthesis to embrace open science. *Environmental Evidence*, *7*(1), 4–8. https://doi.org/10.1186/s13750-018-0140-4
- Tsuji, S., Bergmann, C., & Cristia, A. (2014). Community-augmented meta-analyses: Toward cumulative data assessment. *Perspectives on Psychological Science, 9*(6), 661–665. https://doi.org/10.1177/1745691614552498
- Viechtbauer, W. (2010). Conducting meta-analyses in R with the metafor package, *Journal of Statistical Software, 36* (3), 1-48. http://dx.doi.org/10.18637/jss.v036.i03

From static to dynamic meta-analyses



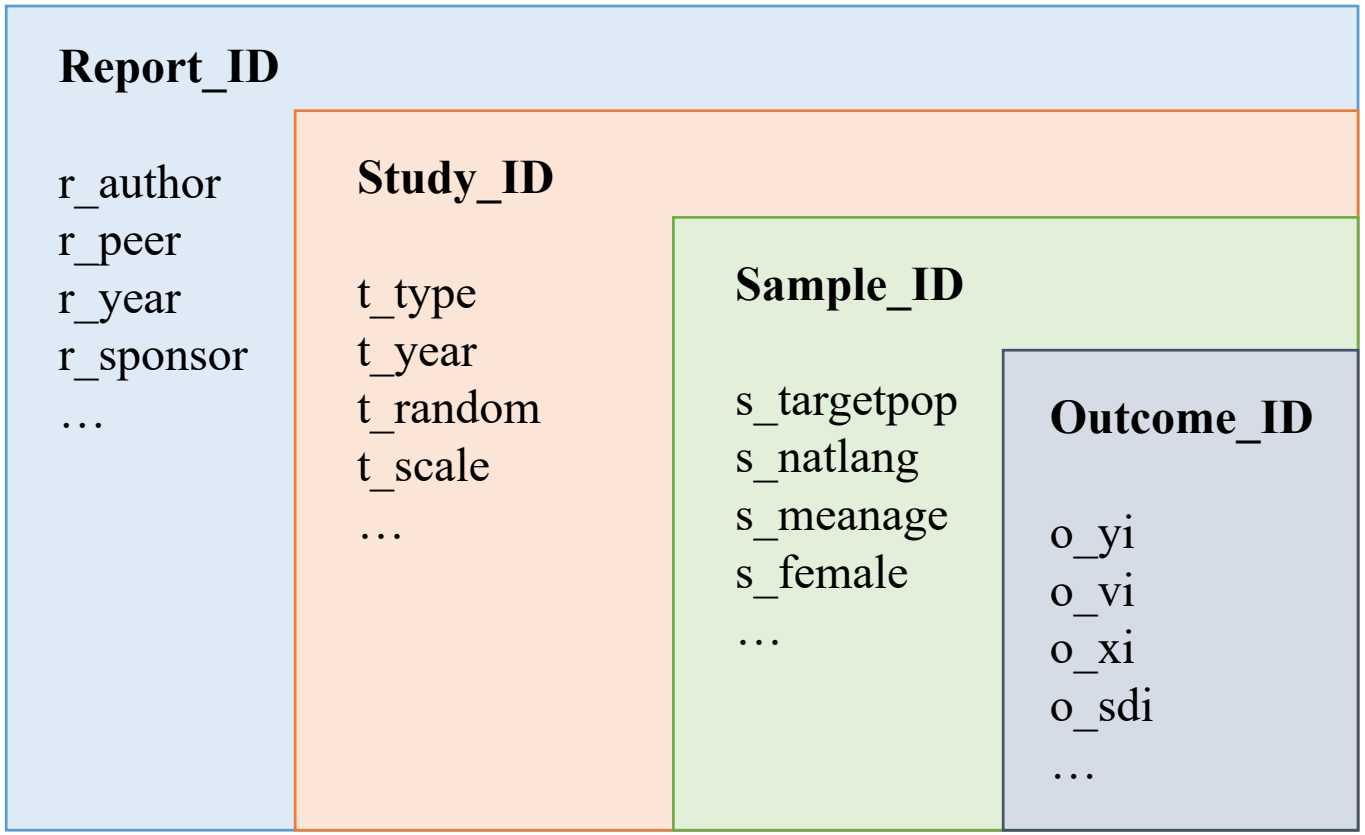
Requirements:
Access to complete meta-analytic data & thorough documentation of methodology

- **Fixed**: Interpretation and discussion of results under certain methodological assumptions and decisions
- **Static**: Overview on a research question at a certain point in time

Source: Haddaway (2018),
Bastian, Glasziou, & Chalmers (2010)

- **Flexible**
  - Analyses can be replicated
  - Robustness of results can be checked by varying subjective decisions
- **Dynamic**
  - Data can be re-used for other analysis purposes
  - Data can be updated more efficiently and faster

Data template



Information is collected on different levels. If data are nested, dependencies are automatically accounted for by using a multilevel model

The naming of study outcomes and the type of effect size measure used in the meta-analysis (in the metadata) follows the metafor package (Viechtbauer, 2010). As we use this package as the basis for effect size calculation and most of the meta-analytic outputs, consistent naming makes life easier.

Metadata


```
{
  "datensatz": {
    "name": "Weight stigma and mental health",
    "data_name": "CAMA_Weight",
    "domain": "Social Psychology",
    "metaanalysis_type": "standard",
    "moderators": [
      {"type": "num", "value": "s_BMI","label": "Mean BMI Sample"},
      {"type": "num", "value": "s_meanage", "label": "Mean Age Sample"},
      {"type": "num","value": "s_female","label": "Proportion of females"},
      {"type": "cat", "value": "r_peer","label": "Peer-reviewed"},
      {"type": "cat","value": "s_coping","label": "Type of coping strategy"},
      {"type": "cat","value": "o_uvtype","label": "Type of stigma assessed"},
      {"type": "cat","value": "o_avdomain","label": "Type of mental health out
    ],
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      "label": "COR",
      "variable_labels": [
        {
          "name": "pearson_r",
          "data_label_yi": "o_ri",
          "varianz_label_vi": "o_ri_var"
        }
      ]
    },
    "analysis_levels": [
      "outcome_ID", "study_ID"
    ]
```


Generic Function

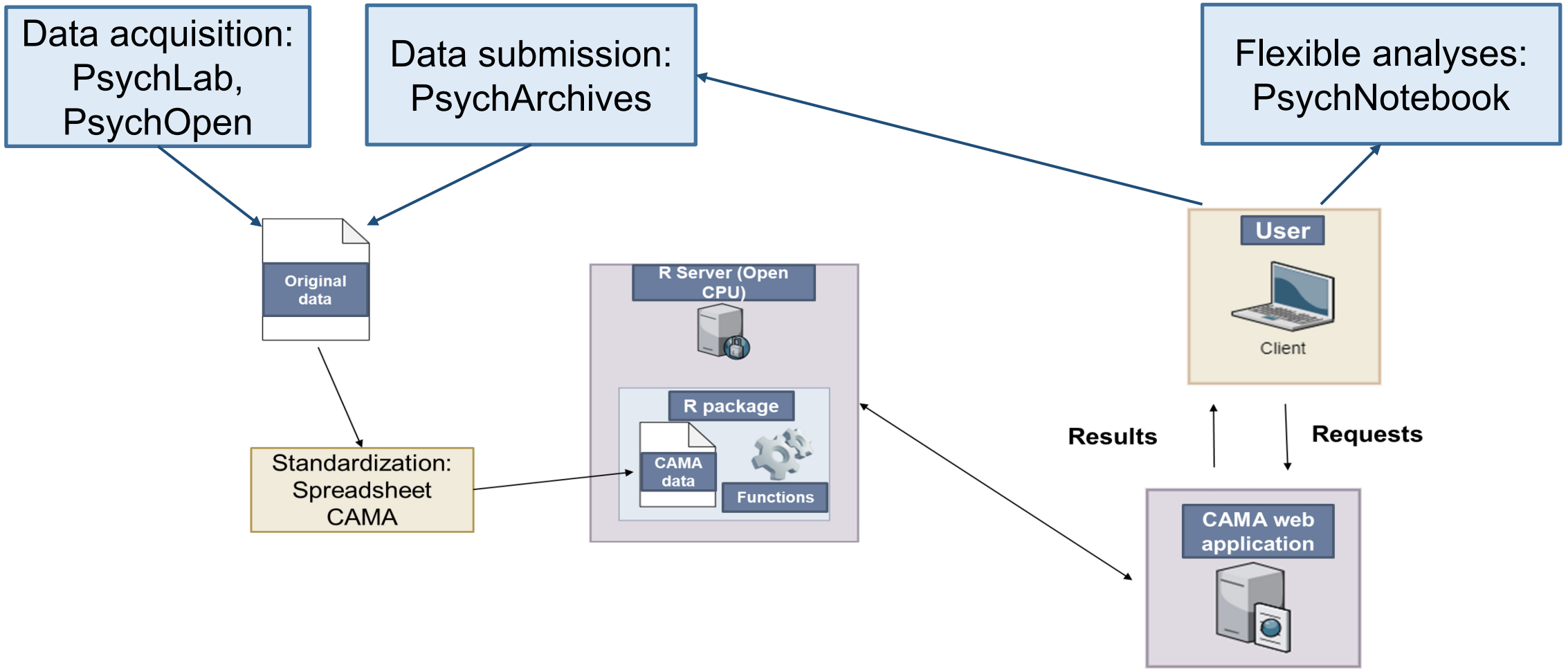
```r
funnelPLot <- function(yi,vi,measure,d,effectName="Effect") {

  library(metafor)
  library(metaviz)

  dat<-get(d)

  rma_model <- rma.uni(yi=dat[,yi],vi=dat[,vi],measure=measure)
  RTest <-regtest(x=rma_model)

  metafor::funnel(rma_model, yaxis="sei") # 'label'
  metafor::funnel(rma_model, level=c(90, 95, 99), shade=c("white", "orange", "red"), refline=0, legend=TRUE)

  return(RTest)
}
```

Synergy effects with other ZPID services