## Calculating ES for your MA

19 November 2021 Modern Possarch Mothe

Modern Research Methods

### Logistics

- Poster draft due Tuesday (11/23, noon)
  - Should include 4 key figures and text
  - Along with your poster, submit the markdown that you used to create your plots
- 1 markdown and 1 poster per group (1 person from each group should turn in html of markdown on Canvas)
- In person poster session (4:30-6pm on Thursday, 12/2)

### Raw data to visualizations

( 🛧 -

### Group 2 MA data 🛛 🕁 💿 📀 Ħ

File Edit View Insert Format Data Tools Extensions Help Last edit was made yesterday at 4:00 PM by Carla Reyes

🗠 🚈 🖶 🚏 100% 🗸 💲 % .0\_ .00 123- Arial ▼ 10 ▼ B I S A ◆ 田 昭 ▼ 三▼ ± ▼ ├ ▼ ♡ ▼ …

| 1  | • JX  | coder          |                |                    |                  |                 |                |          |                |
|----|-------|----------------|----------------|--------------------|------------------|-----------------|----------------|----------|----------------|
|    | А     | В              | С              | D                  | E                | F               | G              | н        | 1              |
| 1  | coder | unique_id      | long_cite      | paper_elligibility | exclusion_reason | short_cite      | source_of_data | expt_num | expt_condi     |
| 10 | chloe | carr2015       | Carr, J. W. It | include            |                  | Carr, J. W      | figure         | 2        | chain K        |
| 11 | chloe | carr2015       | Carr, J. W. It | include            |                  | Carr, J. W      | figure         | 2        | chain L        |
| 12 | chloe | carr2015       | Carr, J. W. It | e include          |                  | Carr, J. W      | figure         | 2        | chain I        |
| 13 | chloe | carr2015       | Carr, J. W. It | include            |                  | Carr, J. W      | figure         | 2        | chain J        |
| 14 | chloe | carr2015       | Carr, J. W. It | include            |                  | Carr, J. W      | figure         | 2        | chain K        |
| 15 | chloe | carr2015       | Carr, J. W. It | include            |                  | Carr, J. W      | figure         | 2        | chain L        |
| 16 | chloe | carr2015       | Carr, J. W. It | include            |                  | Carr, J. W      | figure         | 1        | chain A        |
| 17 | chloe | carr2015       | Carr, J. W. It | include            |                  | Carr, J. W      | figure         | 1        | chain B        |
| 18 | chloe | carr2015       | Carr, J. W. It | include            |                  | Carr, J. W      | figure         | · 1      | chain C        |
| 19 | chloe | carr2015       | Carr, J. W. It | include            |                  | Carr, J. W      | figure         | 1        | chain D        |
| 20 | chloe | carr2015       | Carr, J. W. It | include            |                  | Carr, J. W      | figure         | 2        | chain I        |
| 21 | chloe | carr2015       | Carr, J. W. It | include            |                  | Carr, J. W      | figure         | 2        | chain J        |
| 22 | chloe | carr2015       | Carr, J. W. It | include            |                  | Carr, J. W      | figure         | 2        | chain K        |
| 23 | chloe | carr2015       | Carr, J. W. It | include            |                  | Carr, J. W      | figure         | 2        | chain L        |
| 24 | chloe | carstensen2015 | Carstensen,    | include            |                  | Carstensen, A.  | paper          | 1        | color          |
| 25 | chloe | carstensen2015 | Carstensen,    | include            |                  | Carstensen, A., | paper          | 1        | color          |
| 26 | chloe | carstensen2015 | Carstensen,    | include            |                  | Carstensen, A., | paper          | 1        | spatial relati |
| 27 | chice | caretoneon2015 | Caretoneon     | include            |                  | Caretoneon A    | nanor a        | . 1      | enatial relati |

### A meta-analysis of the mutual exclusivity effect in word learning [TEMPLATE]

Method

Results

2 4 6 8 10

**Conclusion and Next Steps** 

· Meta-analytic approach

using term "mutual exclusivity"

experience with objects, etc.

relative to familiar object

R (Viechtbauer, 2019)

50 effect sizes

[1.06, 1.75]

analyses)

Some evidence for

publication bias

Overall effect size is 1.41

· Effect is bigger in X than

larger (moderator

Y, and is larger when X is

type

· Conducted database search on google scholar

proportion of children selecting the novel object

· Coded moderators: object type, demographic

· Estimated effect size using metafor package in

Inclusion criteria: child participants, no prior

Calculated effect size (Cohen's d) as the

Molly Lewis and other group members **Carnegie Mellon University** Modern Research Methods

### Background

 Mapping a word to its referent is an under-constrained learning problem. One of the mechanisms hypothesized to constrain the problem is a bias to map novel words to novel objects termed the "Mutual exclusivity (ME) effect"

### zot



 Seminal Paper: Markman & Wachtel, 1988 Conducted the ME paradigm with 3 and 4 year olds, and found that older but not younger children have shown the effect (+ additional methodological details)

· Since 1988, paper cited over 1000 times, and replicated with many methodological changes E.g., if there's space briefly describe 1

other methodological version that have been conducted since the original

### Research Goal: Evaluate the degree of publication bias in the ME literature. estimate the size of the effect, and examine potential moderators.

· Mutual exclusivity is a robust effect with a large effect size. There is little evidence for publication bias Next steps: Explore additional moderators (which ones?).

and code remaining papers (how many?).

rences: Markman, E. M., & Wachtel, G. F. (1988). Children's RE Mode use of mutual exclusivity to constrain the meanir of words. Cognitive Psychology, 20(2), 121-157. Viechtbauer, W. (2010). Conduction mat-R with the metafor package. Journal of Statistical Software, 36(3), 1-48. URL: ra/v36/103/



Choi & Hwang (2014) Choi & Hwang (2014) Choi & Hwang (2014) Davidson et al (1997) Davidson et al (1997) sed Full-text articles excl with reasons (n = 75) Davidson et al (1997) Davidson et al (1997) Deak, Yen, & Petti (2001) Deak, Yen, & Petti (2001) Estis & Beverly (2015) Estis & Beverly (2015) Estis & Beverly (2015) H+++ Estis & Beverly (2015) H-----Evey & Merriman (1998) Even & Merriman (1996 <u>E I I I I</u> Evey & Merriman (1998) ME effect size by Besponse mode Evey & Merriman (1998) Frank (1999) Frank (1999) Frank (1999) Frank (1999) Gollek & Doherty (2016) Gollek & Doherty (2016) Gollek & Doherty (2016) Gollek & Doherty (2016) Golek & Doherty (2016) Golek & Doherty (2016) Golek & Doherty (2016) Golek & Doherty (2016) Colek & Doherty (2016) Gollek & Doherty (2016) Gollek & Doherty (2016) Golek & Doherty (201 Graham et al. (1998) Graham et al. (2009) Graham et al. (2009) Graham et al. (2009) Grassmann & Tomasello (2010 Grassmann & Tomasello (2010)

Study

through other sources (n = 10)

database searching (n = 500)

ll-text articles asso for eligibility (n = 103)

tudies included meta-analysis (n = 30)

27

Beford et al (2013)

Beford et al (2013) Beverly & Estis (2003) Beverly & Estis (2003)

Beverly & Estis (2003)

Bion, Borovsky, & Fernald (2013)

Bion, Borovsky, & Fernald (2013

Bion, Borovsky, & Fernald (2013) Bion, Borovsky, & Fernald (2013) Byers-Heinlein & Werker (2009) Byers-Heinlein & Werker (2009)

Byers-Heinlein & Werker (2009)

Byers-Heinlein & Werker (2013)

Estimate (95% CI)

4.00 [ 2.94, 5.06]

3.00 [2.17, 3.83] 2.59 [0.76, 4.41] 4.50 [1.58, 7.42]

4.88 [ 1.73, 8.03]

0.14 [-0.28, 0.56] 0.14 [-0.28, 0.58] 1.15 [0.65, 1.66] 1.29 [0.69, 1.88] 0.42 [-0.09, 0.93] -0.12 [-0.62, 0.37]

0.67 [0.12, 1.21]

0.20[-0.24, 0.64]

0.20 [-0.24, 0.64] 1.65 [0.84, 2.45] 1.91 [1.06, 2.76] 0.55 [0.02, 1.07] 0.77 [0.21, 1.32] 0.62 [0.09, 1.16]

0.38 [-0.14, 0.87]

1.64 [0.97, 2.31] 1.92 [1.18, 2.65] 0.23 [-0.47, 0.93] 6.57 [3.28, 9.87]

3.00 [ 1.37, 4.63]

4.09 [ 1.97, 6.21]

0.73 [0.09, 1.36]

1.48 [0.66, 2.29] 1.52 [0.69, 2.35] 1.74 [0.64, 2.83] 1.89 [0.94, 2.83]

2.00 [ 0.80, 3.20]

0.67 [0.24, 1.09]

0.81 [0.39, 1.24] 0.52 [ 0.13, 0.91] 0.87 [ 0.46, 1.29] 0.20 [-0.24, 0.64]

0.89 [0.42, 1.35]

3.58 [2.42, 4.75]

5.57 [3.87, 7.27]

5.57 [3.87, 7.27] 0.38 [-0.06, 0.83] 0.17 [-0.24, 0.58] 9.35 [ 5.96, 12.73] 1.49 [0.70, 2.28]

-0.61 [-1.17, -0.06] 0.67 [0.07, 1.27]

0.87 [0.07, 1.27] 0.82 [0.40, 1.23] 0.95 [0.44, 1.47] 1.12 [0.59, 1.85] 2.12 [1.36, 2.87]

1.53 [ 0.70, 2.36]

1.72 [ 0.83, 2.61]

1.41 [ 1.06, 1.75]

## Step 1: Make sure your data sheet is "clean" and ready for analysis in R

- All missing values should be NA
- Clean up categorical variable levels (no more than ~4 levels per variable)
  - Don't delete old original variables! Just make a new one.
- Variables that are numbers (e.g., age) should be numbers (23 months -> 23)
- No ranges (.1-.3 -> .2 )

### Step 2: Calculate effect sizes in R

- Download data file as csv to your local computer
- Make a copy of R script titled "calculate\_ES.R" in your folder
- Use tidyverse functions to do any additional cleanup on your data
  - Use filter to get the rows where paper eligibility is "include"
  - Use **select** to get rid of the columns that are empty/irrelevant
  - Use mutate to convert SEs to SDs (SD = SE\*sqrt(n))
  - Impute missing SDs (talk to me about this)
  - For groups that are using a theoretical baseline, SD\_2 = SD\_1

### Step 2: Calculate effect sizes in R

- We want point estimates and confidence intervals for effect sizes for each row
  - metafor is the package for construction meta-analytic models
  - It requires two variables: d\_calc (point estimates) d\_var\_calc (for computing confidence intervals)
- Add two new columns to your dataframe: d\_calc and d\_var\_calc
- Write dataframe to new csv titled "MA\_data\_with\_ES.csv"

# Step 3: Fit MA models and make four plot types

- Make copy of "Final\_project\_analyses\_template.Rmd" in your folder
- Fit meta-analytic model
- Make PRISMA plot
- Make forest plot
- Make funnel plot
- Explore moderators, and make plots

### Questions to ask yourself

- Are there any extreme outliers? Go back and check your coding.
- How big is the effect size? How does it compare to other ES in psychology?
- What are the limitations of your approach? What would make your analyses better?



- <u>Step 1</u>: Make sure your data sheet is "clean" and ready for analysis in R
- <u>Step 2:</u> Calculate effect sizes in R
- <u>Step 3:</u> Fit MA models and make four plot types