

Dynamically aggregating evidence in community-augmented meta-analyses

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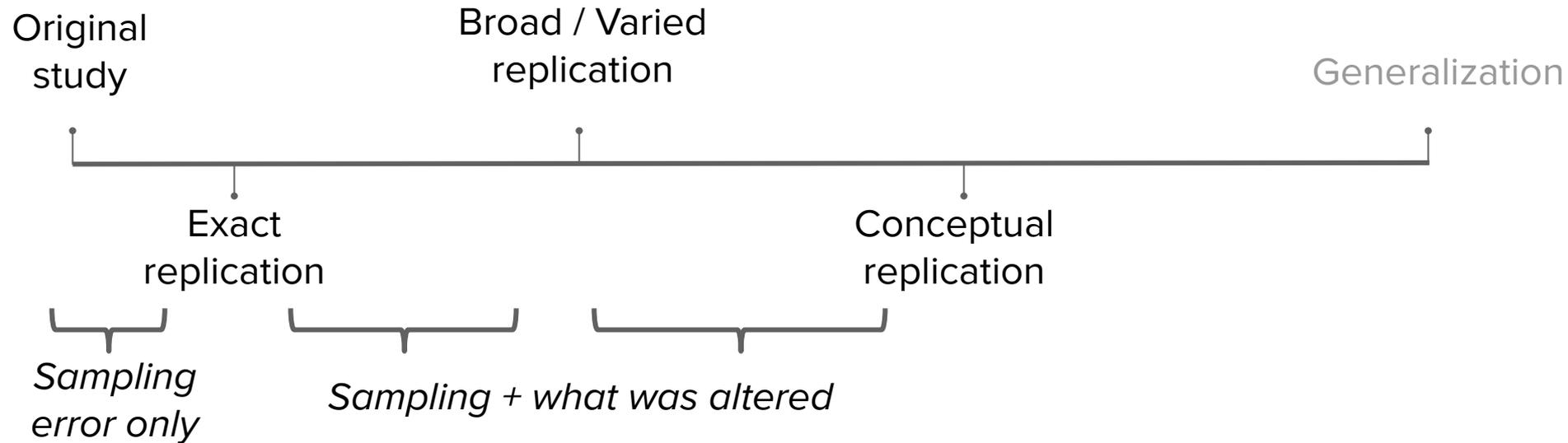
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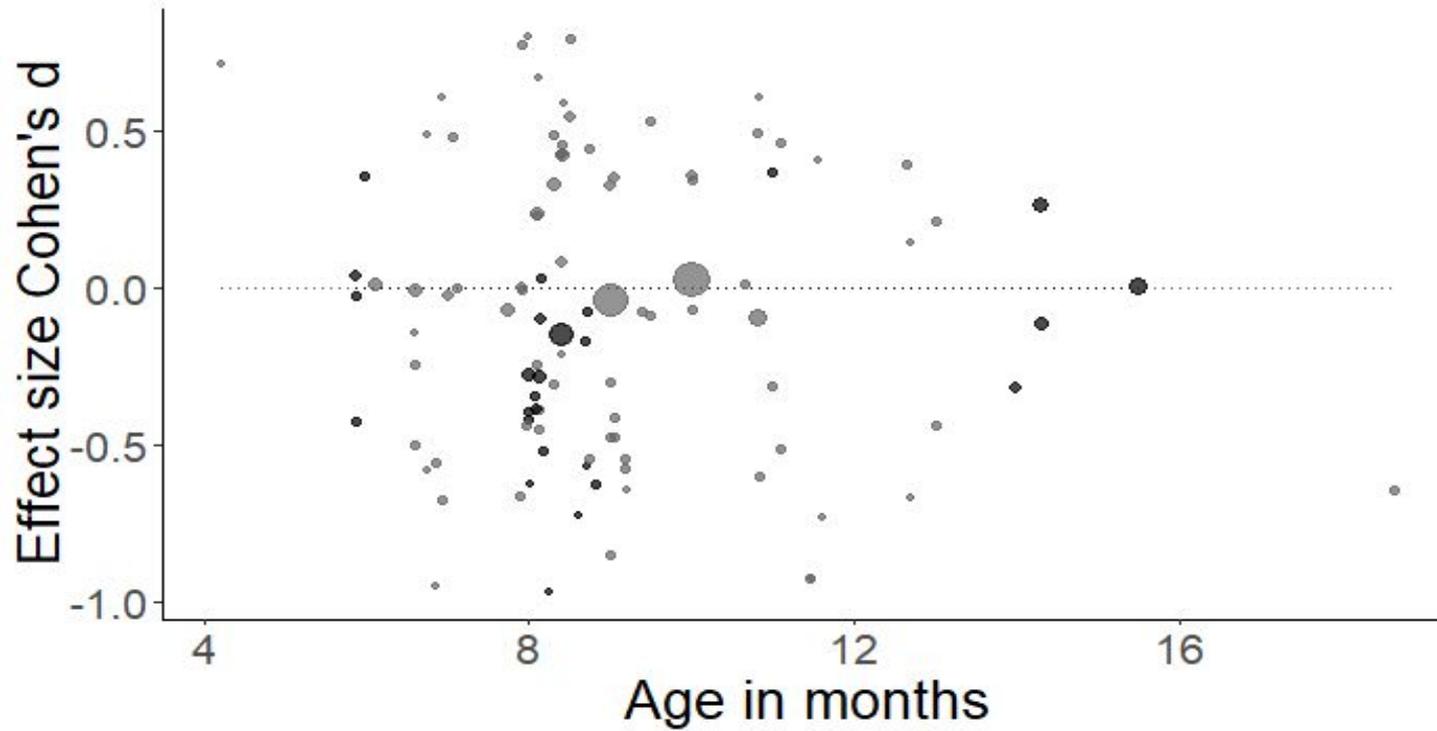
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A notion of replication in meta-analyses

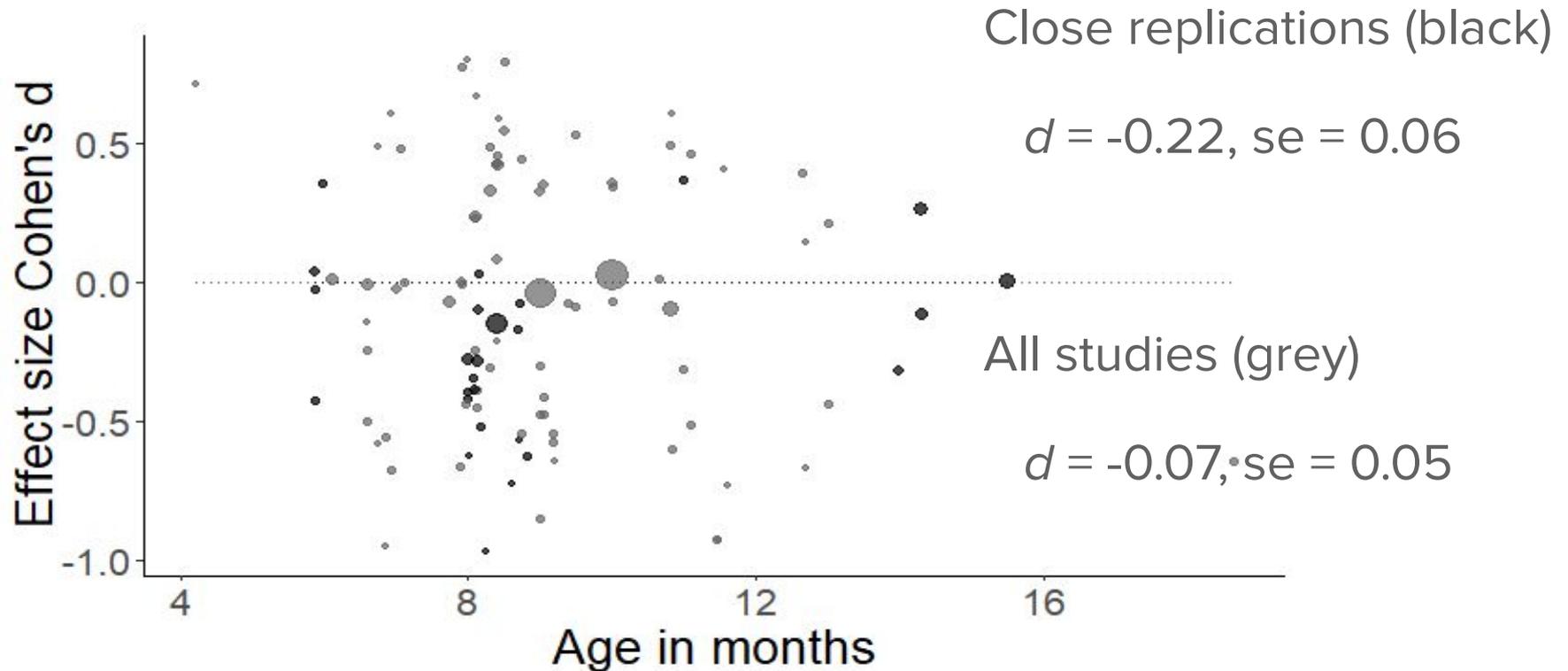
Pairs of studies in a meta-analysis live on a replication continuum



Just in case: Replication distance matters

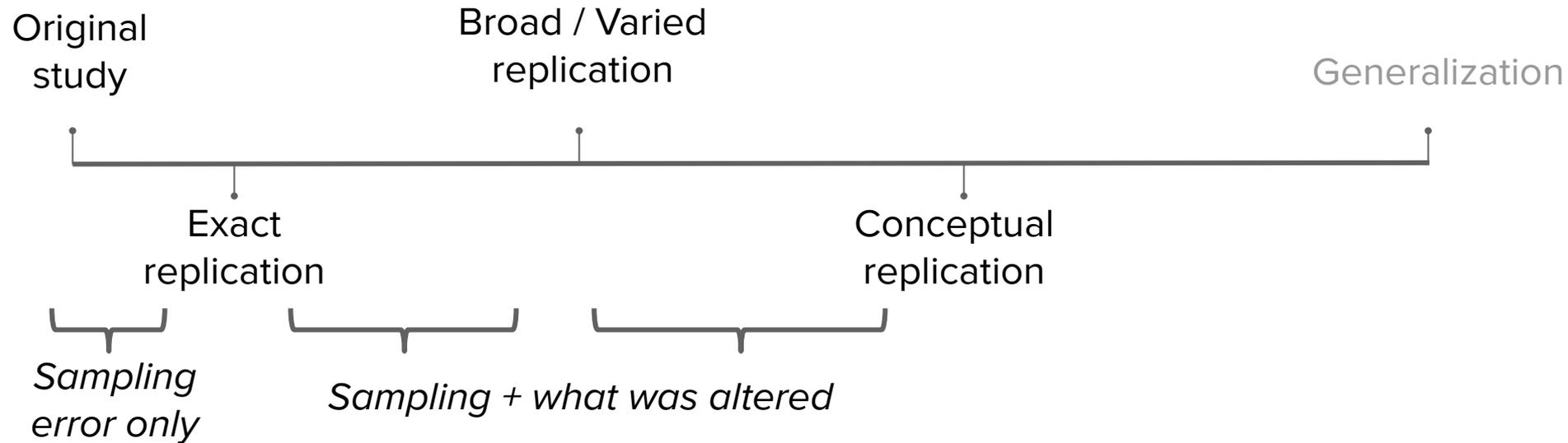


Just in case: Replication distance matters



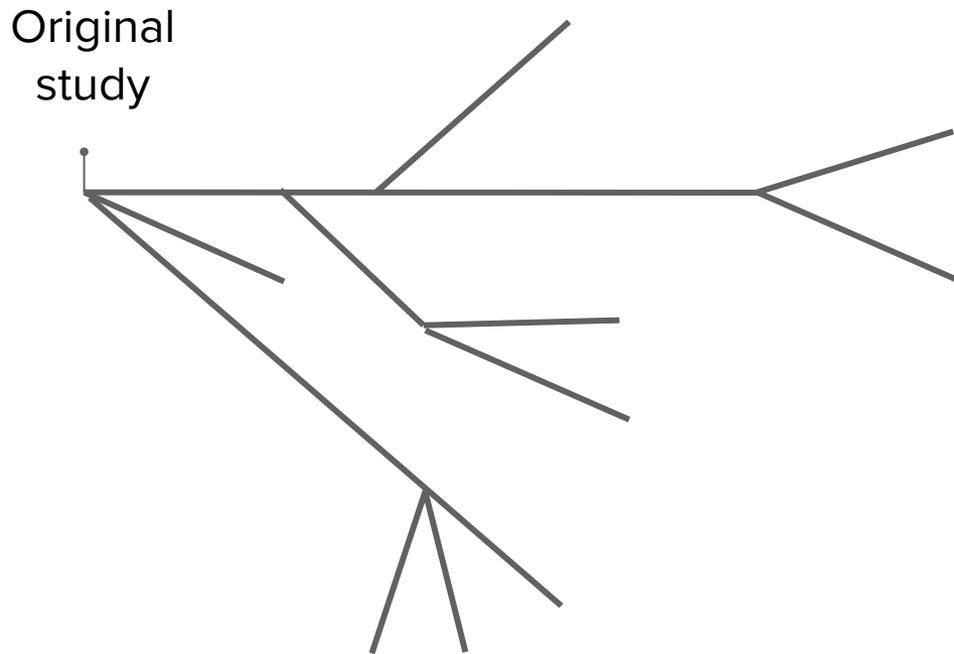
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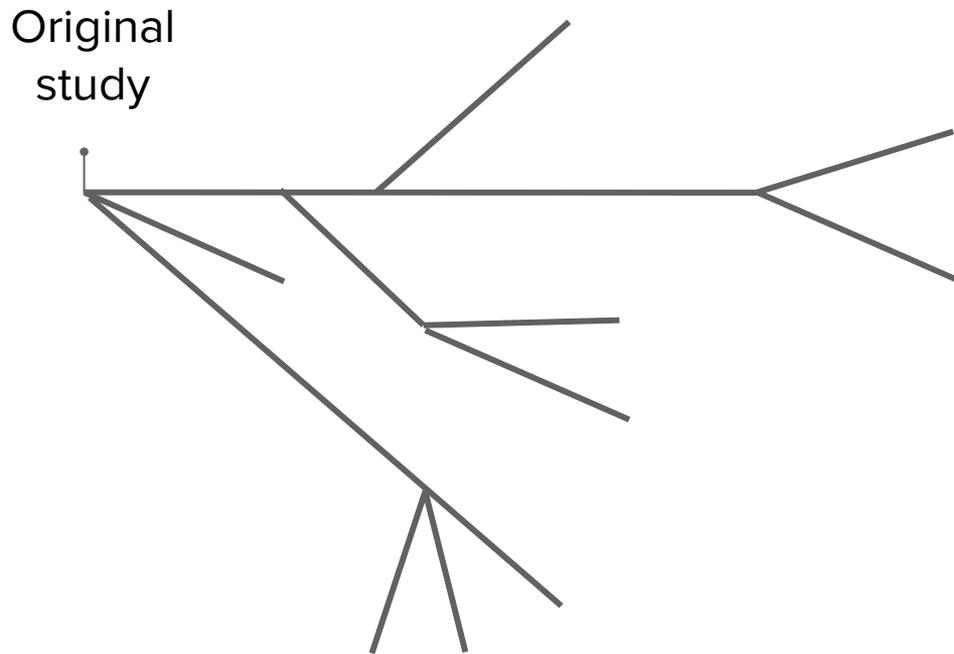
A notion of replication in meta-analyses

Groups of studies in a meta-analysis live in a replication space



A notion of replication in meta-analyses

Groups of studies in a meta-analysis live in a replication space



Accurate (statistical) modeling

→ Determine effects of study differences / commonalities on

replication distance

Use CAMAs to understand replication distance?



But first: What are CAMAs?

The classical meta-analysis

- ❑ Few researchers → high workload



The classical meta-analysis

- ❑ Few researchers → high workload
- ❑ Static, closed data
 - ❑ New study = new meta-analysis?
 - ❑ New moderator = new meta-analysis?



The classical meta-analysis

- ❑ Few researchers → high workload
- ❑ Static, closed data
 - ❑ New study = new meta-analysis?
 - ❑ New moderator = new meta-analysis?
- ❑ Intransparent
 - ❑ Selection
 - ❑ Computation
 - ❑ Analysis decisions



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- ❑ Idiosyncratic format



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 - ❑ Analysis decisions
- ❑ Idiosyncratic format
- ❑ Possible biases (see Tsuji et al., submitted)



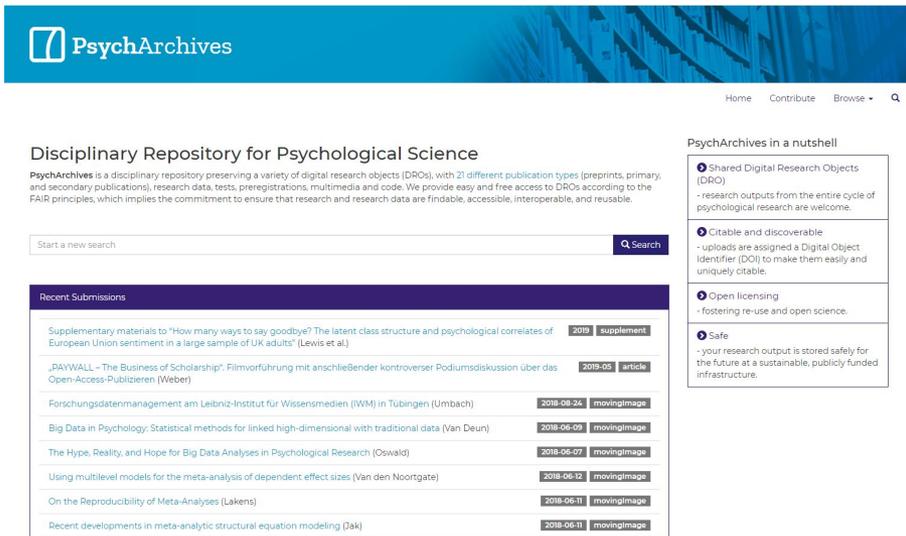
A proposal: Open and team up!

→ Community-augmented meta-analyses (CAMAs)



Community-Augmented Meta-Analyses (CAMAs)

Open repository + Classical meta-analysis



PsychArchives

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PsychArchives is a disciplinary repository preserving a variety of digital research objects (DROs), with 21 different publication types (preprints, primary, and secondary publications), research data, tests, preregistrations, multimedia and code. We provide easy and free access to DROs according to the FAIR principles, which implies the commitment to ensure that research and research data are findable, accessible, interoperable, and reusable.

Start a new search

Recent Submissions

Supplementary materials to "How many ways to say goodbye? The latent class structure and psychological correlates of European Union sentiment in a large sample of UK adults" (Lewis et al.)	2019	supplement
"DAYWALL – The Business of Scholarship": Filmvorführung mit anschließender kontroverser Podiumsdiskussion über das Open-Access-Publishing (Weber)	2019-05	article
Forschungsdatenmanagement am Leibniz-Institut für Wissensmedien (IWM) in Tübingen (Umbach)	2018-08-24	movingimage
Big Data in Psychology: Statistical methods for linked high-dimensional with traditional data (Van Deun)	2018-06-09	movingimage
The Hype, Reality, and Hope for Big Data Analyses in Psychological Research (Oswald)	2018-06-07	movingimage
Using multilevel models for the meta-analysis of dependent effect sizes (Van den Noortgate)	2018-06-12	movingimage
On the Reproducibility of Meta-Analyses (Lakens)	2018-06-11	movingimage
Recent developments in meta-analytic structural equation modeling (Jäk)	2018-06-11	movingimage

PsychArchives in a nutshell

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 - research outputs from the entire cycle of psychological research are welcome.
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- Safe
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Quantifying Infants' Statistical Word Segmentation: A Meta-Analysis

Alexis Black (akblack2g@gmail.com)
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Vancouver, BC, Canada V6T 1Z4

Christina Bergmann (chbergma@gmail.com)
Laboratoire des Sciences Cognitives, Ecole Normale Supérieure, 29, rue d'Ulm
75005 Paris, France

Abstract

Theories of language acquisition and perceptual learning increasingly rely on statistical learning mechanisms. The current meta-analysis aims to provide the first comprehensive overview of this capacity in infancy within the context of statistical learning. Our analysis reveals a significant effect of statistical learning on word segmentation, and a nonsignificant effect of conceptual replications and statistical learning is modulated by the type of stimuli used. These findings have deeper questions about the nature of statistical learning, and its role in language acquisition.

Keywords: language acquisition; meta-analysis

Intro

analysis that examined natural speech word segmentation (not determined by TPs) revealed a significant, but small effect (Bergmann & Cristia, 2016), leading to concerns about the robustness of infants' word segmentation in the

Development of infants' segmentation of words from native speech: a meta-analytic approach

Christina Bergmann and Alejandrina Cristia

Laboratoire de Sciences Cognitives et Psycholinguistique (ENS, EHESS, CNRS), Département d'Études Cognitives, Ecole Normale Supérieure, PSL Research University, Paris, France

Abstract

Infants start learning words, the building blocks of language, at least by 6 months. To do so, they must be able to extract the phonological form of words from running speech. A rich literature has investigated this process, termed word segmentation. We addressed the fundamental question of how infants of different ages segment words from their native language using a meta-analytic approach. Based on previous popular theoretical and experimental work, we expected infants to display familiarity preferences early on, with a switch to novelty preferences as infants become more proficient at processing and segmenting native speech. We also considered the possibility that this switch may occur at different points in time as a function of infants' native language and took into account the impact of various task- and stimulus-related factors that might affect difficulty. The combined results from 168 experiments reporting on data gathered from 3774 infants revealed a persistent familiarity preference across all ages. There was no significant effect of additional factors, including native language and experiment design. Further analyses revealed no sign of selective data collection or reporting. We conclude that models of infant information processing that are frequently cited in this domain may not, in fact, apply in the case of segmenting words from native speech.

Community-Augmented Meta-Analyses (CAMAs)

Open repository + Classical meta-analysis

PsychArchives

Home Contribute Browse

+ Transparent
Disciplinary Repository for Psychological Research

+ Searchable
PsychArchives is a disciplinary repository preserving a variety of digital research objects (DROs), with 21 different publication types (preprints, primary and secondary publications), research data, tests, preregistrations, multimedia and code. We provide easy and free access to DROs according to the FAIR principles, which implies that our content is findable, accessible, interoperable, and reusable.

+ Updatable
Supplementary materials to "How many ways to say goodbye? The latent class structure and psychological correlates of European Union sentiment in a large sample of UK adults" (Lewis et al.)

+ File-drawer studies
JAYWALL - The Business of Design: The Open-Access Publisher

+ New results
Forschungsdatenmanagement am Leibniz-Institut für Wissensmedien (IWM) in Göttingen (Limbach)

+ Dynamic
Big Data in Psychology: Statistical Methods for the Hypothesis Testing

+ Adapt selection
Using multilevel models for the meta-analysis of dependent effect sizes (Van den Noortgate)

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Vancouver, BC, Canada V6T 1Z4

Christina Bergmann (chbergma@gmail.com)
School of Psychology, University of British Columbia

+ Well-defined topic

+ Systematic synthesis

+ Detailed

Design variables

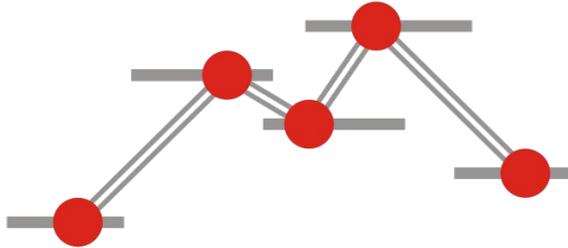
Moderators

Abstract
This analysis examined natural speech word segmentation (word segmentation) that is determined by the statistical structure of the input, but small changes in the statistical structure can lead to different segmentations. However, concerns about the reliability of word segmentation in the laboratory have led to a focus on the development of infants' segmentation of words from native speech. Our analysis reveals a significant effect of the statistical structure of the input on word segmentation. Conceptual replications and statistical learning is modulated by the statistical structure of the input. Deeper questions about the nature of statistical learning, including the role of statistical learning in language acquisition, are discussed.

Keywords: language acquisition; word segmentation; meta-analysis

Introduction
The phonological form of words from running speech. A rich literature has investigated this process, termed word segmentation. We addressed the fundamental question of how infants of different ages segment words from their native language using a meta-analytic approach. Based on previous popular theoretical and experimental work, we expected infants to display familiarity preferences early on, with a switch to novelty preferences as infants become more proficient at processing and segmenting native speech. We also considered the possibility that this switch may occur at different points in time as a function of infants' native language and took into account the impact of various task- and stimulus-related factors that might affect difficulty. The combined results from 165 experiments reporting on data gathered from 3774 infants revealed a persistent familiarity preference across all ages. There was no significant effect of additional factors, including native language and experiment design. Further analyses revealed no sign of selective data collection or reporting. We conclude that models of infant information processing that are frequently cited in this domain may not, in fact, apply in the case of segmenting words from native speech.

CAMAs implemented



MetaLab



Early Language

How do children learn their native language?

19

Meta-analyses



436

Papers



1,649

Effect sizes



26,328

Participants



Cognitive Development

What is the nature of children's understanding?

3

Meta-analyses



41

Papers



155

Effect sizes



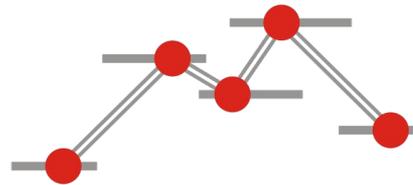
1,941

Participants



The metafor Package
A Meta-Analysis Package for R

CAMAs implemented



MetaLab

Alejandrina Cristia
ENS, Paris

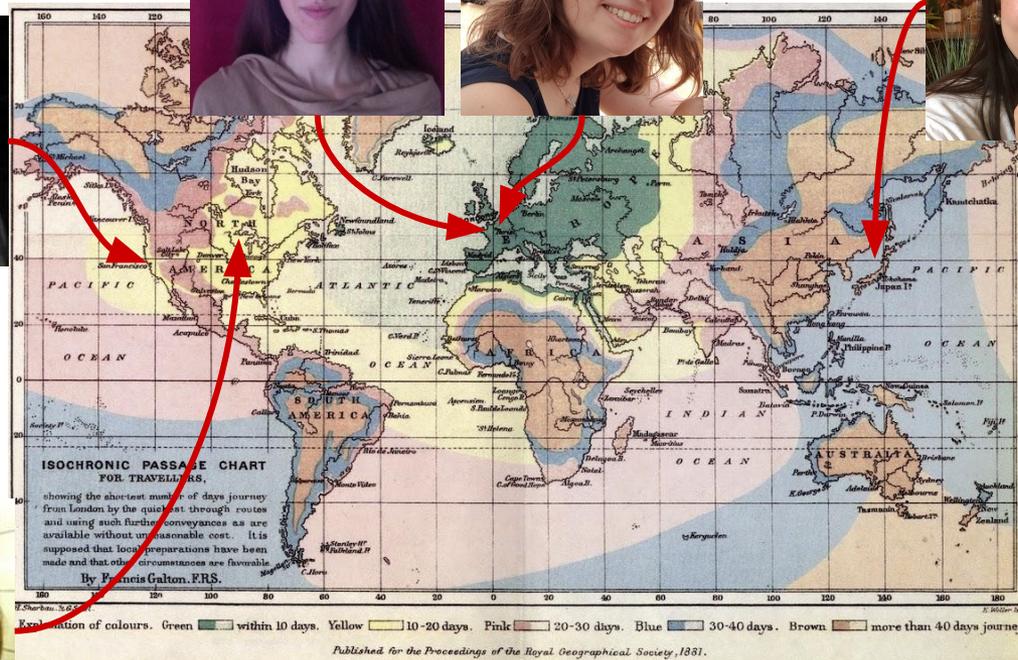
Cécile Issard
ENS, Paris

Sho Tsuji
Tokyo

Michael C. Frank
Stanford

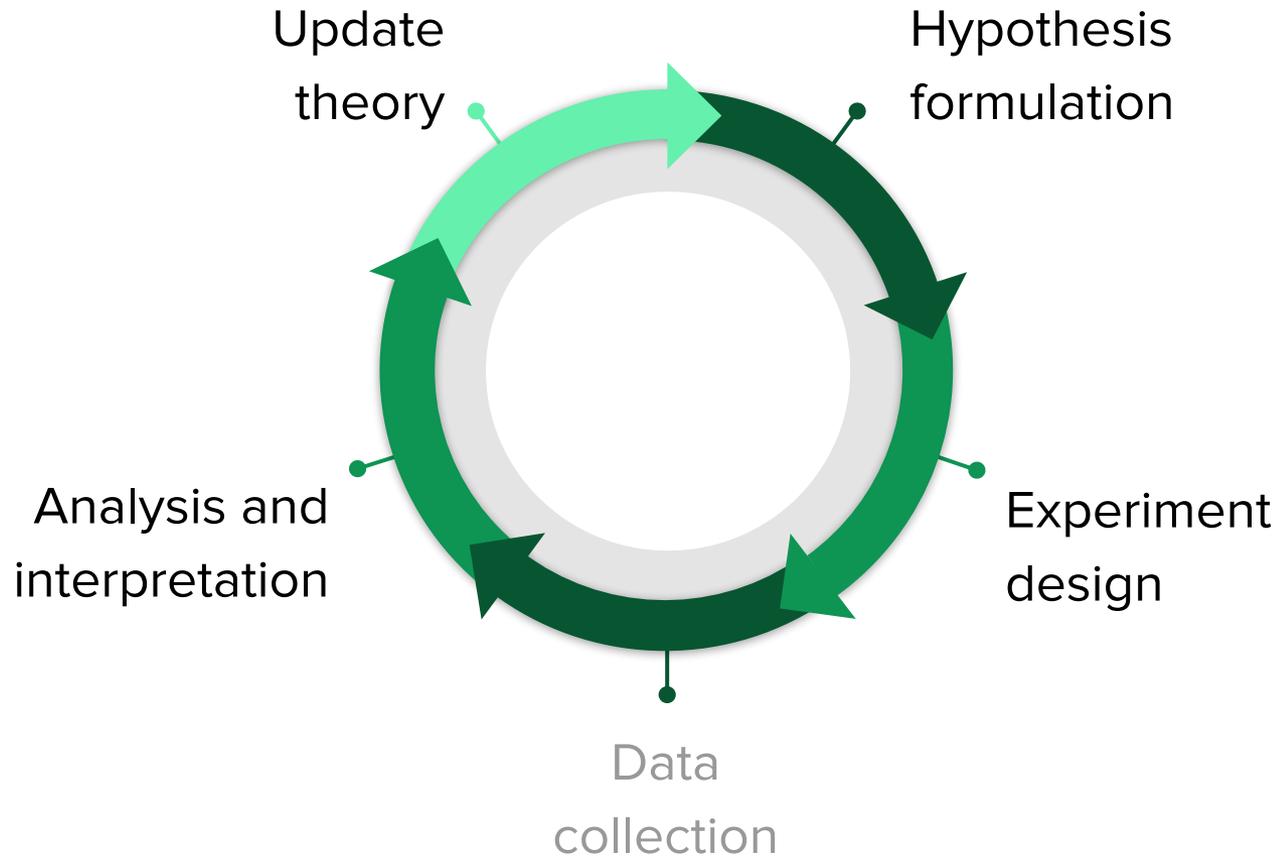


Molly L. Lewis
Chicago/Wisc.



+ Team of
Curators

MetaLab: Making a researcher's life easier

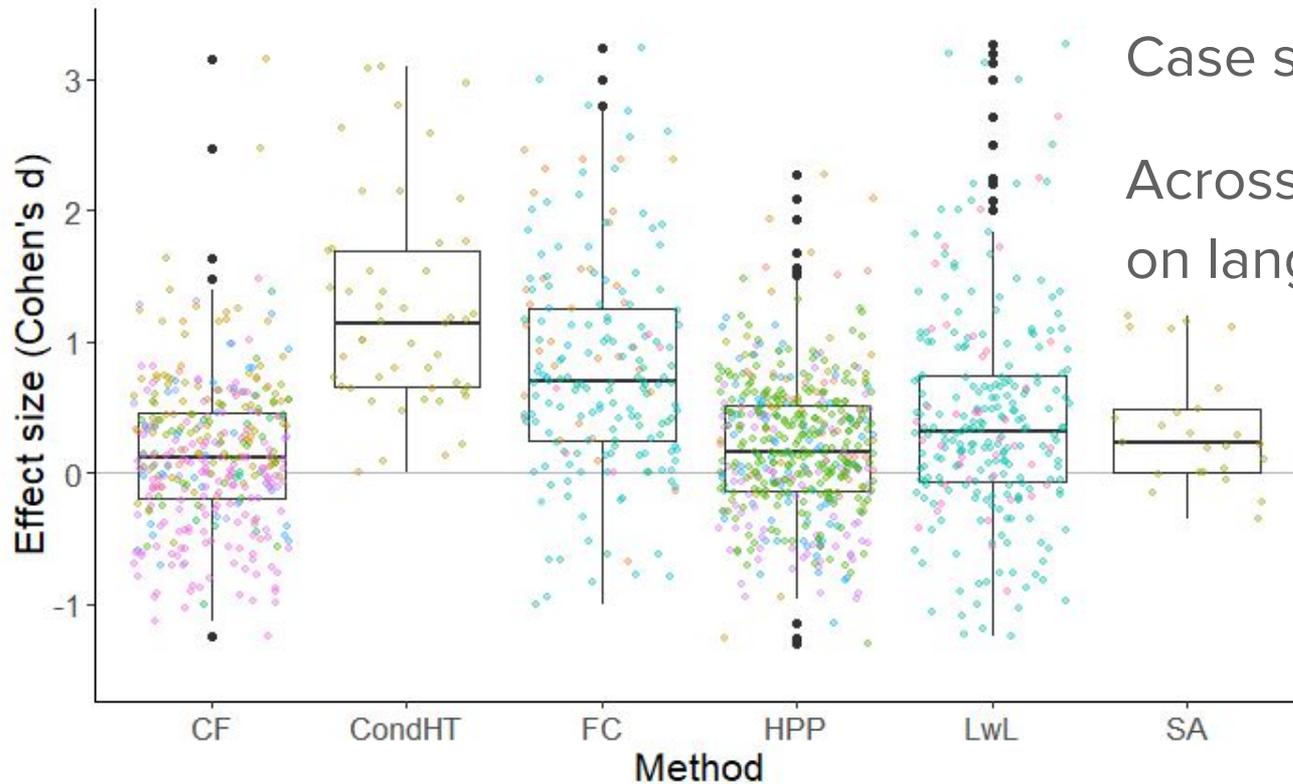


CAMAs: Tracking study differences

study_ID	response_mode	exposure_phase	method	dependent_measure	native_lang
Cooper1990	eye-tracking	test_only	CF	looking_time	American English
Cooper1990	eye-tracking	test_only	CF	looking_time	American English
Cooper1994	eye-tracking	test_only	CF	looking_time	American English
Cooper1994	eye-tracking	test_only	CF	looking_time	American English
Cooper1994	eye-tracking	test_only	CF	looking_time	American English
Cooper1994	eye-tracking	test_only	CF	looking_time	American English
Cooper1997	eye-tracking	test_only	CF	looking_time	American English
Cooper1997	eye-tracking	test_only	CF	looking_time	American English
Cooper1997	eye-tracking	test_only	CF	looking_time	American English
Droucker2013	eye-tracking	familiarization	CF	looking_time	Canadian English
Droucker2013	eye-tracking	familiarization	CF	looking_time	Canadian English
Droucker2013	eye-tracking	familiarization	CF	looking_time	Canadian English
Droucker2013	eye-tracking	familiarization	CF	looking_time	Canadian English
Droucker2013	eye-tracking	familiarization	CF	looking_time	Canadian English
Fernald1985	behavior	conditioning	CHT	target_selection	American English
Fernald1987	behavior	conditioning	CHT	target_selection	American English
Fernald1987	behavior	conditioning	CHT	target_selection	American English
Fernald1987	behavior	conditioning	CHT	target_selection	American English
Glenn1983	behavior	conditioning	FC	target_selection	British English
Glenn1983	behavior	conditioning	FC	target_selection	British English
Hayashi2001	behavior	familiarization	HPP	looking_time	Japanese
Hayashi2001	behavior	familiarization	HPP	looking_time	Japanese
Hayashi2001	behavior	familiarization	HPP	looking_time	Japanese
Inoe2011	behavior	familiarization	HPP	looking_time	Japanese
Inoe2011	behavior	familiarization	HPP	looking_time	Japanese

1. Standardized
2. Expandable

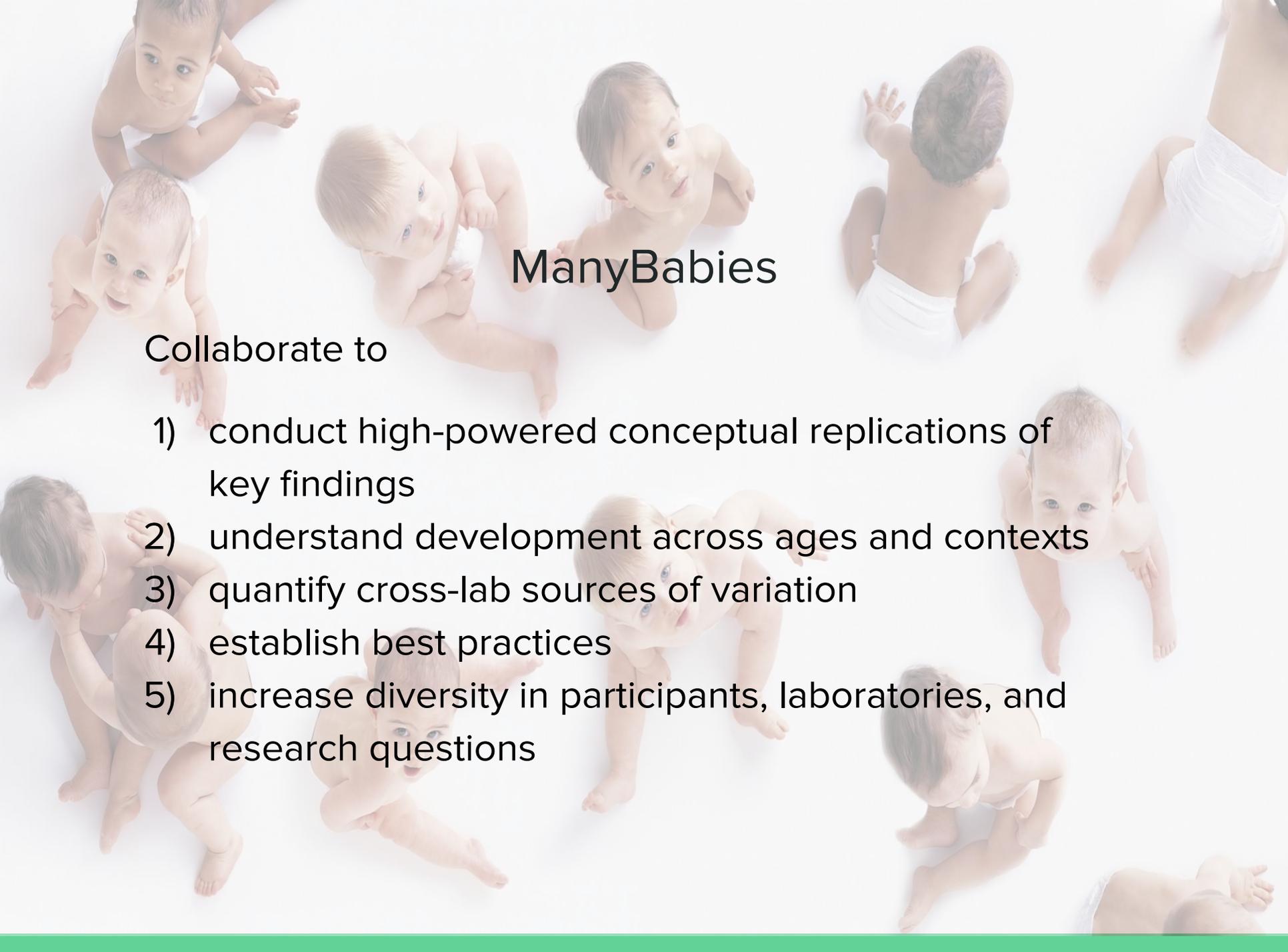
CAMAs: Quantify the impact of study differences



Case study: Method

Across **all** meta-analyses
on language development

CAMAs in the times of
large-scale replication
projects



ManyBabies

Collaborate to

- 1) conduct high-powered conceptual replications of key findings
- 2) understand development across ages and contexts
- 3) quantify cross-lab sources of variation
- 4) establish best practices
- 5) increase diversity in participants, laboratories, and research questions

ManyBabies 1 - Goals

- Test a key phenomenon

ManyBabies 1 - Goals

- Test a key phenomenon
- Quantify differences across labs

ManyBabies 1 - Goals

- Test a key phenomenon
- Quantify differences across labs
 - Standardize where possible
& Investigate effects of systematic and incidental differences
 - ➔ Most prominent: Method effects

Meta-analysis for planning ManyBabies 1

- Exploit literature overview
- Selecting efficient design and stimuli



Infant-Directed Speech Preference

Infant-Directed Speech (IDS): higher, slower, more variable in pitch, preferred by infants over adult-directed speech



Infant-Directed Speech Preference

Infant-Directed Speech (IDS): higher, slower, more variable in pitch, preferred by infants over adult-directed speech

Theoretical importance

- Universal? Language Specific?
- Signal tailored for learning language?



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Theoretical importance

- Universal? Language Specific?
- Signal tailored for learning language?

Practical relevance

- Key recommendation for parents
- (Almost) All infant studies use IDS



Infant-Directed Speech Preference: Meta-Analysis

Studies: 71 (from 23 papers)

Age: 0-18 months

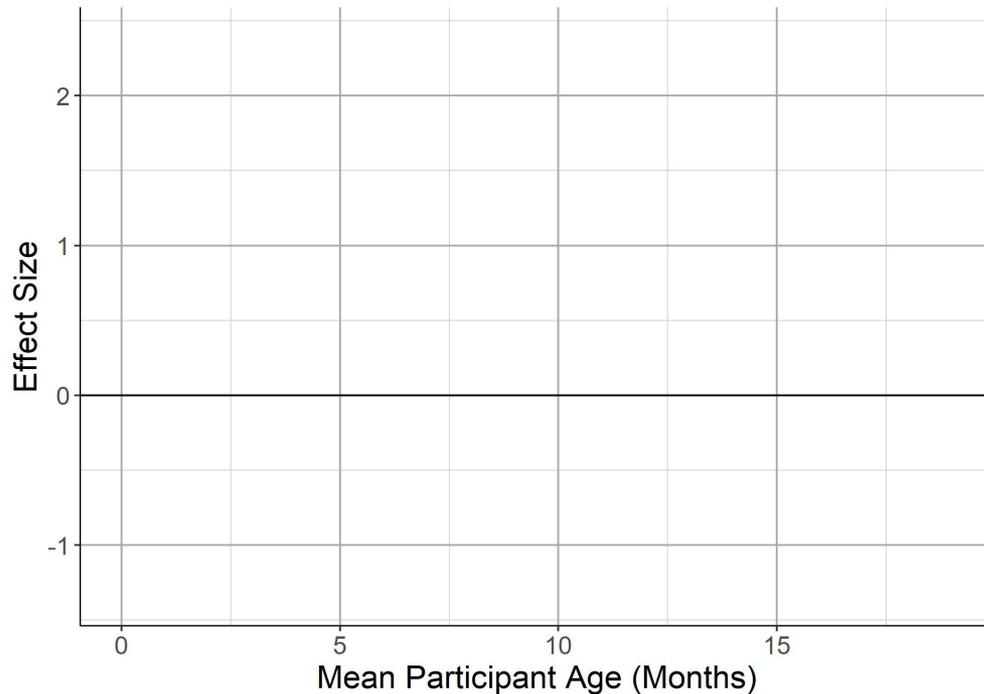
Effect size: $d = 0.62$, $se = 0.1$

Sample size: 20 (9-60)

Average power: 69%

*Note: Updated from the paper, original
meta-analysis: Dunst, Gorman, & Hamby (2012)*

Infant-Directed Speech Preference: Meta-Analysis



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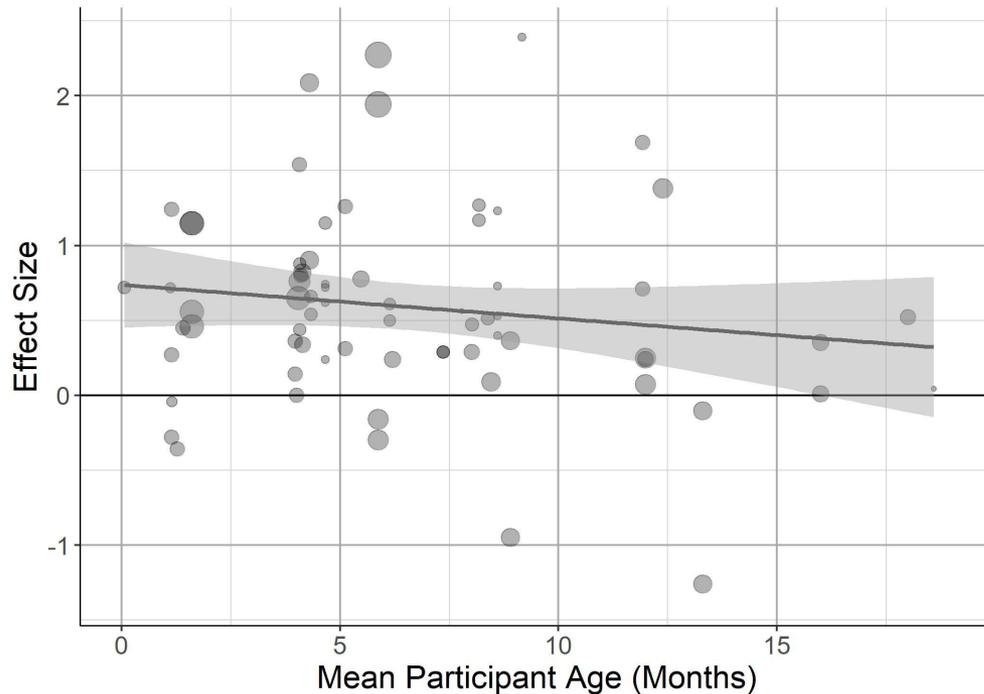
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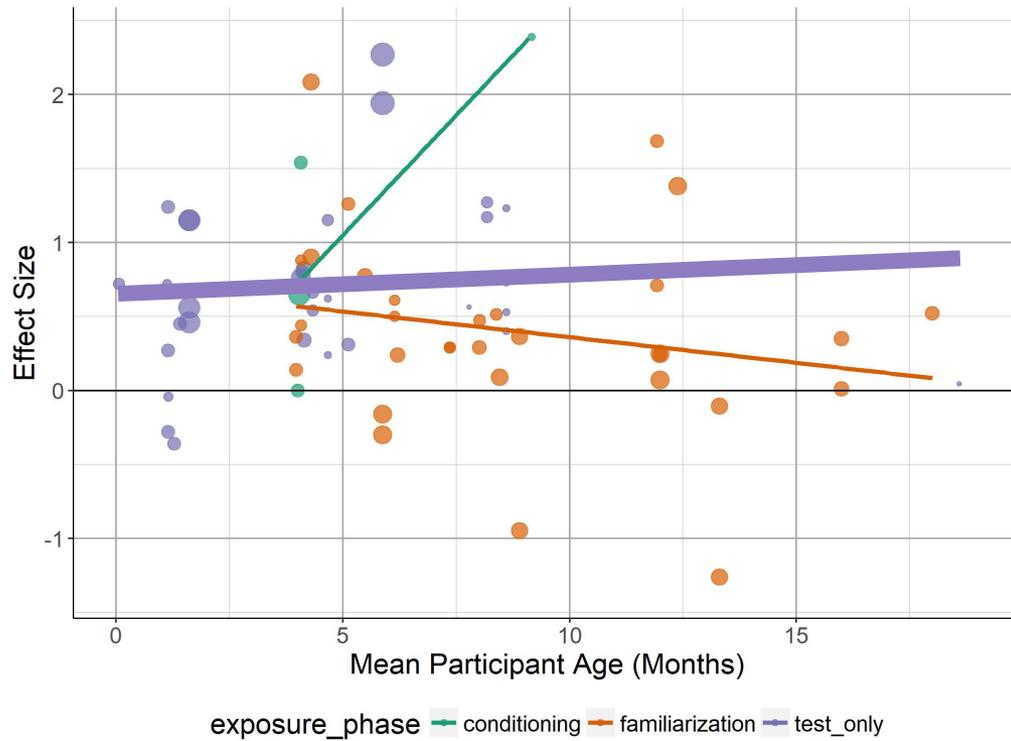
Selecting design and stimuli

→ Identify most "effective" way to test IDS preference

Note: Not a close replication



IDS preference - Design



conditioning (n = 5) >
test only (n = 33) >
familiarization (n = 32)

Re-designing the optimal study: ManyBabies 1

Design = test only (no exposure phase)

Stimuli = naturalistic

Re-designing the optimal study: ManyBabies 1

Design = test only (no exposure phase)

Stimuli = naturalistic

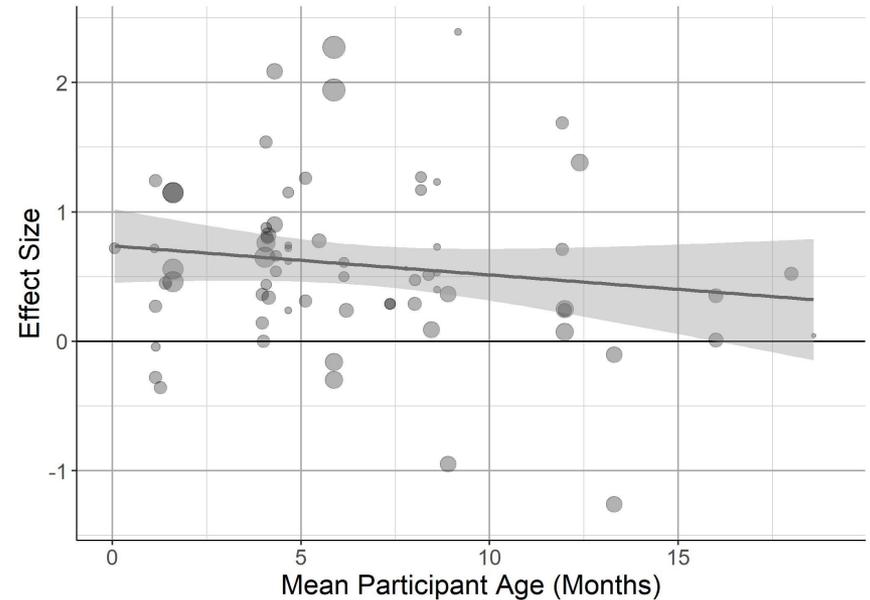
→ Subset meta-analysis

Re-designing the optimal study: ManyBabies 1

Design = test only (no exposure phase)

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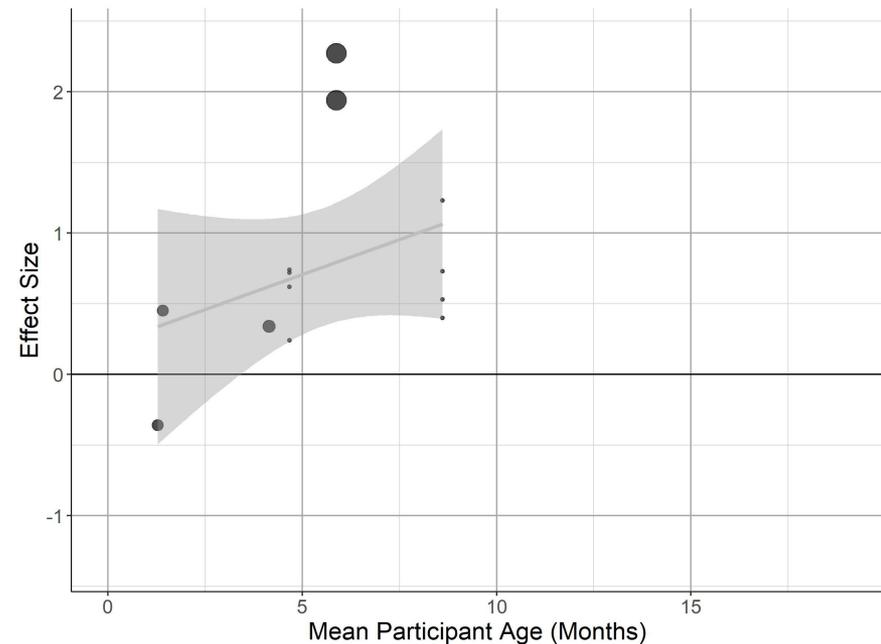


Re-designing the optimal study: ManyBabies 1

Design = test only (no exposure phase)

Stimuli = naturalistic

→ Subset meta-analysis



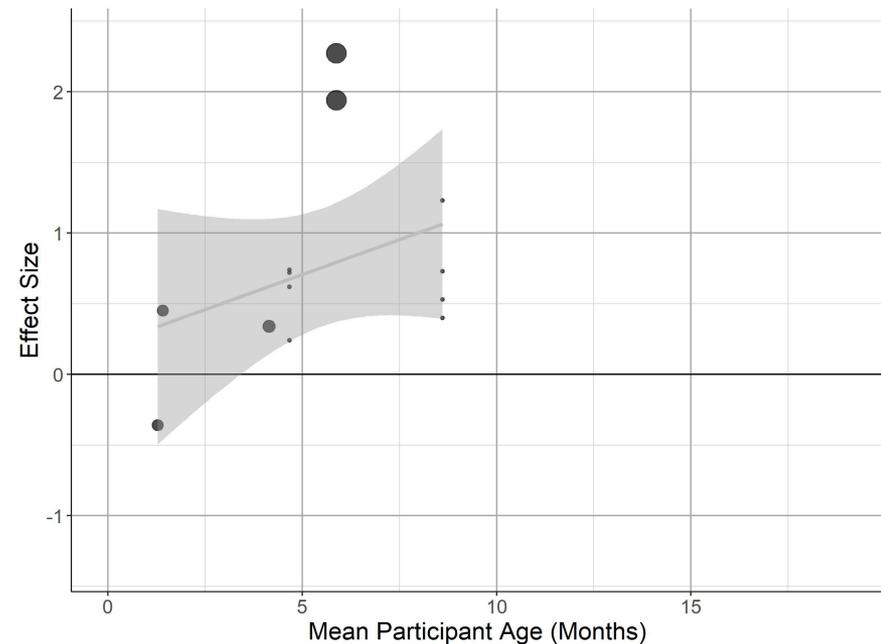
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Stimuli = naturalistic

→ Subset meta-analysis

New effect size: 0.66 (vs 0.62)



Re-designing the optimal study: ManyBabies 1

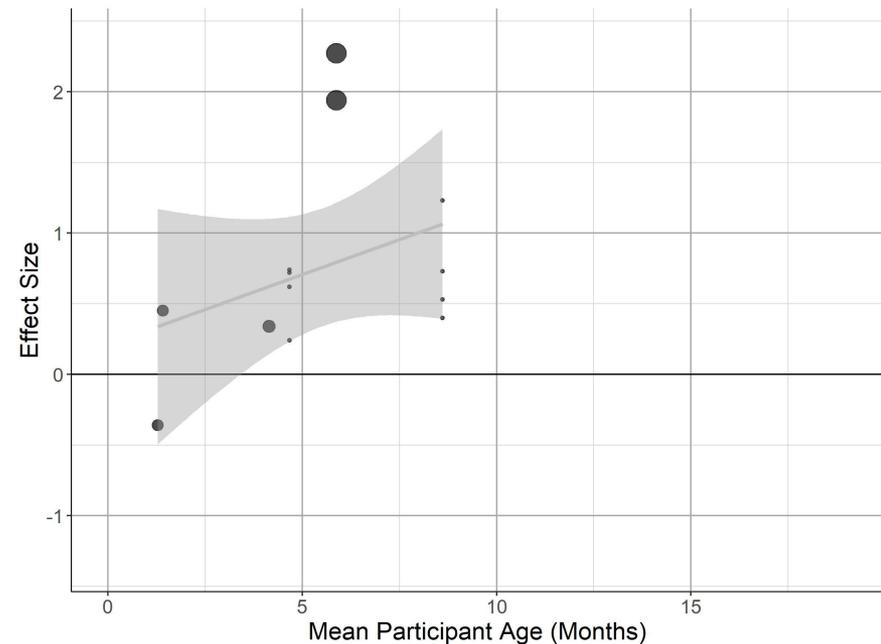
Design = test only (no exposure phase)

Stimuli = naturalistic

→ Subset meta-analysis

New effect size: 0.66 (vs 0.62)

Note: Interaction with age positive



Quantifying sources of variability in infancy research using the infant-directed speech preference

AUTHORS

Elika Bergelson, Christina Bergmann, Krista Byers-Heinlein, Alejandrina Cristia, Rhodri Cusack, Kelsey Dyck, caroline floccia, Michael Frank, Judit Gervain, Nayeli Gonzalez, Kiley Hamlin, Erin Hannon, Danielle Kellier, Melissa Kline, Casey Lew-Williams, Thierry Nazzi, Robin Panneton, Hugh Rabagliati, Jennifer Rennels, Amanda Seidl, Melanie Soderstrom, Daniel Yurovsky

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LAST EDITED July 02, 2018
SUPPLEMENTAL MATERIALS osf.io/ctvd5/

Running head: QUANTIFYING VARIABILITY IN INFANT RESEARCH 1

Quantifying sources of variability in infancy research using the infant-directed speech preference

Pre-data collection manuscript for peer-review

The ManyBabies Consortium, consisting of:
Elika Bergelson (Duke University)
Christina Bergmann (École Normale Supérieure)
Krista Byers-Heinlein (Concordia University)
Alejandrina Cristia (École Normale Supérieure)
Rhodri Cusack (University of Western Ontario)
Kelsey Dyck (University of Manitoba)
Caroline Floccia (University of Plymouth, UK)

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Abstract

The field of psychology has become increasingly concerned with issues related to methodology and replicability. Infancy researchers face specific challenges related to replicability: high-powered studies are difficult to conduct, testing conditions vary across labs, and different labs have access to different infant populations, amongst other ...

[See more](#)

Preprint DOI

[10.31234/osf.io/s98ab](https://doi.org/10.31234/osf.io/s98ab)

License

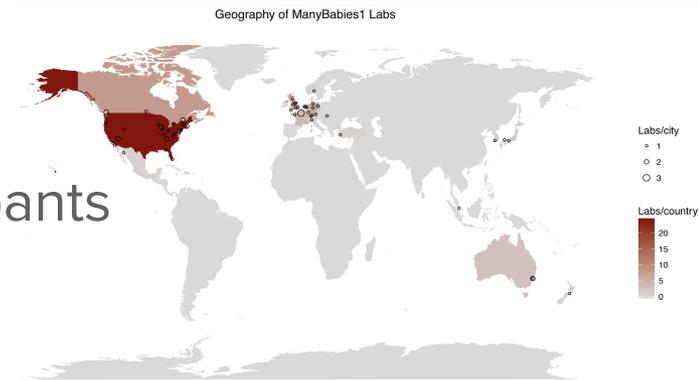
Stage 2 Registered Report under review at
Advances in Methods and Practices in Psychological Science
Stage 1 preprint: <https://psyarxiv.com/s98ab/>

Final Sample ManyBabies1

Number of Participating labs: 69 contributed data (67 in final sample)

Number of Countries: 17

Final Sample with Exclusions: **2329** participants



North American English: N = 1066

Non-North American English: N = 1263

Meta-Analyses versus Replication

★ Meta-Analysis:

- Incidental variation and uncontrolled co-variation
 - Stimuli
 - Method
 - Population (American / British / Canadian English; Cantonese; Japanese)

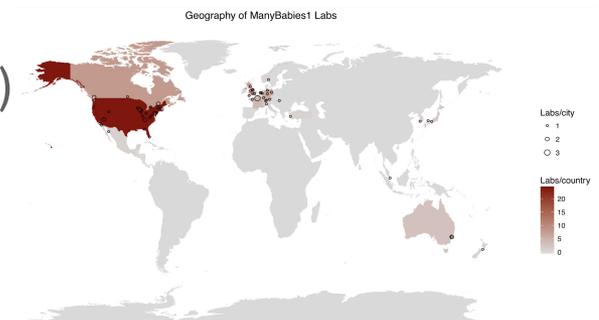
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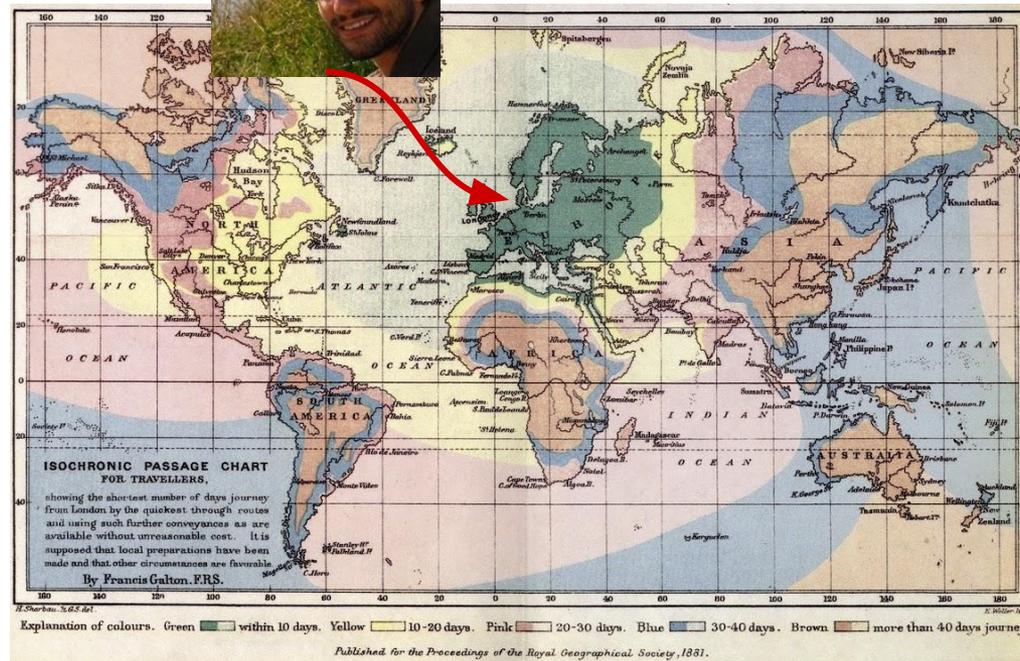
★ ManyBabies 1:

- Standardization (as much as possible)
 - 1 stimulus set
 - 3 Methods
- More diverse population (16 languages)
- New variable (nativeness)



Meta-Analyses versus Replication

Riccardo Fusaroli
Aarhus



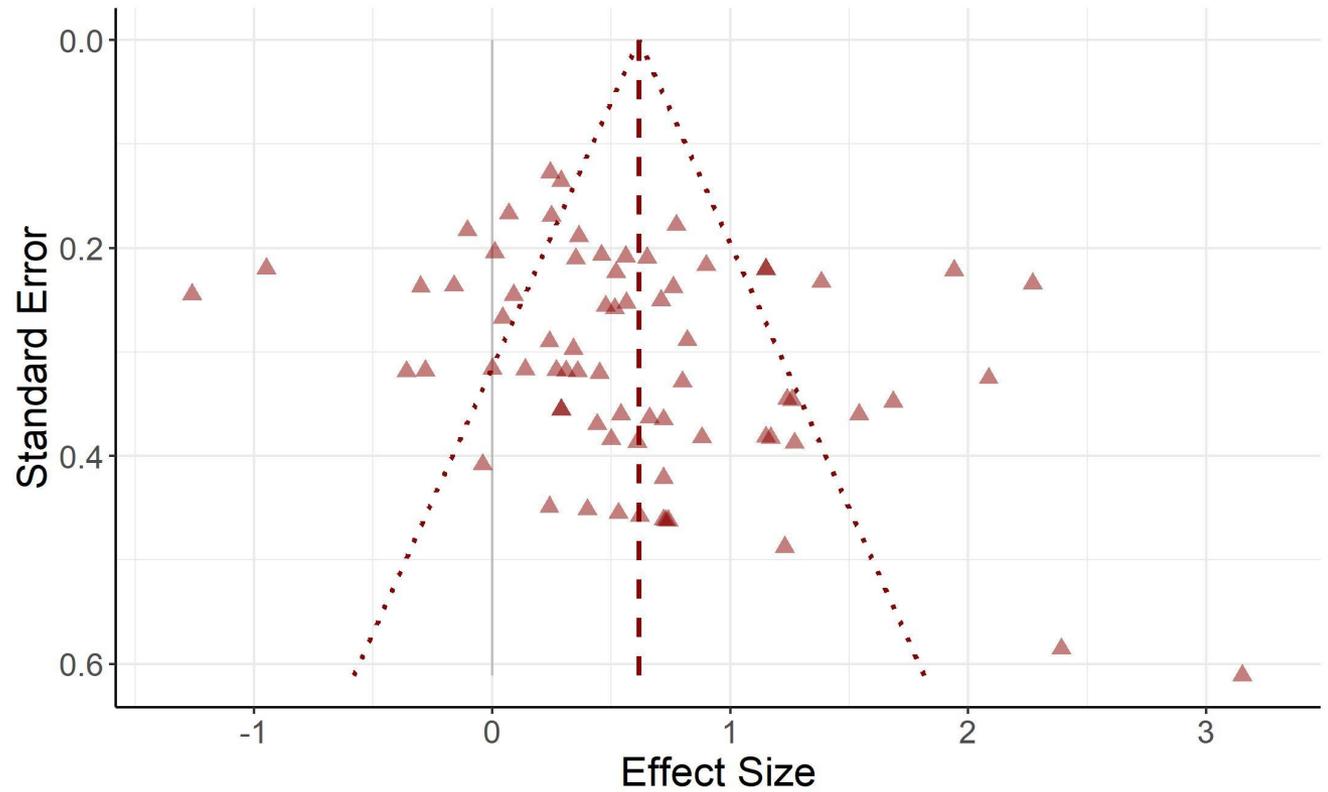
Goals

1. Compare the main effect size to the meta-analysis
2. Consistent moderator effects - method?

Visual comparison

Meta-analysis

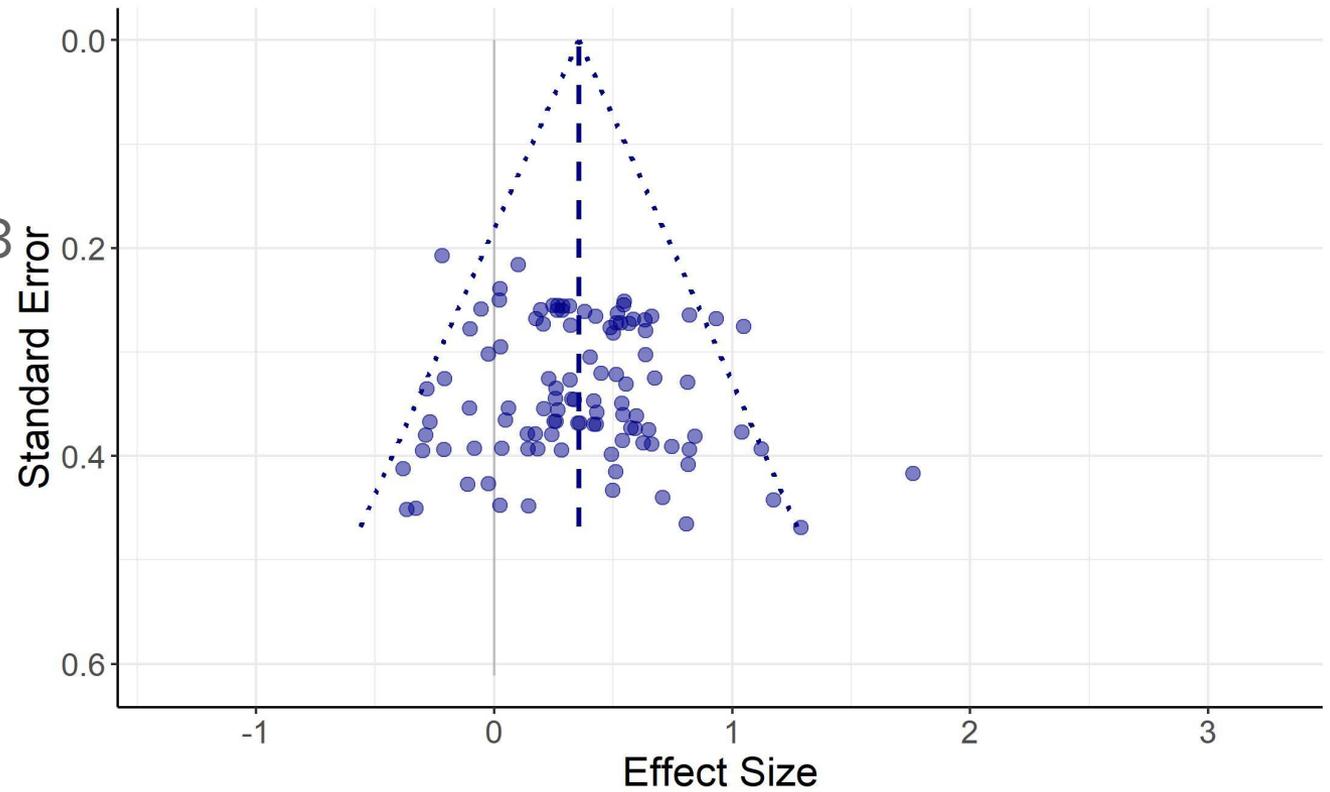
$d = 0.62, se = 0.1$



Visual comparison

ManyBabies 1

$d = 0.36$, $se = 0.03$



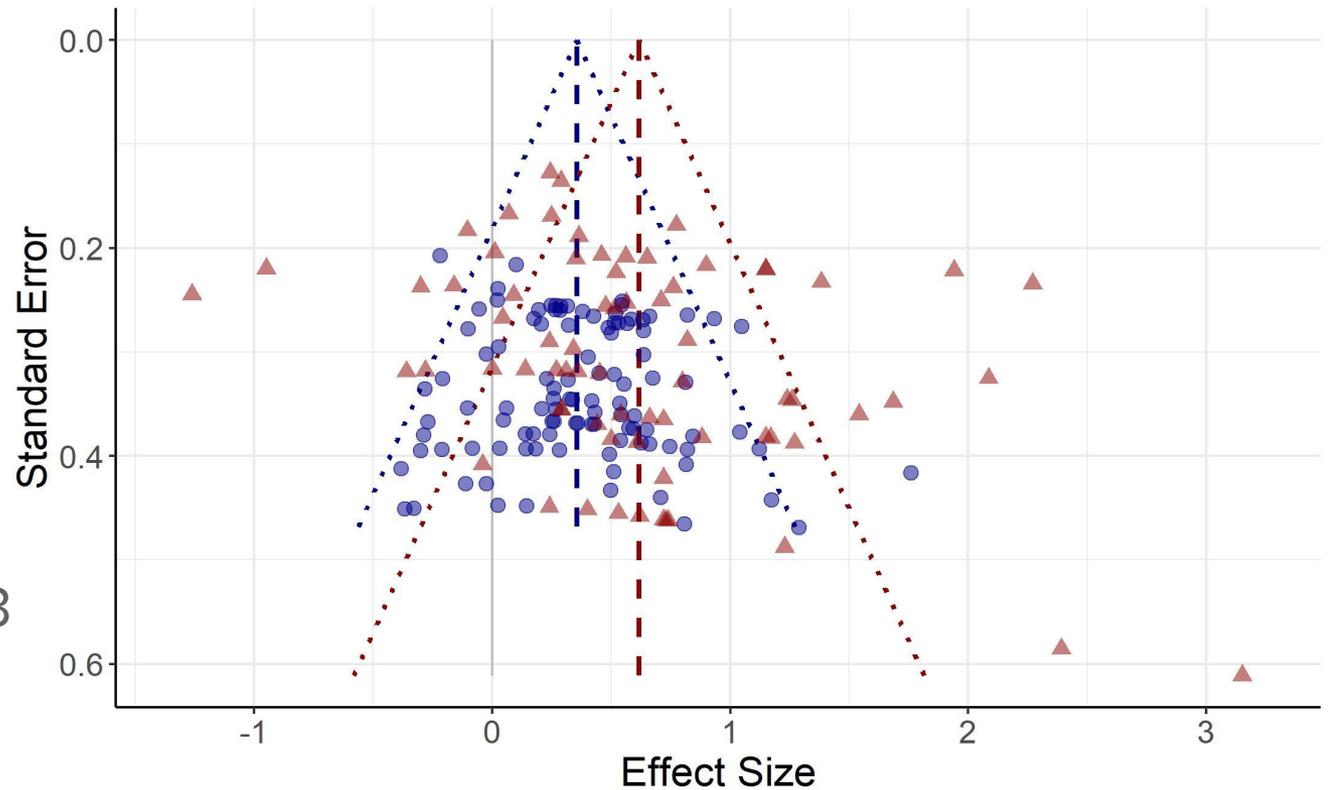
Visual comparison

Meta-analysis

$d = 0.62$, $se = 0.1$

ManyBabies 1

$d = 0.36$, $se = 0.03$



Predicting ManyBabies overall effect size

Bayesian approach:

Skeptic prior versus informed prior



$m = 0, sd = 0.3$



$m = 0.62, sd 0.1$

Predicting ManyBabies overall effect size

Bayesian approach:

Skeptic prior versus informed prior

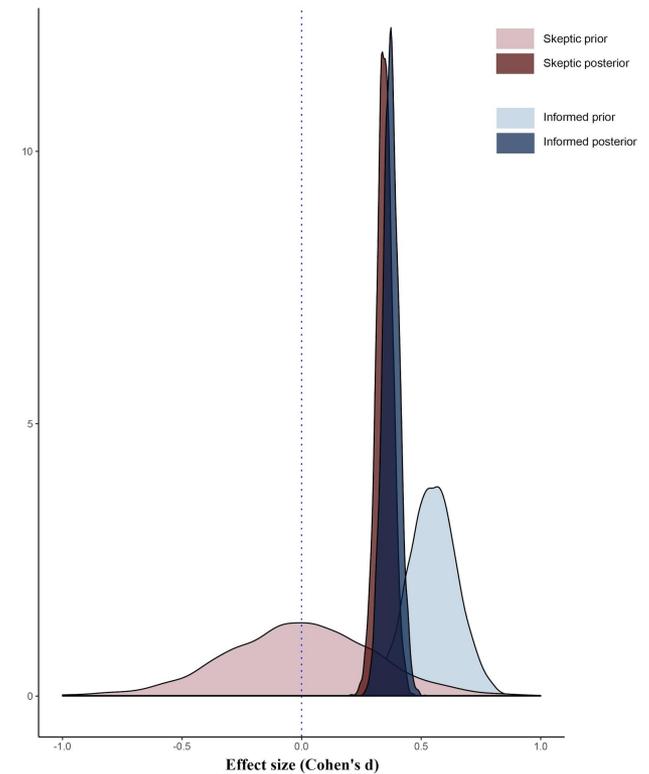


$m = 0, \text{sd} = 0.3$



$m = 0.62, \text{sd} 0.1$

→ No gain from informed prior



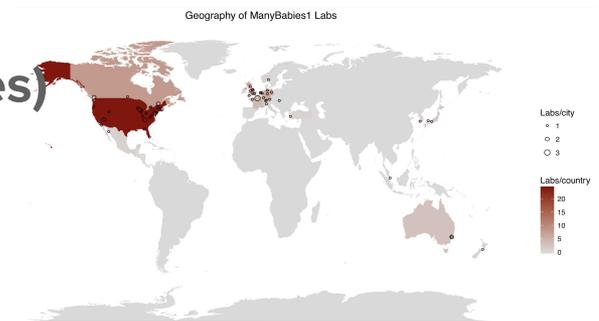
Meta-Analyses versus Replication: Main effect size

★ Meta-Analysis:

- **Incidental variation and uncontrolled co-variation**
 - **Stimuli**
 - **Method**
 - **Population** (American / British / Canadian English; Cantonese; Japanese)

★ ManyBabies 1:

- **Standardization (as much as possible)**
 - **1 stimulus set**
 - **3 Methods**
- **More diverse population (16 languages)**
- **New variable (nativeness)**



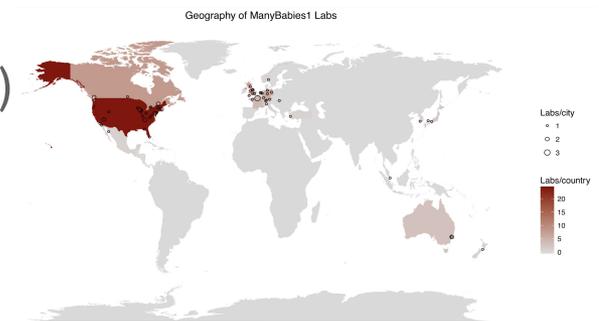
Meta-Analyses versus Replication: Moderators

★ Meta-Analysis:

- Incidental variation and uncontrolled co-variation
 - Stimuli
 - **Method (5, 2 dominant)**
 - Population (American / British / Canadian English; Cantonese; Japanese)

★ ManyBabies 1:

- Standardization (as much as possible)
 - 1 stimulus set
 - **3 Methods, evenly distributed**
- More diverse population (16 languages)
- New variable (nativeness)

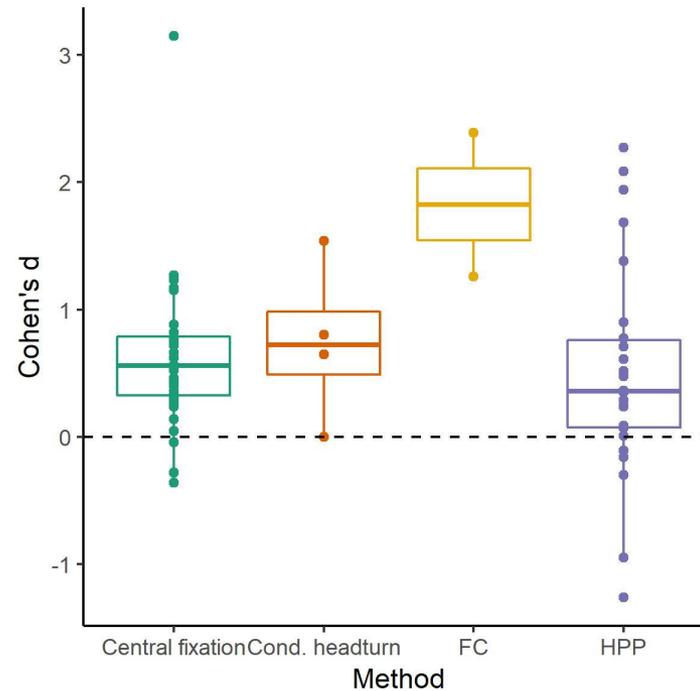


Predicting moderators: Method effect

Skeptic prior versus informed prior



$m = 0, sd = 0.3$

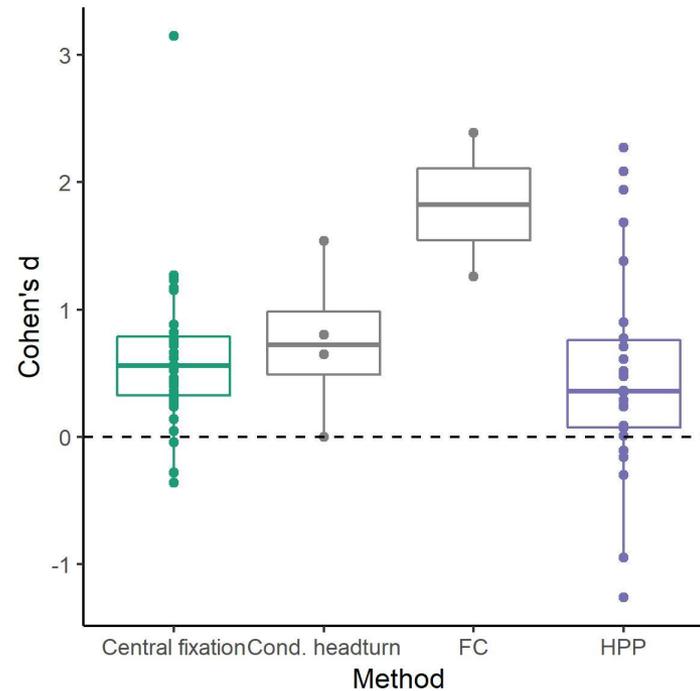


Predicting moderators: Method effect

Skeptic prior versus informed prior

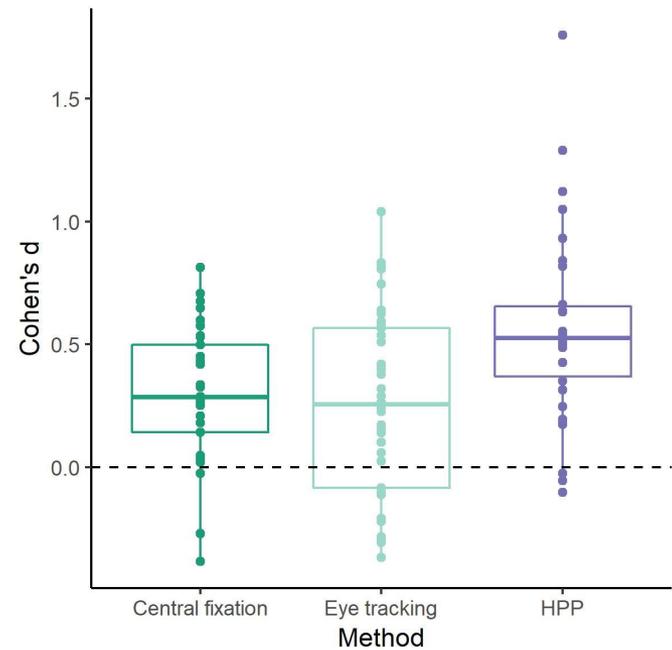
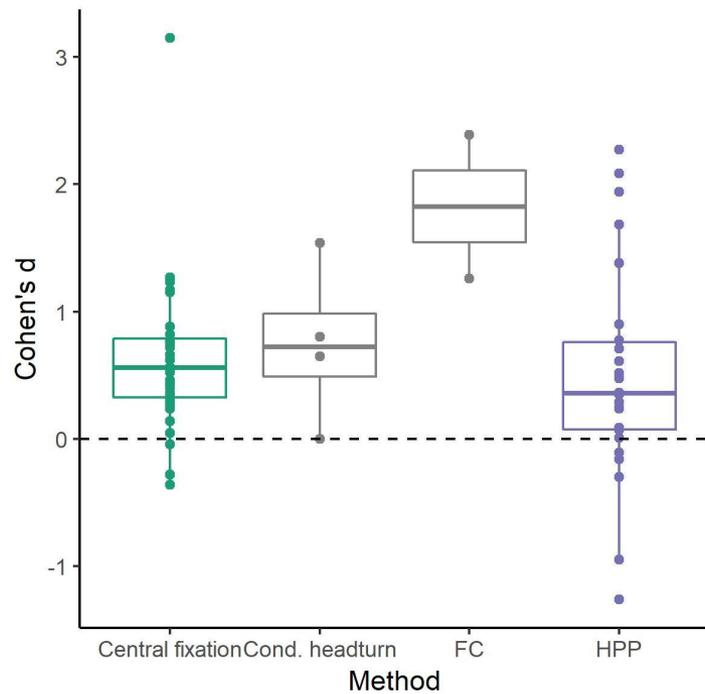


$m = 0, sd = 0.3$



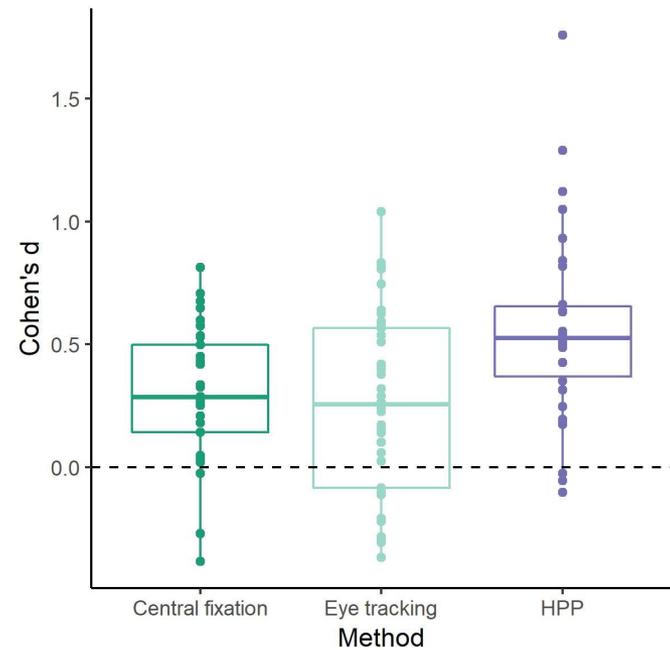
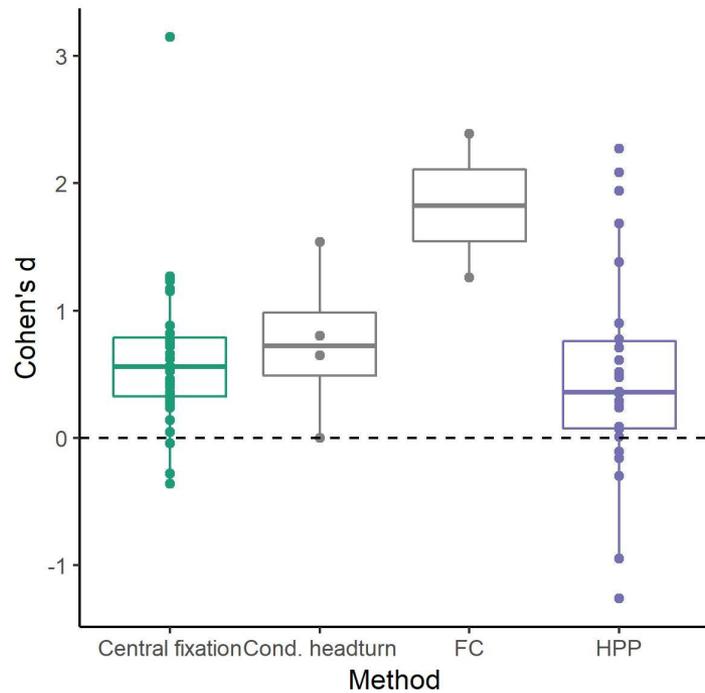
Predicting moderators: Method effect

Skeptic prior versus informed prior



Predicting moderators: Method effect

Skeptic prior versus **informed prior**



Summary: CAMAs and ManyBabies

Experiment planning:

- Design
- Stimuli

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Results:

- Meta-analysis informative for moderators

Summary: CAMAs and ManyBabies

Experiment planning:

- Design
- Stimuli

Results:

- Meta-analysis informative for moderators

Next steps:

- Update meta-analysis (in progress)
- Further dig into possible joint analyses
 - ◆ Open for participation!

Theory adjudication
though meta-analysis

Theories of language acquisition

Key characteristics

- Age as driving factor
- Universal stages

Theories of language acquisition

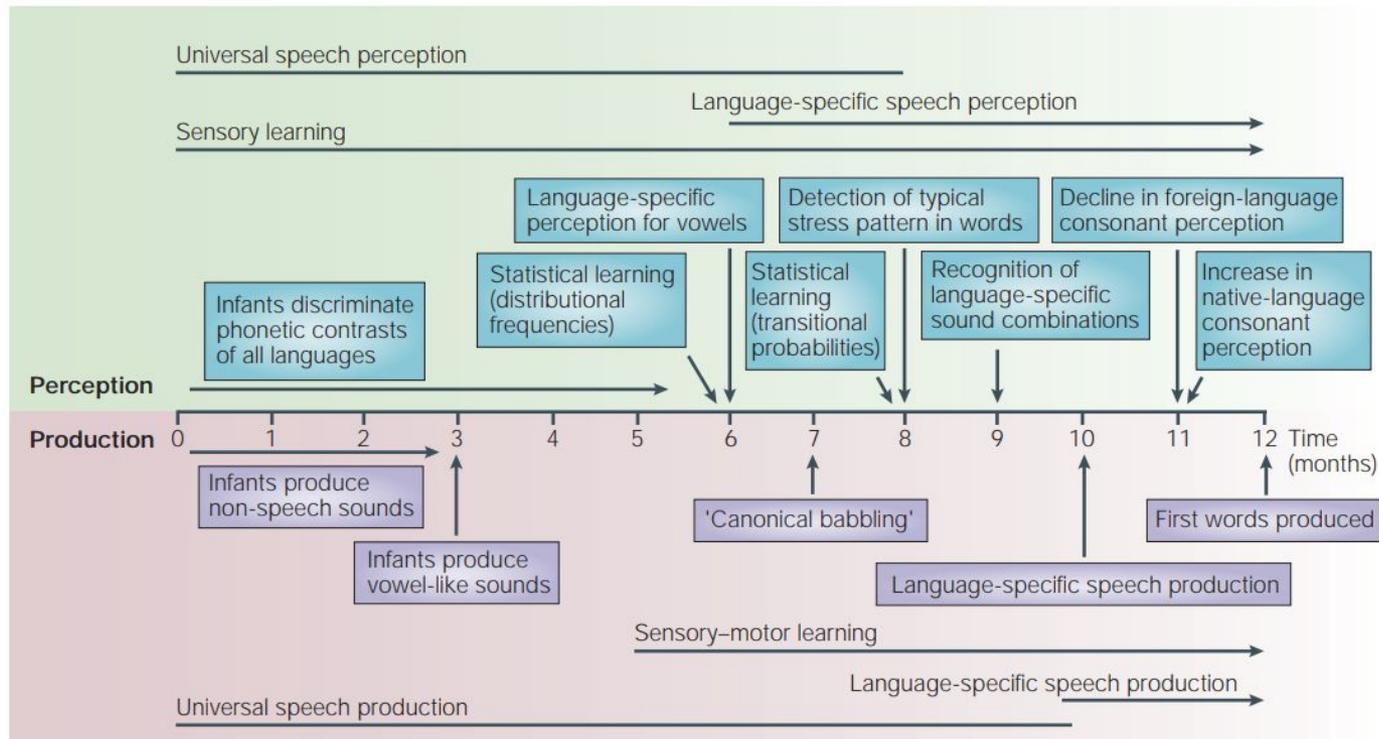
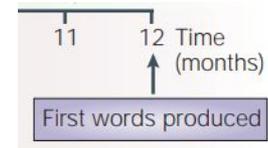
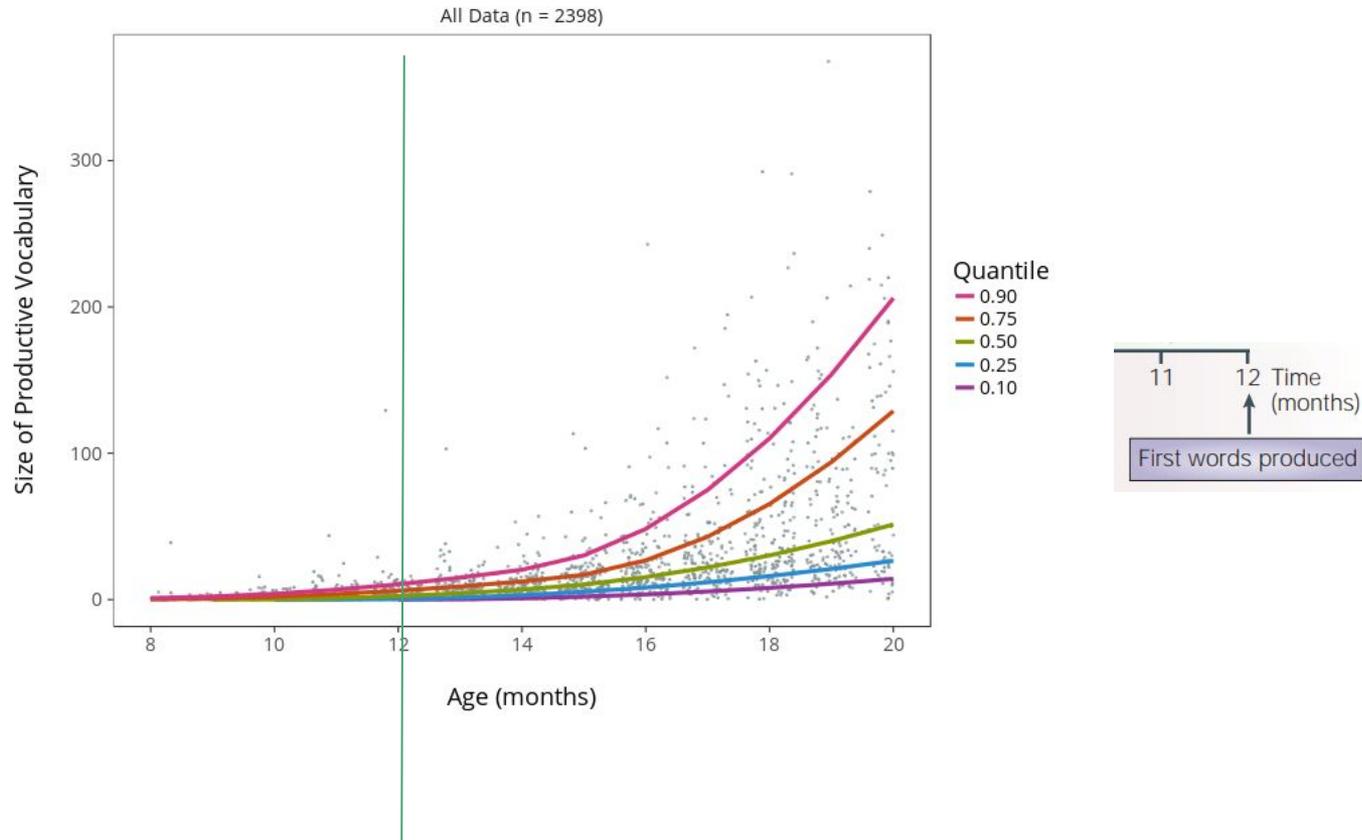


Figure 1 | **The universal language timeline of speech-perception and speech-production development.** This figure shows the changes that occur in speech perception and production in typically developing human infants during their first year of life.

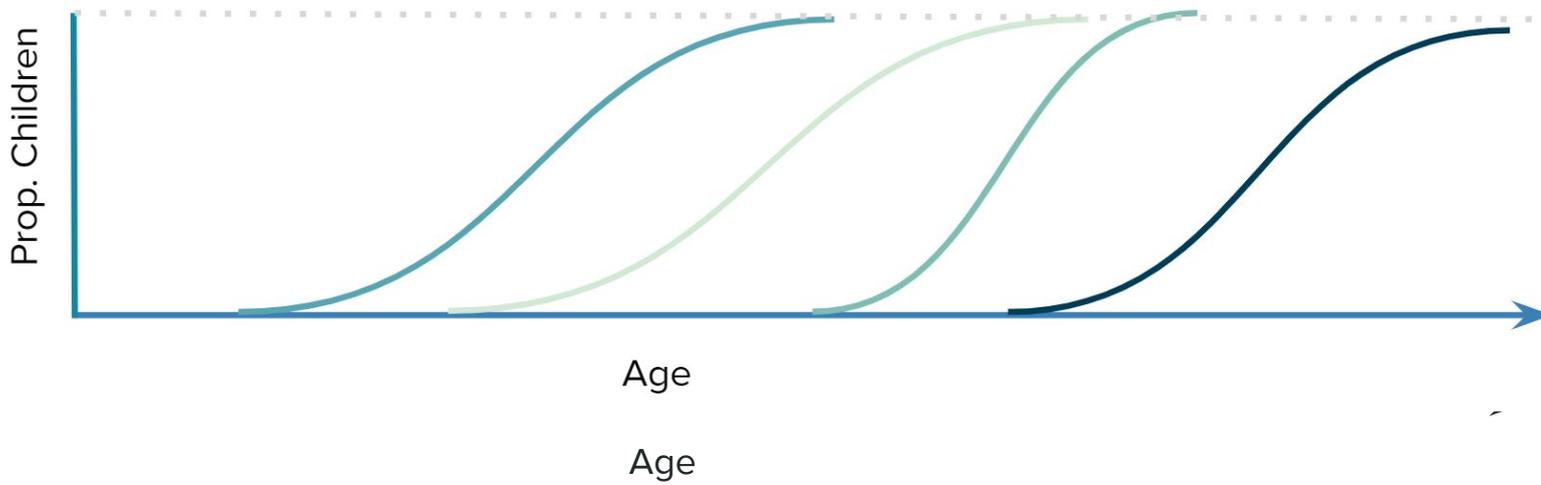
Theory vs Reality



Theory vs Reality



A different way of conceptualizing



From point-estimates towards model comparison

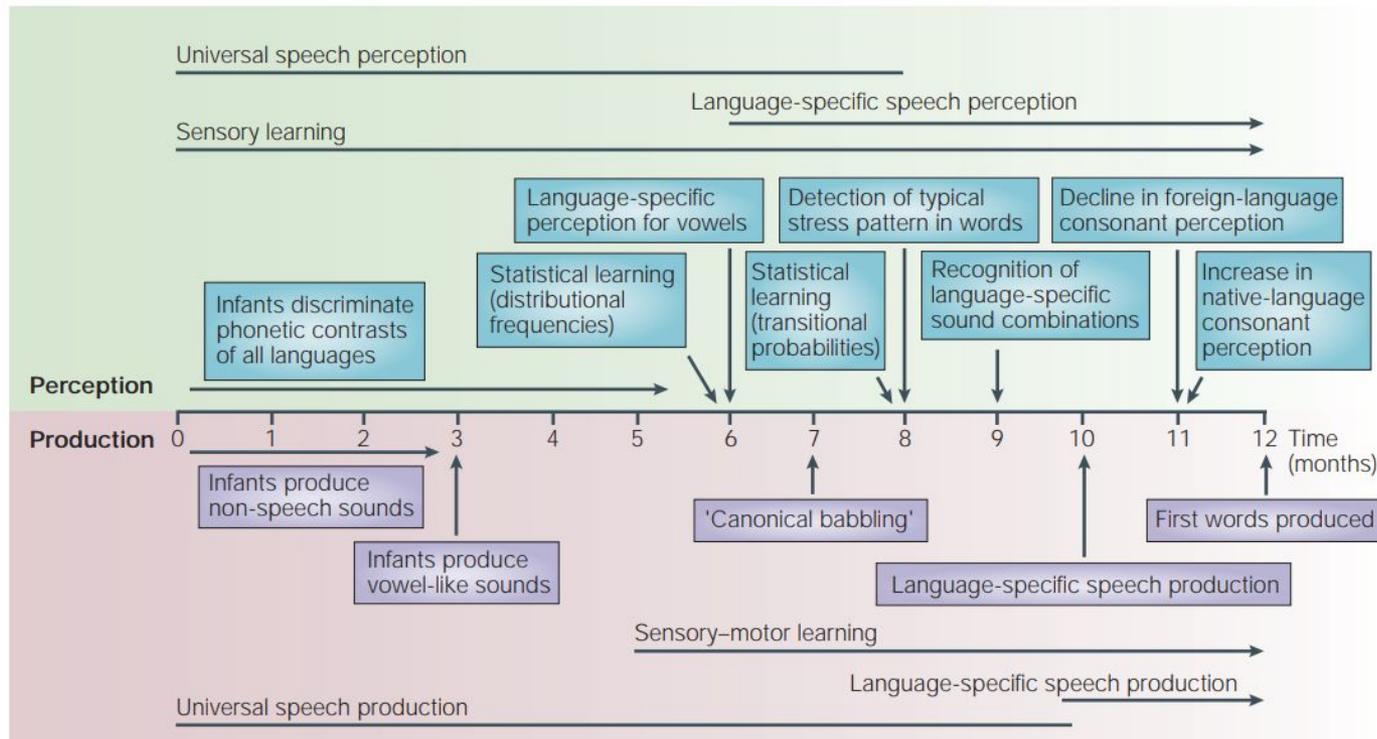
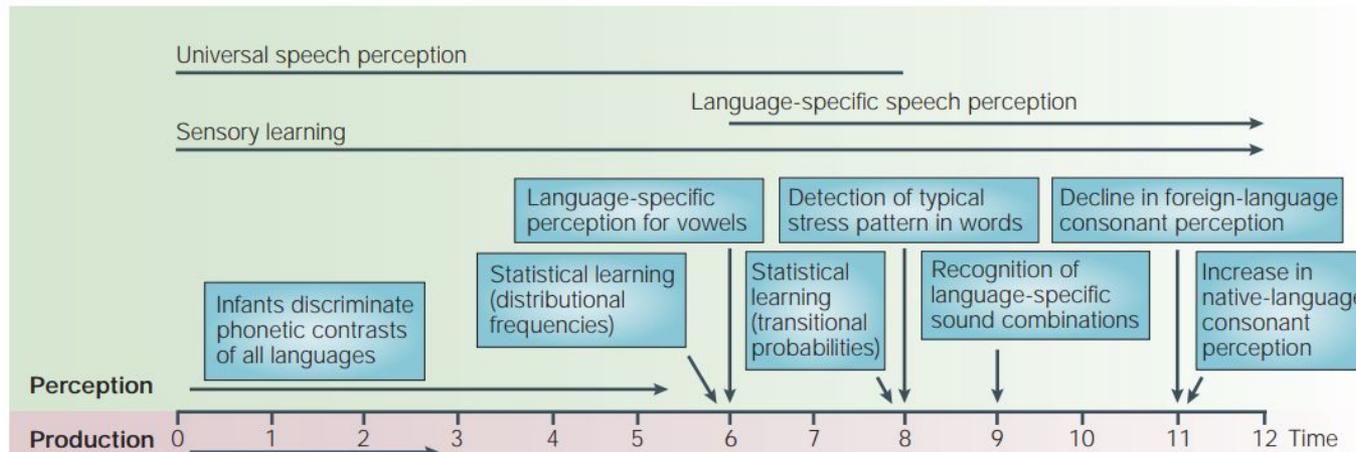


Figure 1 | **The universal language timeline of speech-perception and speech-production development.** This figure shows the changes that occur in speech perception and production in typically developing human infants during their first year of life.

From point-estimates towards model comparison

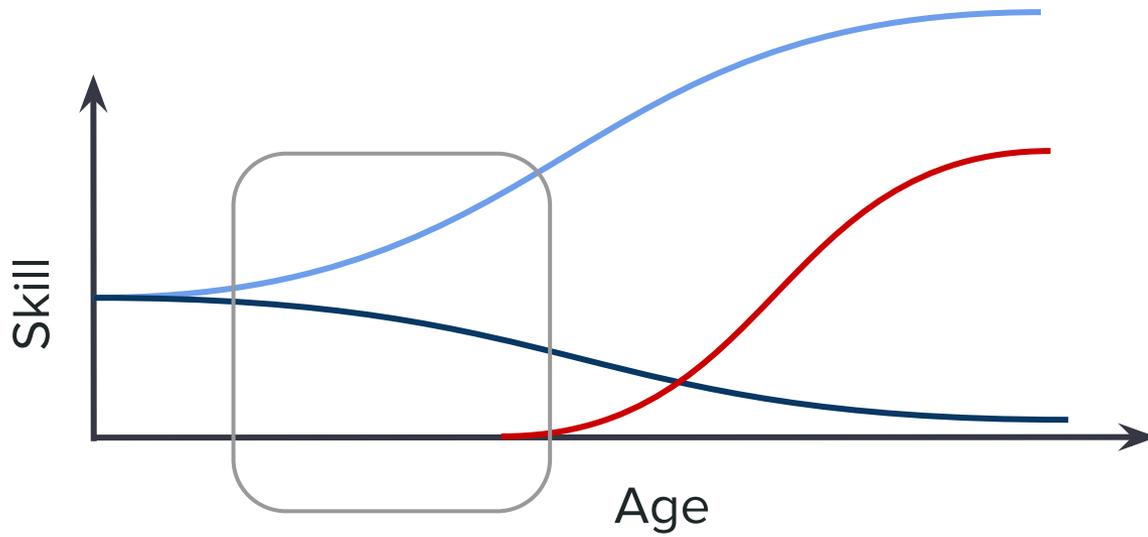


From point-estimates towards model comparison

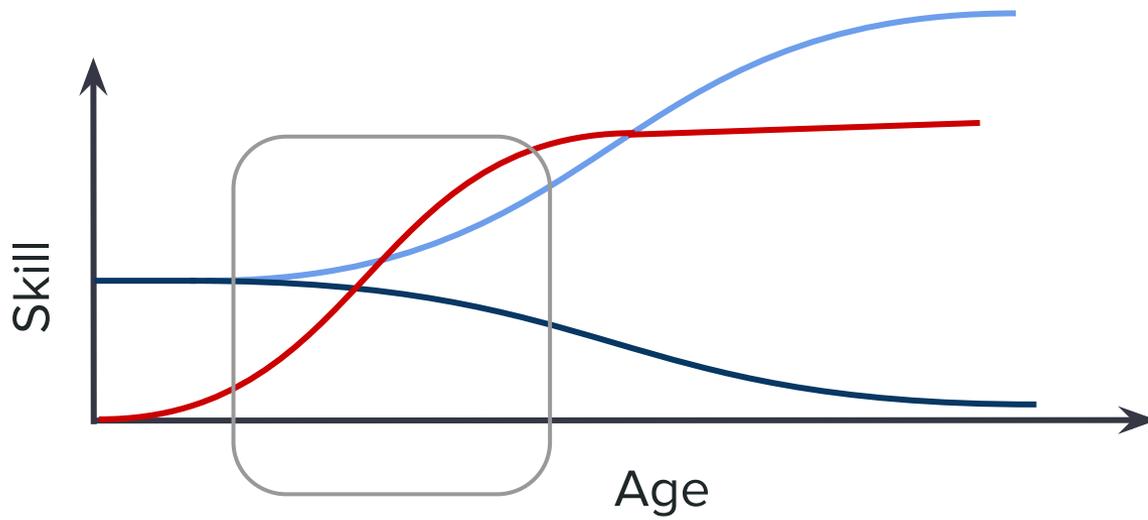
Required:

- ❖ Clear (verbal) model predictions
- ❖ Various skills on a common scale

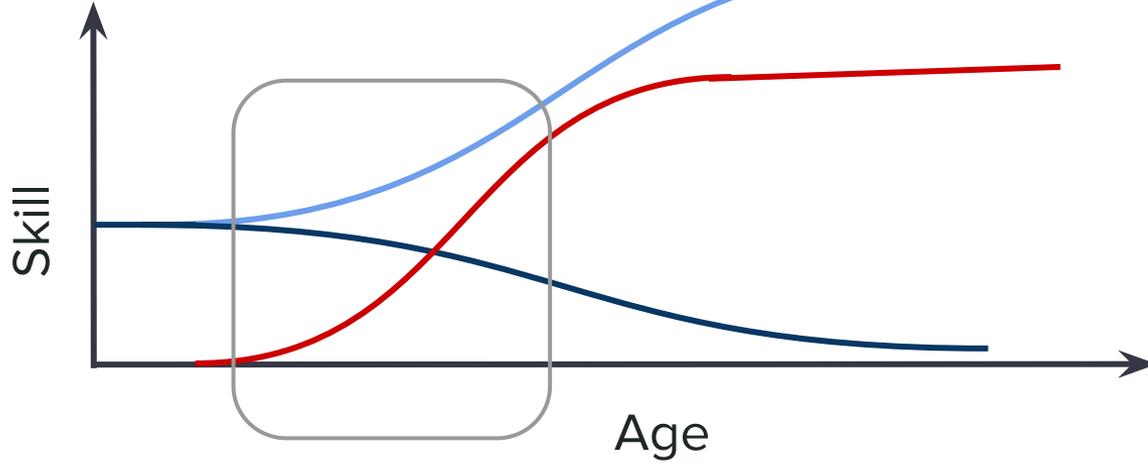
Theory 1: Sounds before words



Theory 2: Words before sounds



Theory 3: Parallel development



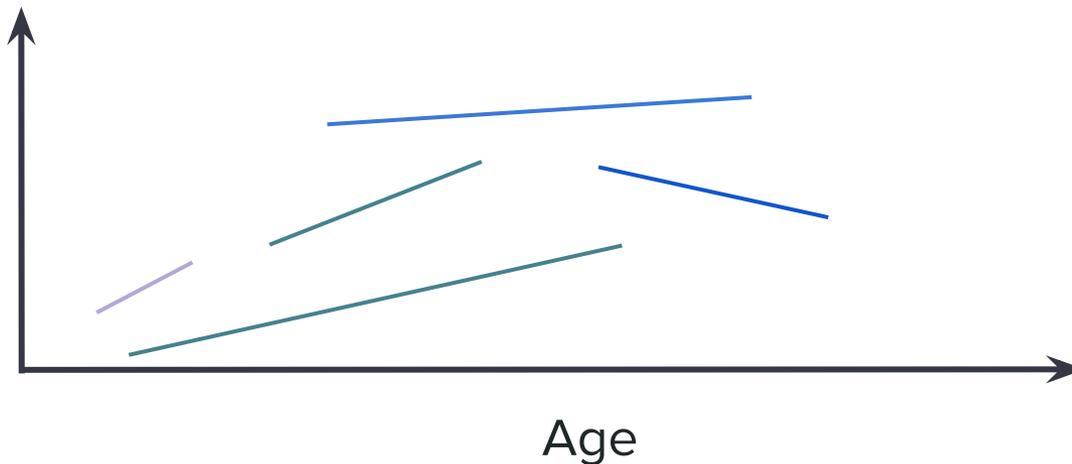
Preprocessing

Data quality check: Is the expected trajectory present?

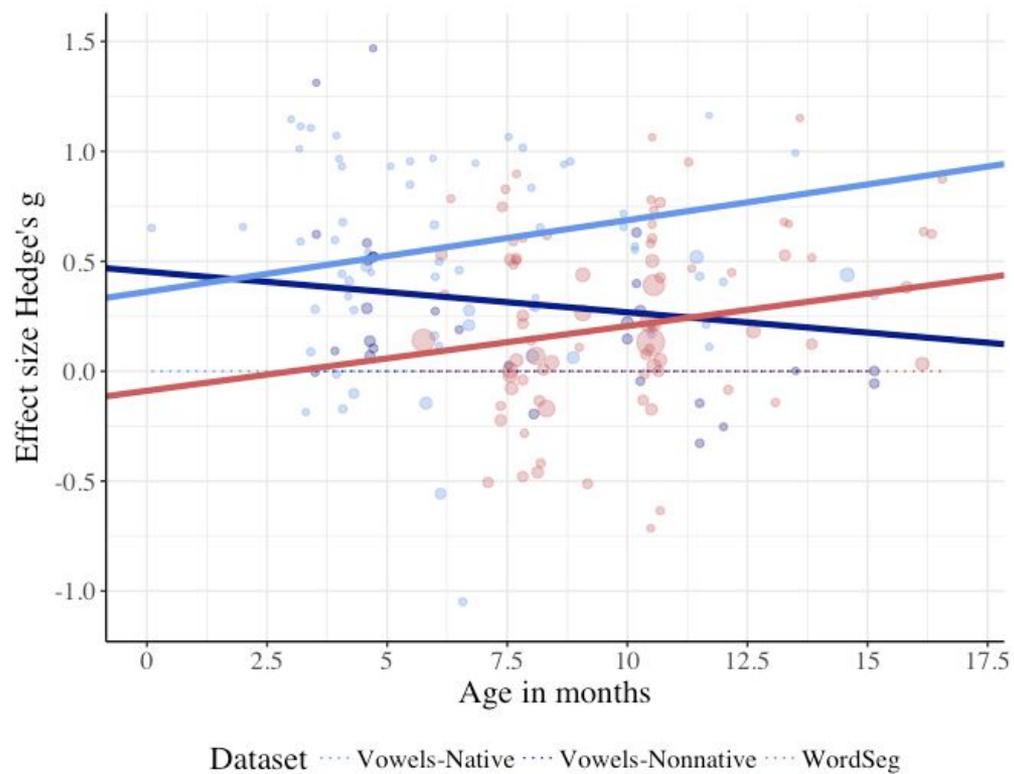
Preprocessing

Data quality check: Is the expected trajectory present?

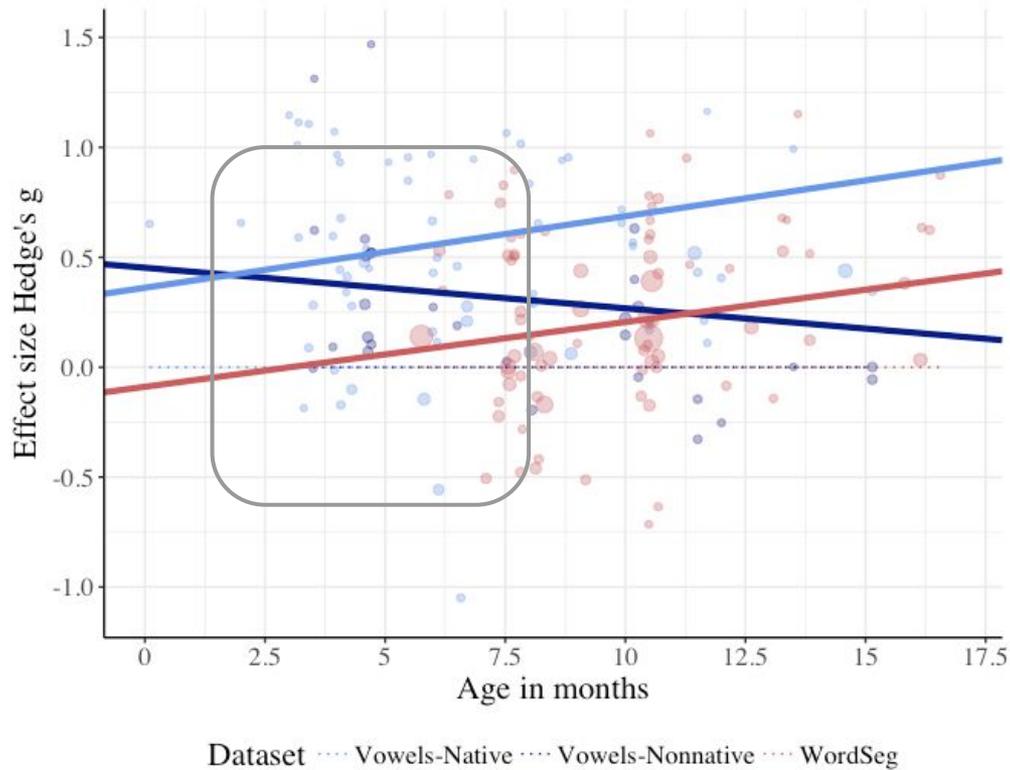
→ Subset to studies with multiple age groups to control variation



Qualitative comparison



Qualitative comparison



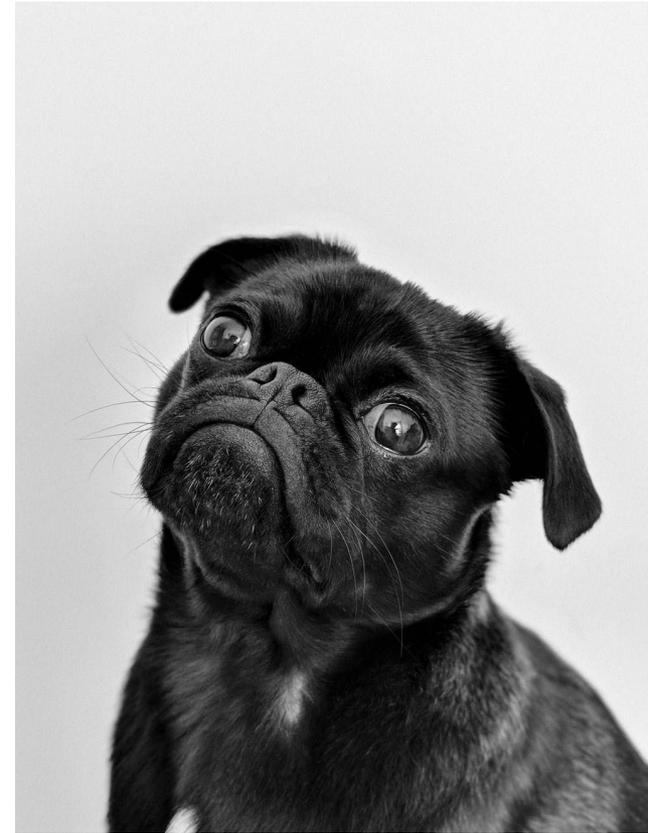
Support for Theory 3:
parallel development

→ No clear developmental
order

Open questions

Divergence versus emergence?

Can we really compare studies that different?



Open questions

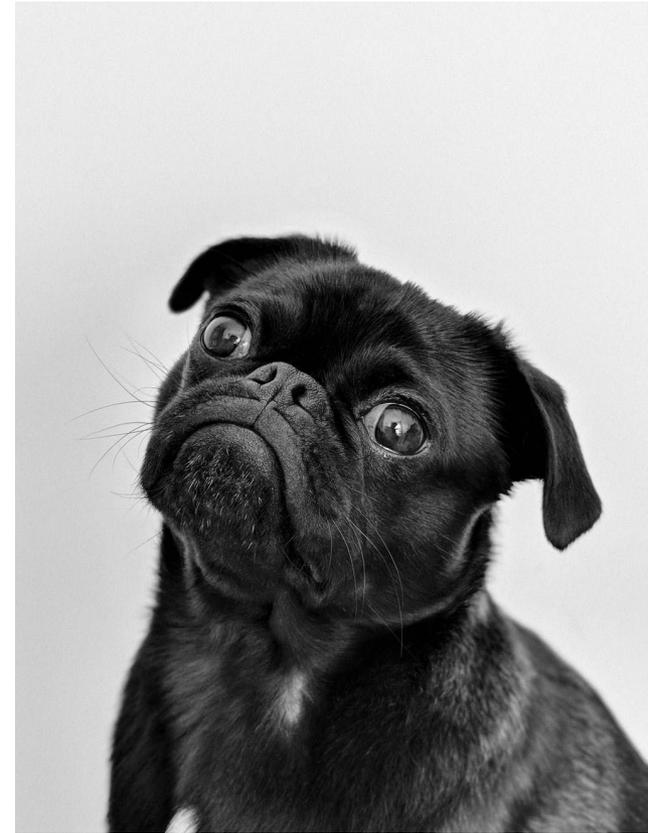
Divergence versus emergence?

Can we really compare studies that different?

Replication distance and method effects as "noise"?

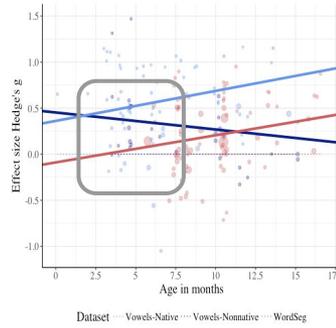
...or meaningful task effects?

→ Prerequisite for useful model comparison

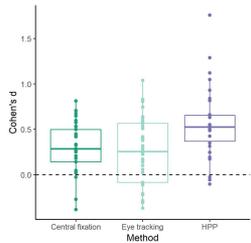


Summary

Why CAMAs?



Study ID	long_cite	short_cite	doi	peer_reviewed
Cooper1990	Cooper, R. P. & Aslin, N. R. Cooper & Aslin (1990)		10.1111/j.1467-8624.1990.tb02102.yes	
Cooper1990	Cooper, R. P. & Aslin, N. R. Cooper & Aslin (1990)		10.1111/j.1467-8624.1990.tb02102.yes	
Cooper1994	Cooper, R. P. & Aslin, N. R. Cooper & Aslin (1994)		10.1111/j.1467-8624.1994.tb02102.yes	
Cooper1994	Cooper, R. P. & Aslin, N. R. Cooper & Aslin (1994)		10.1111/j.1467-8624.1994.tb02102.yes	
Cooper1994	Cooper, R. P. & Aslin, N. R. Cooper & Aslin (1994)		10.1111/j.1467-8624.1994.tb02102.yes	
Cooper1994	Cooper, R. P. & Aslin, N. R. Cooper & Aslin (1994)		10.1111/j.1467-8624.1994.tb02102.yes	
Cooper1997	Cooper, R. P., Abraham, J., Cooper et al. (1997)		10.1016/S0163-4333(97)60037-0	yes
Cooper1997	Cooper, R. P., Abraham, J., Cooper et al. (1997)		10.1016/S0163-4333(97)60037-0	yes
Cooper1997	Cooper, R. P., Abraham, J., Cooper et al. (1997)		10.1016/S0163-4333(97)60037-0	yes



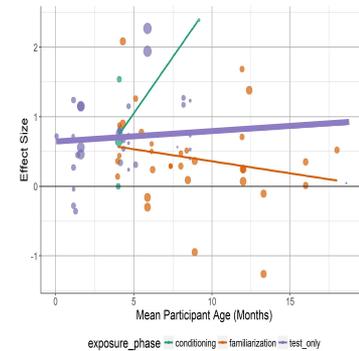
Update theory

Hypothesis formulation

Analysis and interpretation

Experiment design

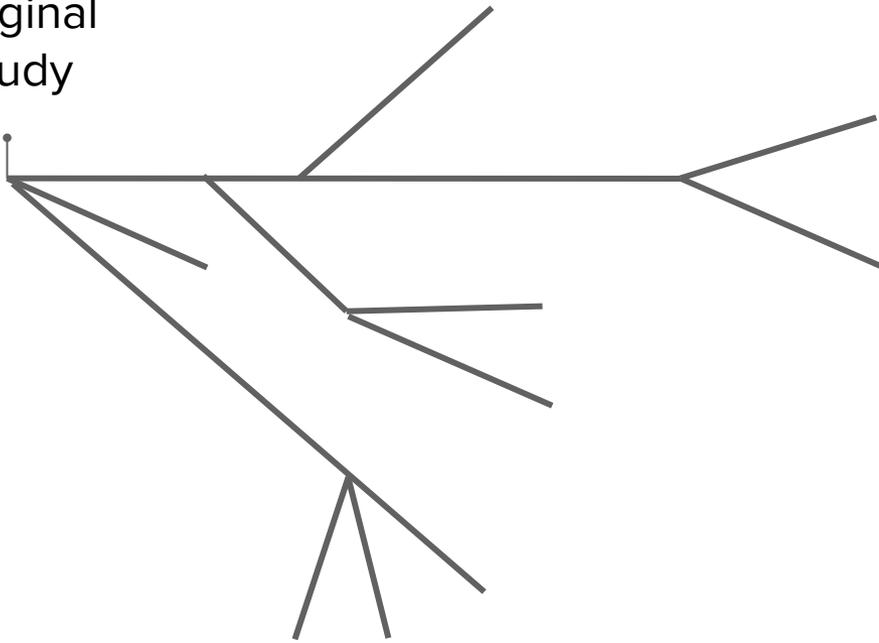
Data collection



CAMAs to understand replication in meta-analyses

Rich, dynamic data

Original
study

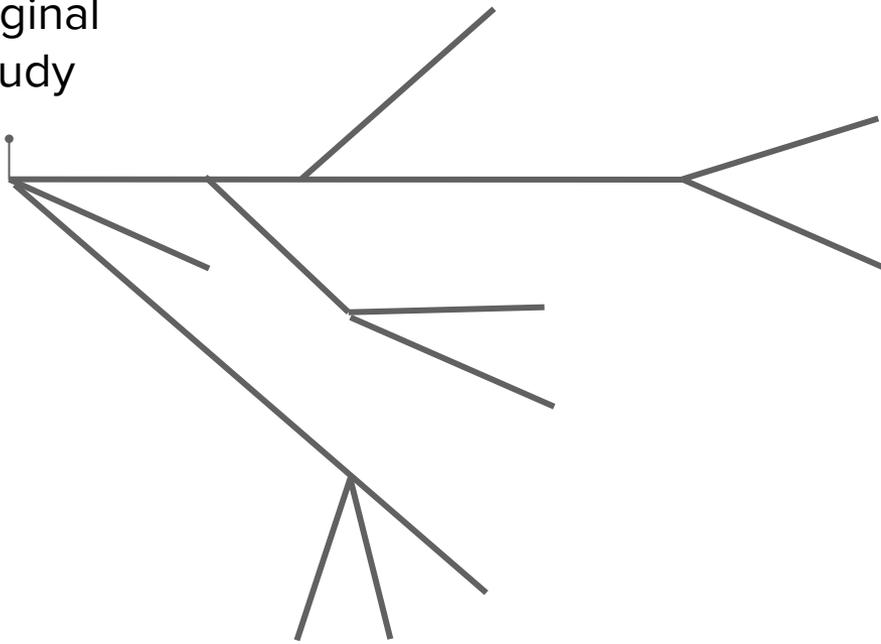


→ Determine effects of study differences / commonalities on *replication distance*

CAMAs to understand replication in meta-analyses

Rich, dynamic data

Original
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→ Determine effects of study differences / commonalities on

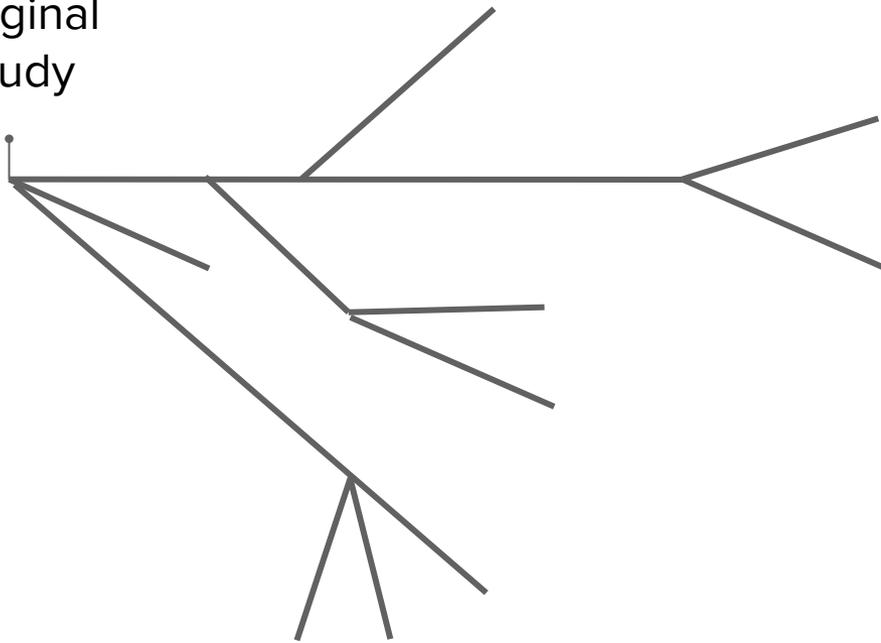
replication distance

Leverage meaningful variation, control "noise"

CAMAs to understand replication in meta-analyses

Improve our models (statistical and cognitive)

Original
study



Future directions

Integrate participant-level data

→ Multi-level approach experts welcome



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Integrate participant-level data

→ Multi-level approach experts welcome

Improve educational tools

→ Further increase engagement (see also yesterday's talk)



Future directions

Integrate participant-level data

- Multi-level approach experts welcome



Improve educational tools

- Further increase engagement (see also yesterday's talk)

Facilitate data upload

- Automatic integration of new meta-analyses

Thank you
