MetaLab and *metalabR*: Facilitating dynamic meta-analyses in developmental psychology

Loretta Gasparini
& Team MetaLab

Research Synthesis and Big Data Virtual Conference
May 18th -21st 2021
MetaLab: http://metalab.stanford.edu/; metalabR repo: https://github.com/langcog/metalabr/; Email: gasparini.lorett@gmail.com

How and when do babies learn language?

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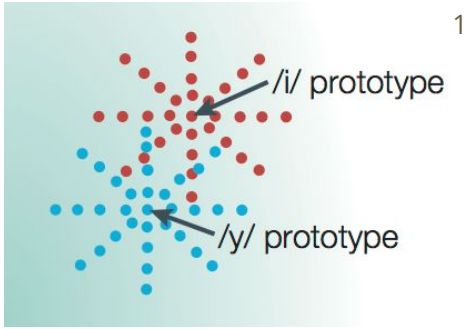
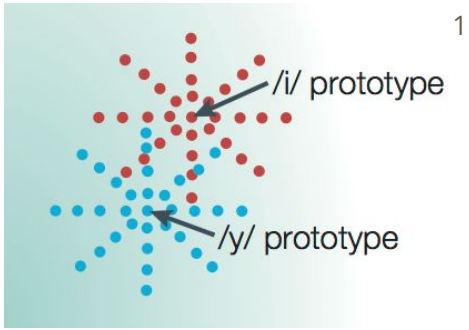


1

1. Kuhl (2004)

How and when do babies learn language?



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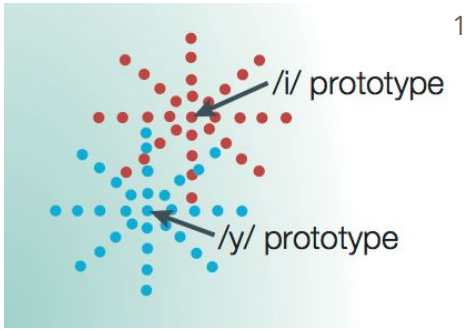

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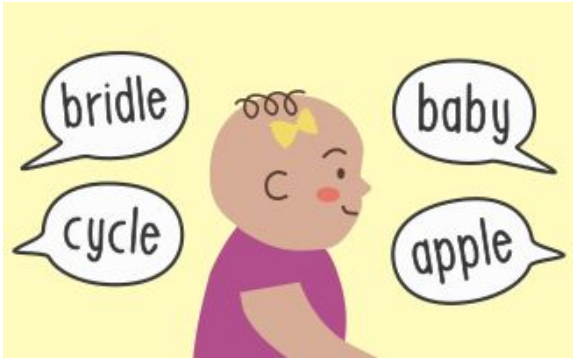

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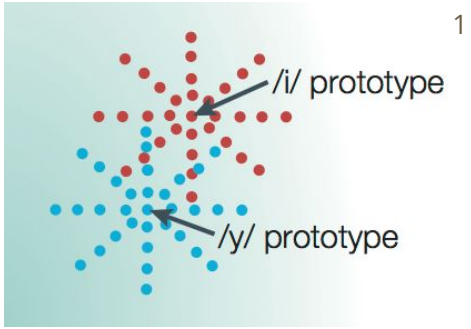

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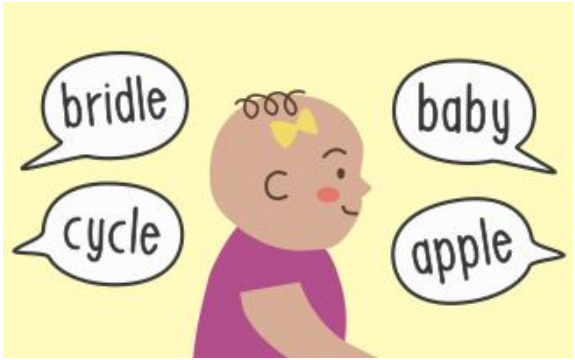
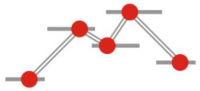


1. Kuhl (2004)

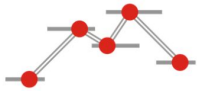
Babies can do X at age Y



Babies can do X at age Y

- False positives (5%), false negatives (40-90%) [1]
- Generalisable results? (or restricted by language, lab, stimuli, method) [2]

1. Bergmann et al. (2018) 2. ManyBabies Consortium (2020)



Babies can do X at age Y

- False positives (5%), false negatives (40-90%) [1]
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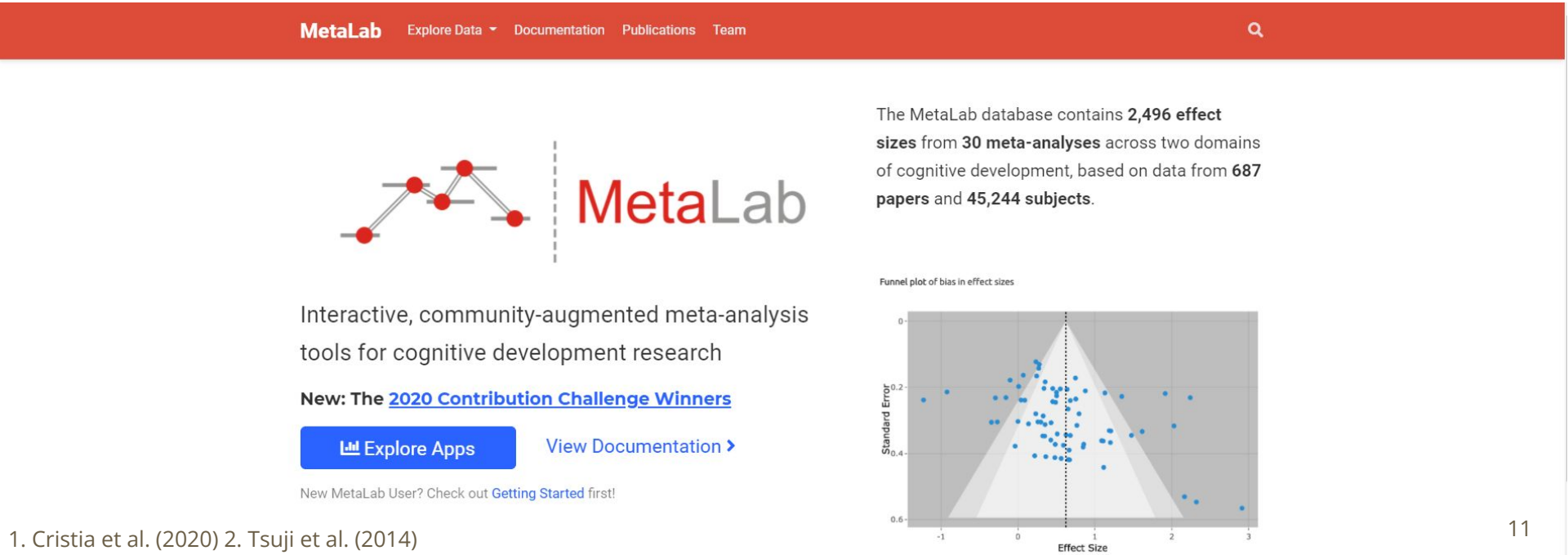
- Systematic review → Meta-analysis

1. Bergmann et al. (2018) 2. ManyBabies Consoritum (2020)

MetaLab

Systematic review → Meta-analysis → Community-augmented meta-analysis (CAMA)[1,2]



1. Cristia et al. (2020) 2. Tsuji et al. (2014)

MetaLab Explore Data Documentation Publications Team

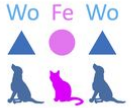
Datasets

All | Cognitive Development | Early Language

Abstract rule learning

Can infants learn abstract repition rules from different types of stimuli?

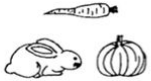
20 papers | 95 experiments | 1111 subjects



Categorization bias

In a triad-task, bias to generalize to taxonomic as opposed to thematic alternative.

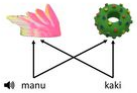
9 papers | 80 experiments | 328 subjects



Cross-situational word learning

Infants and children s abilities to learn words across multiple ambiguous situations.

16 papers | 50 experiments | 2271 subjects

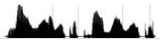


Familiar word recognition

Do infants distingusih familiar words from novel/rare words in listening tasks?

16 papers | 34 experiments | 658 subjects

Function word segmentation



http://metalab.stanford.edu/explore/datasets/

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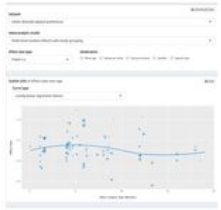
Applications

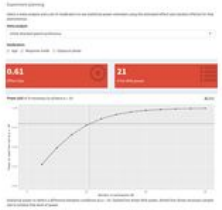
Visualization

Explore a variety of interactive charts driven by the MetaLab database by your datasets and moderators



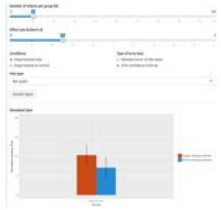
Power Analysis

Analyzes power of your experiment under a variety of conditions



Power Simulation

Simulate power of meta-analyes under a variety of conditions



Data Validation

Validate that new datasets are ready for inclusion in the MetaLab database

http://metalab.stanford.edu/explore/apps/

MetaLab Explore Data Documentation Publications Team

Download data

Domain

Early language

Dataset

Language discrimination and preference

Select a dataset / meta-analysis

Dataset decription: Discrimination of, or preference between, two language varieties, with results from various methods
Dataset citation: Gasparini, L., Langus, A., Tsuji, S., & Boll-Avetisyan, N. (2020, September 17). Quantifying the role of rhythm in infants' language discrimination abilities: A meta-analysis. https://doi.org/10.31219/osf.io/rmn5x

For more information see Documentation or View raw dataset. Please cite the dataset_info that you use following our citation policy.

Effect size type

Hedges' g

Cohen's d corrected for small sample sizes

Moderators

☐ Mean age ☐ Response mode ☑ Exposure phase
☐ Mean age ☐ Method ☐ Infant type

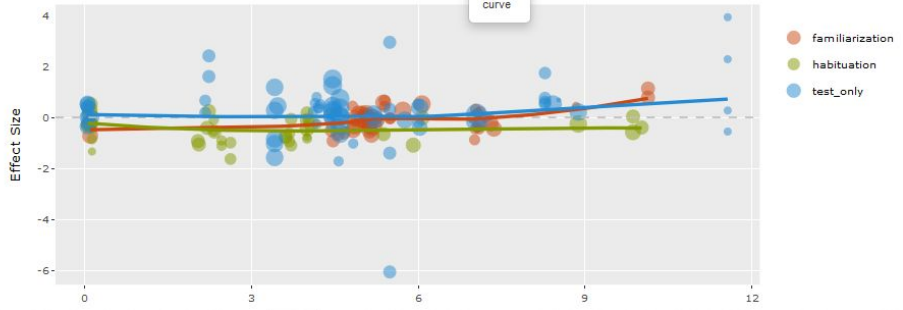
Random effects model assuming studies within a paper share variance. For details, see Statistical Approach.

Scatter plot of effect sizes over age

Curve type

Locally-linear regression (loess)

Select a type of curve

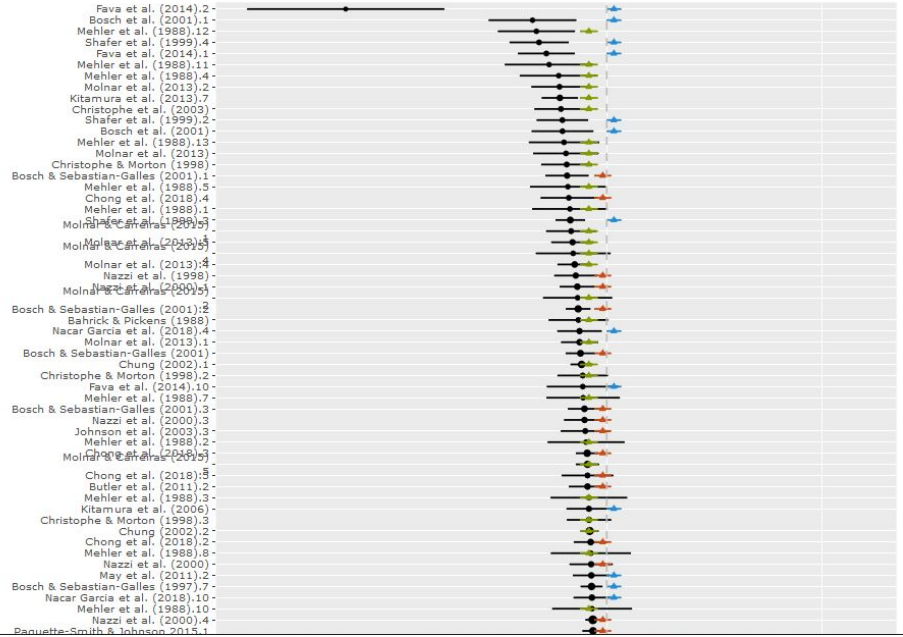


165	-0.08	0.07
Conditions	Effect Size	Effect Size SE

Forest plot of effect sizes and meta-analysis model estimates

Sort order

effect size



http://metalab.stanford.edu/app/visualization/

MetaLab Explore Data Documentation Publications Team

Search...

- Welcome
- Getting Started
- Contribution Challenge
- FAQ
- Why Meta-Analysis?
- **Using MetaLab Data**
- Conduct MA
- Contribute MA
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- Planning Studies and Interpreting Results
- Citation Policy
- **Applications**
- Data Validator
- Power Analysis
- Power Simulation
- Visualization
- **Building the Metalab**

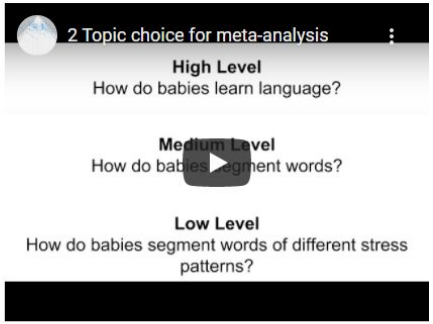
Contents

Conduct MA

Build a MA

Choosing the right MA question

How do I define my MA question?



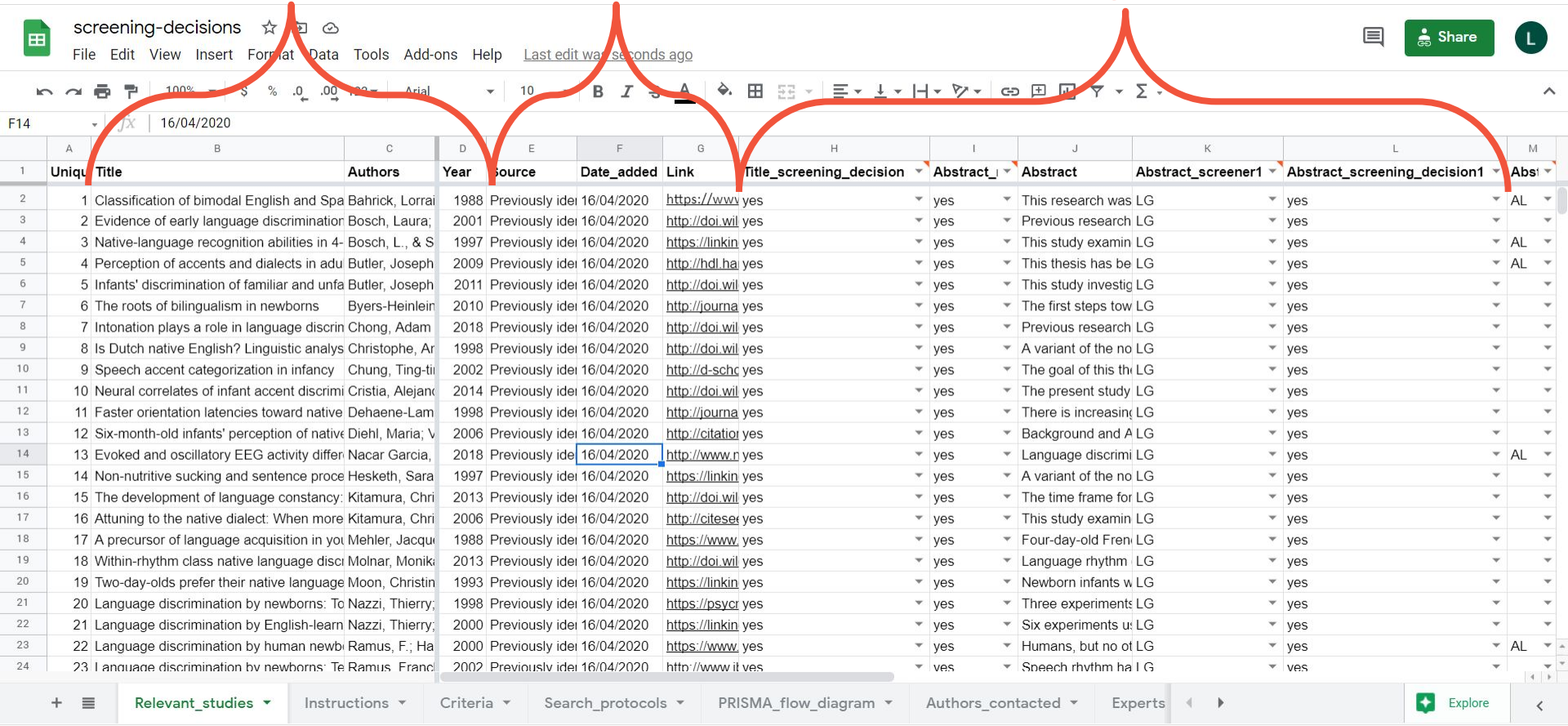
Choose the appropriate level of detail for your MA topic. The topic of your meta-analysis should be broader than the one of a single experiment (e.g. "How do babies segment words of different stress patterns? "), but narrower than a whole research field (e.g. "How do babies learn language? "). The goal is to be able to

http://metalab.stanford.edu/documentation/using_ma_data/conduct_ma/

Publication details

Source

Screening decisions


screening-decisions

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F14 16/04/2020

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Uniqu	Title	Authors	Year	Source	Date_added	Link	Title_screening_decision	Abstract_	Abstract	Abstract_screener1	Abstract_screening_decision1	Abs
2	1	Classification of bimodal English and Spa	Bahrick, Lorrai	1988	Previously ide	16/04/2020	https://www	yes	yes	This research was	LG	yes	AL
3	2	Evidence of early language discriminatior	Bosch, Laura;	2001	Previously ide	16/04/2020	http://doi.wil	yes	yes	Previous research	LG	yes	
4	3	Native-language recognition abilities in 4-	Bosch, L., & S	1997	Previously ide	16/04/2020	https://linkin	yes	yes	This study examin	LG	yes	AL
5	4	Perception of accents and dialects in adu	Butler, Joseph	2009	Previously ide	16/04/2020	http://hdl.ha	yes	yes	This thesis has be	LG	yes	AL
6	5	Infants' discrimination of familiar and unfa	Butler, Joseph	2011	Previously ide	16/04/2020	http://doi.wil	yes	yes	This study investig	LG	yes	
7	6	The roots of bilingualism in newborns	Byers-Heinlein	2010	Previously ide	16/04/2020	http://journa	yes	yes	The first steps tow	LG	yes	
8	7	Intonation plays a role in language discrin	Chong, Adam	2018	Previously ide	16/04/2020	http://doi.wil	yes	yes	Previous research	LG	yes	
9	8	Is Dutch native English? Linguistic analys	Christophe, Ar	1998	Previously ide	16/04/2020	http://doi.wil	yes	yes	A variant of the no	LG	yes	
10	9	Speech accent categorization in infancy	Chung, Ting-ti	2002	Previously ide	16/04/2020	http://d-scho	yes	yes	The goal of this th	LG	yes	
11	10	Neural correlates of infant accent discrimi	Cristia, Alejanc	2014	Previously ide	16/04/2020	http://doi.wil	yes	yes	The present study	LG	yes	
12	11	Faster orientation latencies toward native	Dehaene-Lam	1998	Previously ide	16/04/2020	http://journa	yes	yes	There is increasing	LG	yes	
13	12	Six-month-old infants' perception of native	Diehl, Maria; V	2006	Previously ide	16/04/2020	http://citatior	yes	yes	Background and A	LG	yes	
14	13	Evoked and oscillatory EEG activity differ	Nacar Garcia,	2018	Previously ide	16/04/2020	http://www.r	yes	yes	Language discrimi	LG	yes	AL
15	14	Non-nutritive sucking and sentence proce	Hesketh, Sara	1997	Previously ide	16/04/2020	https://linkin	yes	yes	A variant of the no	LG	yes	
16	15	The development of language constancy:	Kitamura, Chri	2013	Previously ide	16/04/2020	http://doi.wil	yes	yes	The time frame for	LG	yes	
17	16	Attuning to the native dialect: When more	Kitamura, Chri	2006	Previously ide	16/04/2020	http://citeseı	yes	yes	This study examin	LG	yes	
18	17	A precursor of language acquisition in you	Mehler, Jacqu	1988	Previously ide	16/04/2020	https://www.	yes	yes	Four-day-old Fren	LG	yes	
19	18	Within-rhythm class native language discr	Molnar, Monika	2013	Previously ide	16/04/2020	http://doi.wil	yes	yes	Language rhythm	LG	yes	
20	19	Two-day-olds prefer their native language	Moon, Christin	1993	Previously ide	16/04/2020	https://linkin	yes	yes	Newborn infants w	LG	yes	
21	20	Language discrimination by newborns: To	Nazzi, Thierry;	1998	Previously ide	16/04/2020	https://psyc	yes	yes	Three experiments	LG	yes	
22	21	Language discrimination by English-learn	Nazzi, Thierry;	2000	Previously ide	16/04/2020	https://linkin	yes	yes	Six experiments u	LG	yes	
23	22	Language discrimination by human newbı	Ramus, F.; Ha	2000	Previously ide	16/04/2020	https://www.	yes	yes	Humans, but no ot	LG	yes	AL
24	23	Language discrimination by newborns: Te	Ramus, Franc	2002	Previously ide	16/04/2020	http://www.it	yes	yes	Speech rhythm ha	LG	yes	

Relevant_studies | Instructions | Criteria | Search_protocols | PRISMA_flow_diagram | Authors_contacted | Experts | Explore

MetaLab Decision Spreadsheet

Methodological details

Participant details

Quantitative results

language-discrimination

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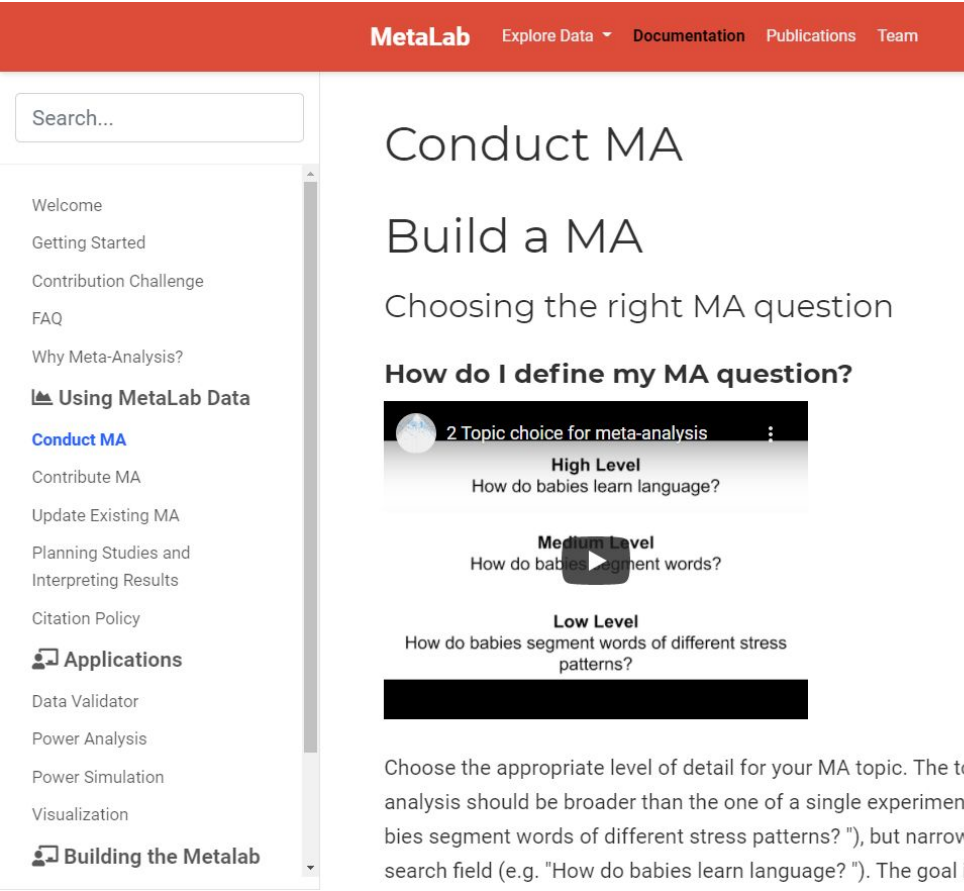
	A	G	I	J	K	M	N	BN	BP	BR	BS	BV	BX	BY	BZ	CA	CB	CC	CD	CE	CF
1	study_ID	expt_num	same_infant	response_mode	task	method	dependent_measur	n_1	n_excluded	mean_age_	age_range	gender_	x_2	x_1	SD_2	SD_1	corr	r	t	F	d
2	bahrick88	1	1	eye-tracking	disc	CF	looking_time	16	14.5	163.6	17.2		7.500	13.400					-1.910		
3	bosch97	1	catalan_1	behavior	pref	HPP	reaction_time	10	5	129	24		1.054	1.294	0.572	0.153			-4.620		
4	bosch97	2	catalan_2	behavior	pref	HPP	reaction_time	10	3.5	126	20		1.173	1.344	0.189	0.343			-2.265		
5	bosch97	2	spanish_2	behavior	pref	HPP	reaction_time	10	3.5	128	20		1.164	1.320	0.372	0.442			-3.789		
6	bosch97	3	catalan_3	behavior	pref	HPP	reaction_time	10	4.5	125	17		1.302	1.393	0.378	0.363			-2.877		
7	bosch97	3	spanish_3	behavior	pref	HPP	reaction_time	10	4.5	127	20		1.301	1.468	0.183	0.196			-4.434		
8	bosch97	4.1	catalan_4.1	behavior	pref	HPP	reaction_time	10	2	127	20		1.597	1.454	0.498	0.508			4.620		
9	bosch97	4.2	4.2	behavior	pref	HPP	reaction_time	10	3	134	25		1.311	1.291	0.324	0.325			1.205		
10	bosch97	5	catalan_5	behavior	pref	HPP	reaction_time	10	3	135	49		1.445	1.292	0.451	0.326			2.550		
11	bosch01a	1	catalan	behavior	pref	HPP	reaction_time	10	1	147	23		1.299	1.523					-3.568		
12	bosch01a	1	spanish	behavior	pref	HPP	reaction_time	10	1	139	36		1.181	1.383					-4.903		
13	bosch01b	1	catalan_1	behavior	disc	HPP	looking_time	14	2	142	34		14.84	10.884	6.947	5.102			-4.038		
14	bosch01b	1	spanish_1	behavior	disc	HPP	looking_time	14	1	136	30		12.23	8.416	4.760	2.751			-4.203		
15	bosch01b	2	catalan_2	behavior	disc	HPP	looking_time	14	6	139	17		13.17	9.209	4.912	6.221			-6.901		
16	bosch01b	2	spanish_2	behavior	disc	HPP	looking_time	14	6	135	12		14.49	11.238	5.736	6.059			-3.003		
17	bosch10	1	1	eye-tracking	pref	CF	reaction_time			136.98											
18	bosch10	2	2	eye-tracking	pref	CF	reaction_time			136.98											
19	bosch10	3	3_mono	eye-tracking	pref	CF	reaction_time			136.98											
20	bosch10	3	3_bi	eye-tracking	pref	CF	reaction_time			136.98											
21	butler11	1	1	behavior	disc	HPP	looking_time	20	7	163.4628	48.0952	0.45	6.820	8.580	2.820	2.980				6.700	
22	butler11	2	2	behavior	disc	HPP	looking_time	20	6	153.4176	50.8348	0.35	7.930	8.190	3.250	3.460					
23	butler11	3	3	behavior	disc	HPP	looking_time	20	4	224.0384	80.9704	0.5	7.970	6.600	3.410	2.390				-4.480	

Data | CodeBook | Methods | Data-in-publication | Explore



In progress:

- Tutorials for planning a new study and adding to a CAMA
- Tutorial paper for conducting a meta-analysis

http://metalab.stanford.edu/documentation/using_ma_data/conduct_ma/

metalabR package

Reads live data

Compatible with *metafor* [1]

Visualization

1. Viechtbauer (2010)

metalabR package

Reads live data

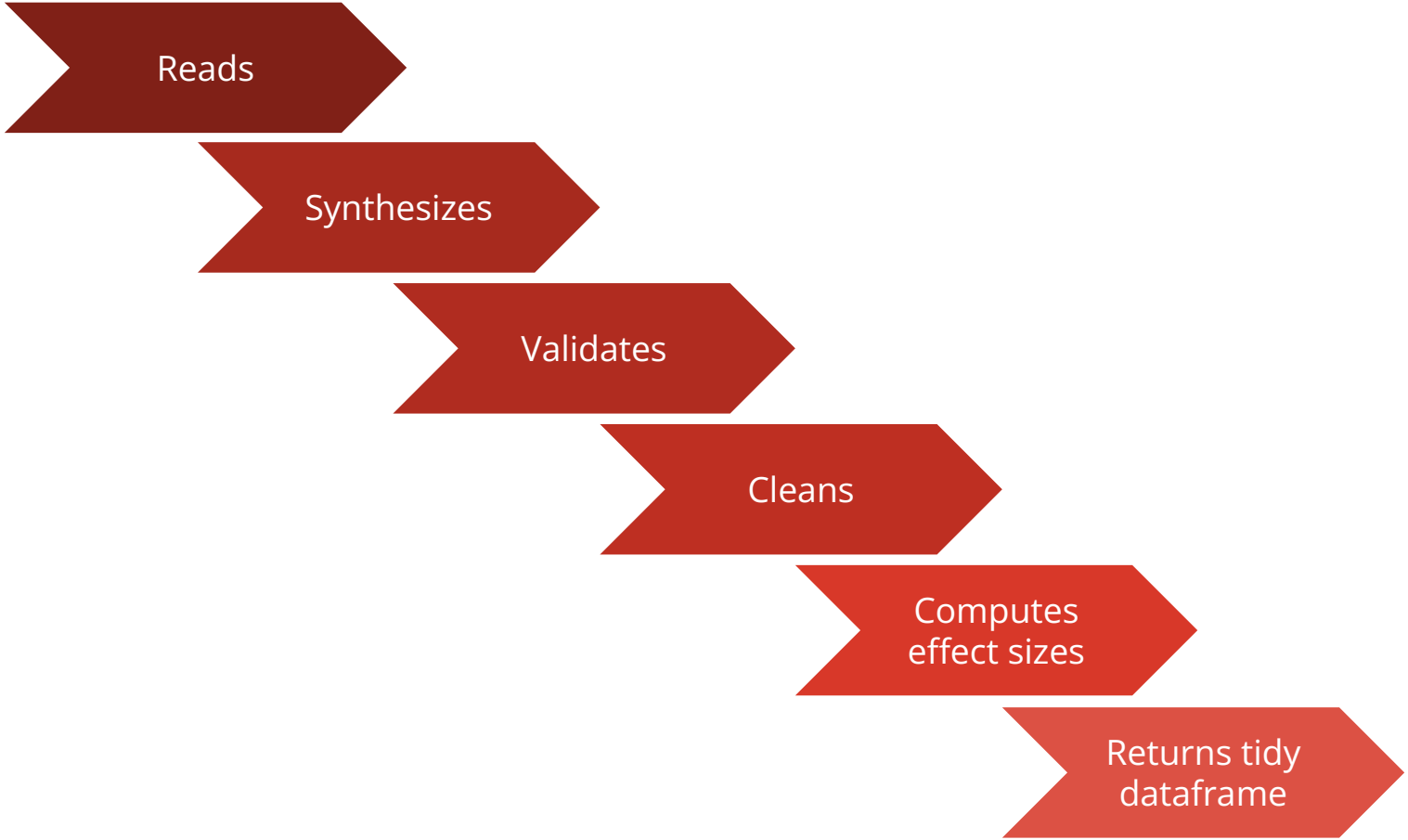
```
> get_metalab_data()
```

Compatible with *metafor* [1]

Visualization

1. Viechtbauer (2010)

> get_metalab_data()



metalabR package

Reads live data

Compatible with *metafor* [1]

```
> rma.mv()
```

Visualization

1. Viechtbauer (2010)

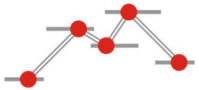
metalabR package

Reads live data

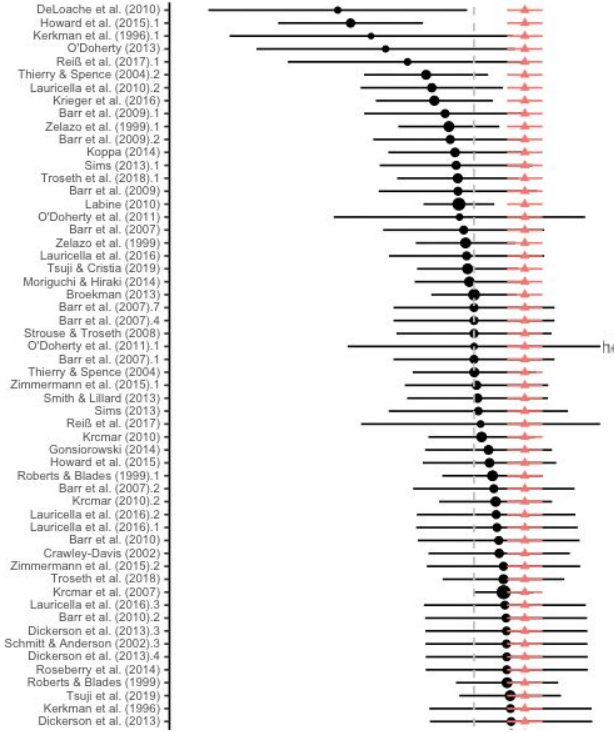
Compatible with *metafor* [1]

Visualization

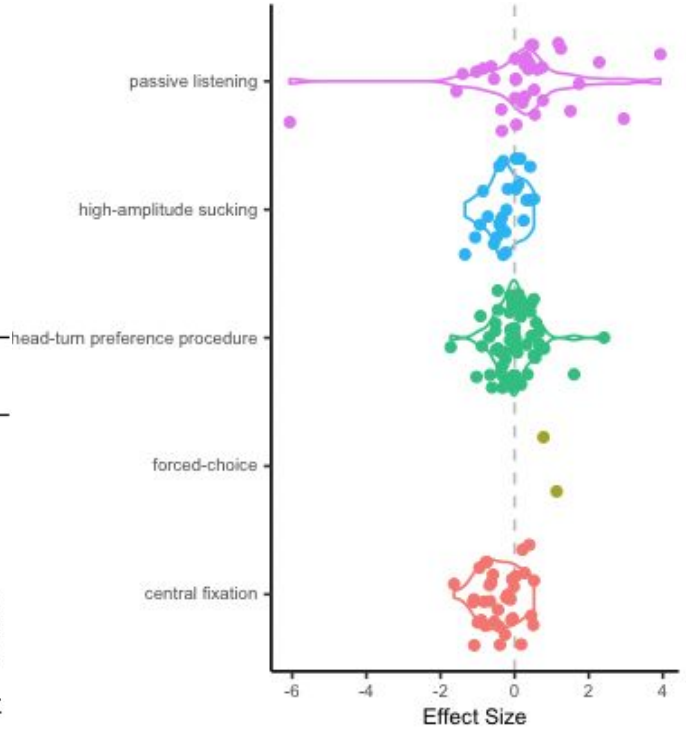
1. Viechtbauer (2010)



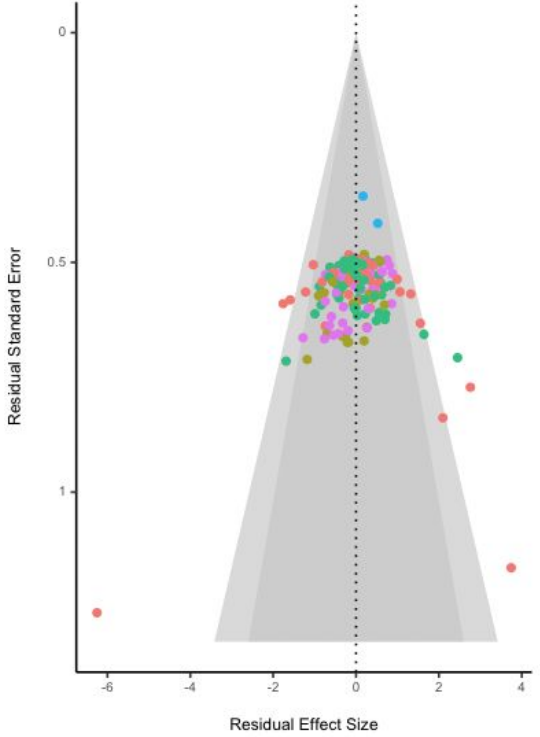
`> forest_plot(...)`



`> violin_plot(...)`

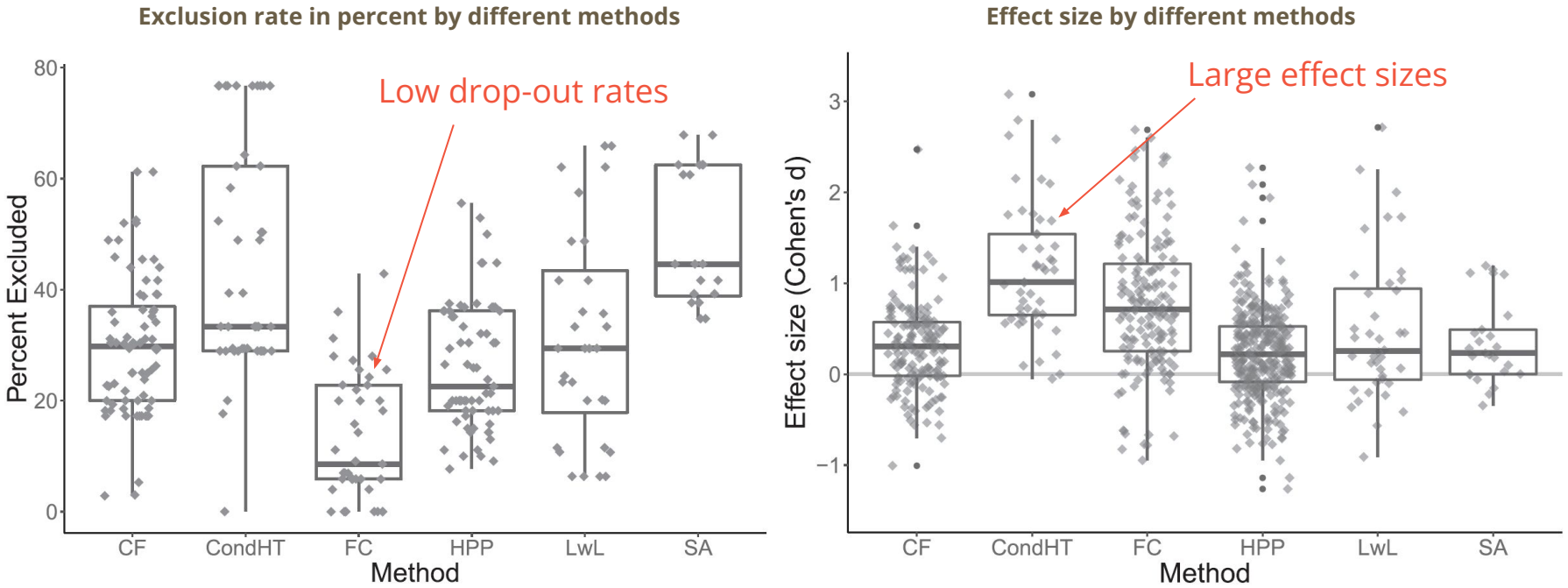


`> funnel_plot(...)`



Meta-meta-analyses

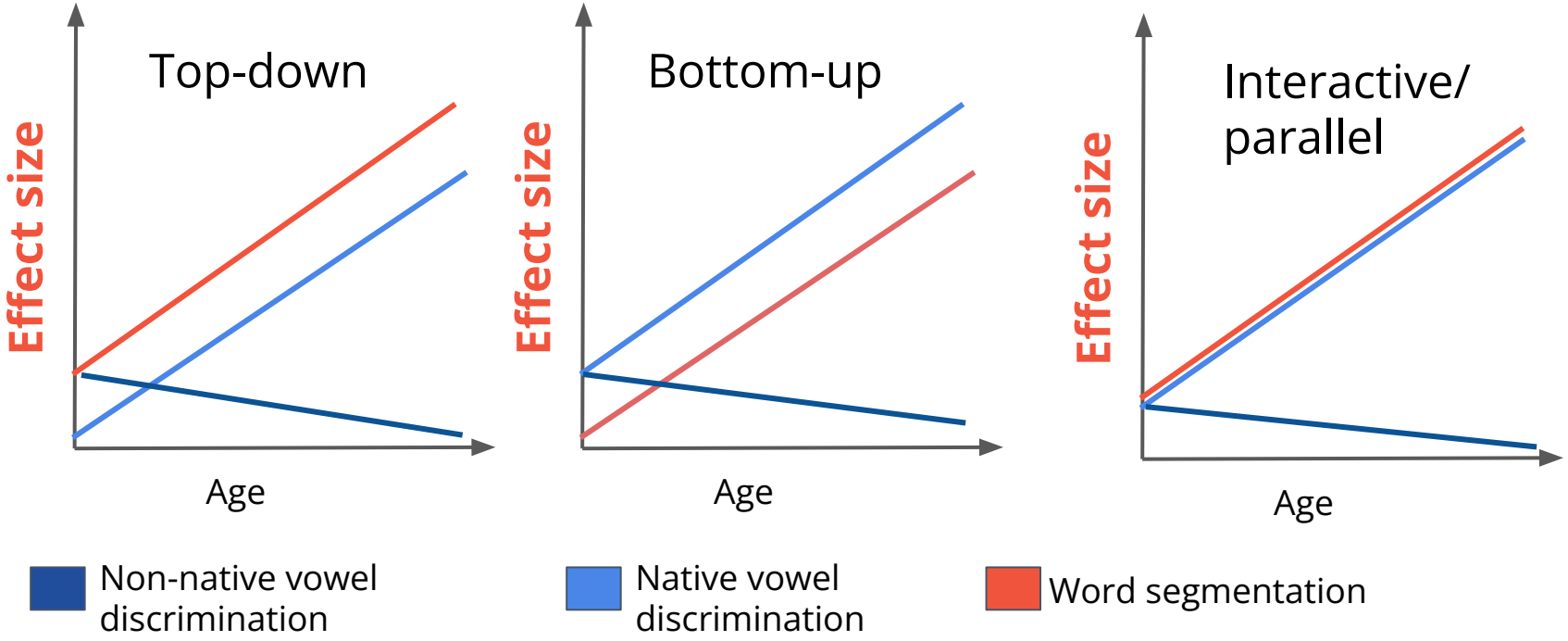
Meta-meta-analyses: Method choice



CF = central fixation; CondHT = conditioned headturn; FC = forced choice; HPP = headturn preference procedure; LwL = looking while listening; SA = stimulus alternation. Each point indicates a single study.

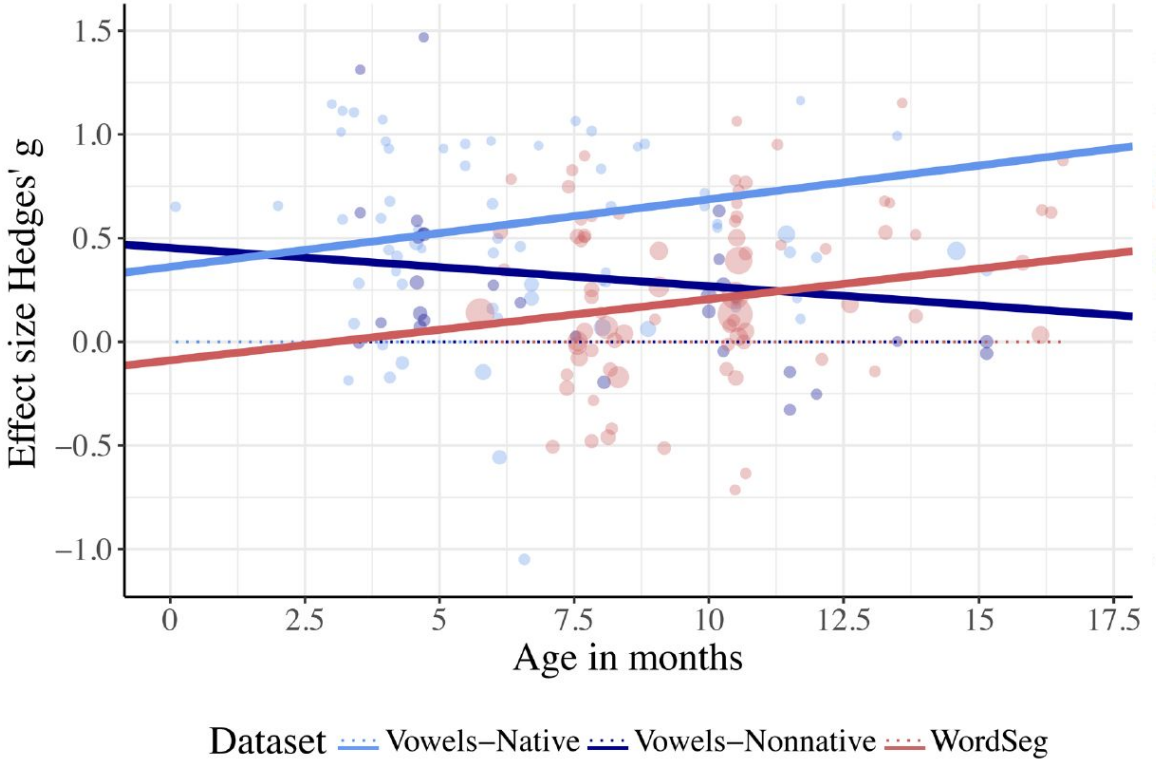
Bergmann et al. (2018)

Meta-meta-analyses: Phonological acquisition



Bergmann et al. (2017)

Meta-meta-analyses: Phonological acquisition



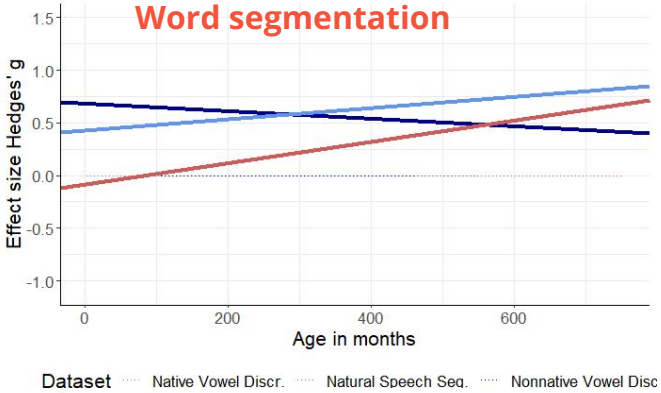
Initial analysis:

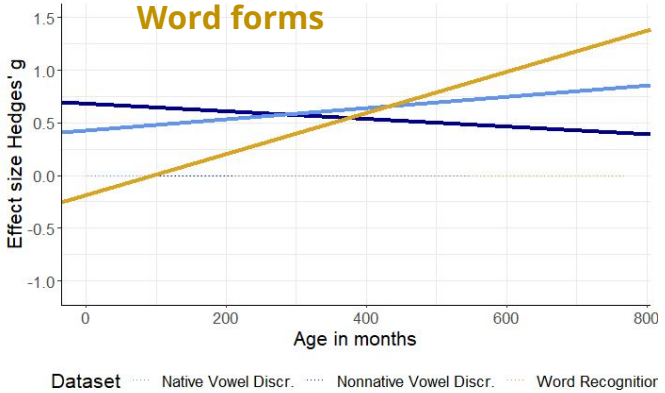
Segmentation skills emerge after native vowel attunement →

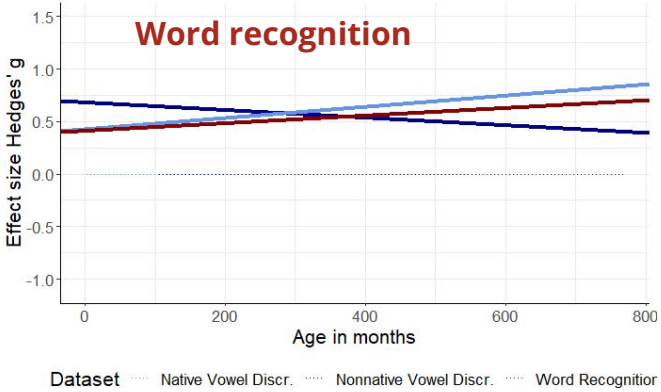
Not supporting top-down theories

Bergmann et al. (2017)

Meta-meta-analyses: Phonological acquisition







Subsequent analyses:

Word recognition from 6 months onwards →

Supporting top-down theories?

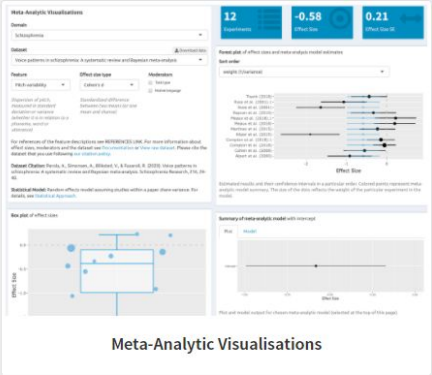
More empirical work needed

Spin-offs in other areas

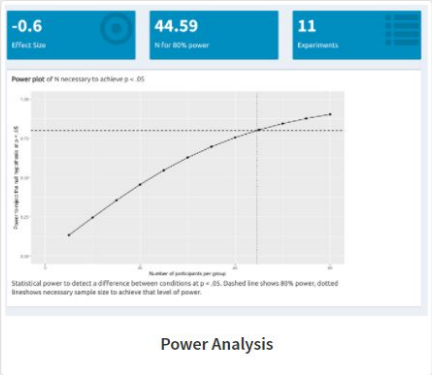
MetaVoice

Interactive tools for community-augmented meta-analysis and
power analysis for experimental planning for voice patterns in neuropsychiatric disorders

MetaVoice | Analyses | Documentation | Publications | FAQ | About



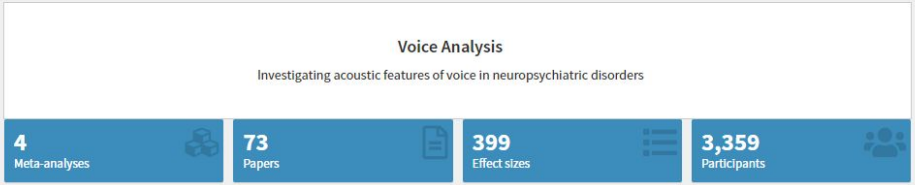
Meta-Analytic Visualisations



Power Analysis

You can explore the data with interactive visualisation tools.

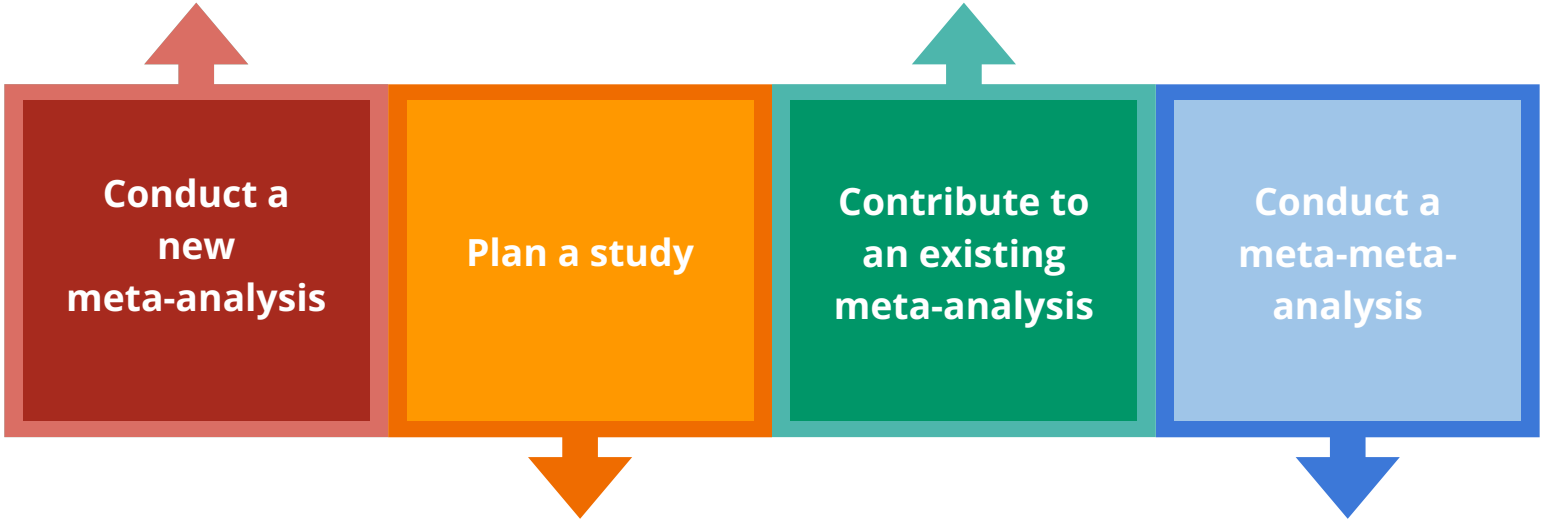
Explore the datasets, the statistical approach and learn how to contribute under Documentation.



Nyholm Jensen & Dwenger (2020, metavoice.au.dk)

Data validation/cleaning
metafor compatibility
Visualization

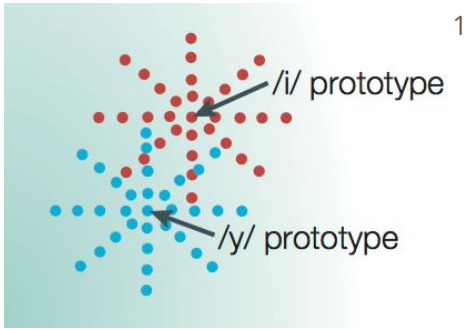
Data validation



Power analysis

Data synthesis
metafor compatibility
Visualization

How and when do babies learn language?



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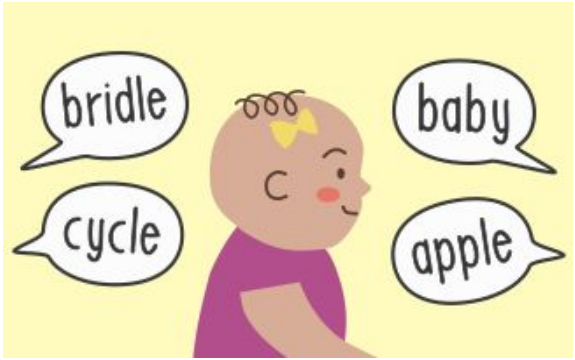
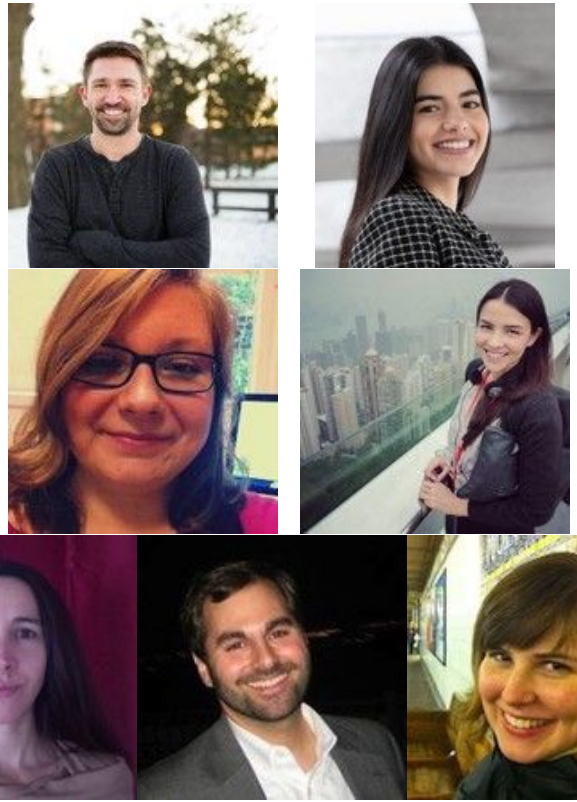
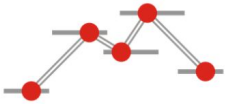


1. Kuhl (2004)

Acknowledgements



Many thanks to the MetaLab Team for their contributions: Erik Iverson and Sara El-Shawa for package development; the MetaLab leaders Christina Bergmann and Sho Tsuji and the governing board Alejandrina Cristia, Michael Frank and Molly Lewis. Thank you also to the many meta-analysis curators and contributors, the authors of original studies who shared data and the 45,000 participating babies and children, and their parents.



MetaLab

Thank you!

Research Synthesis and Big Data Virtual Conference
May 18th -21st 2021
MetaLab: http://metalab.stanford.edu/; metalabR repo: https://github.com/langcog/metalabr/; Email: gasparini.lorett@gmail.com

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