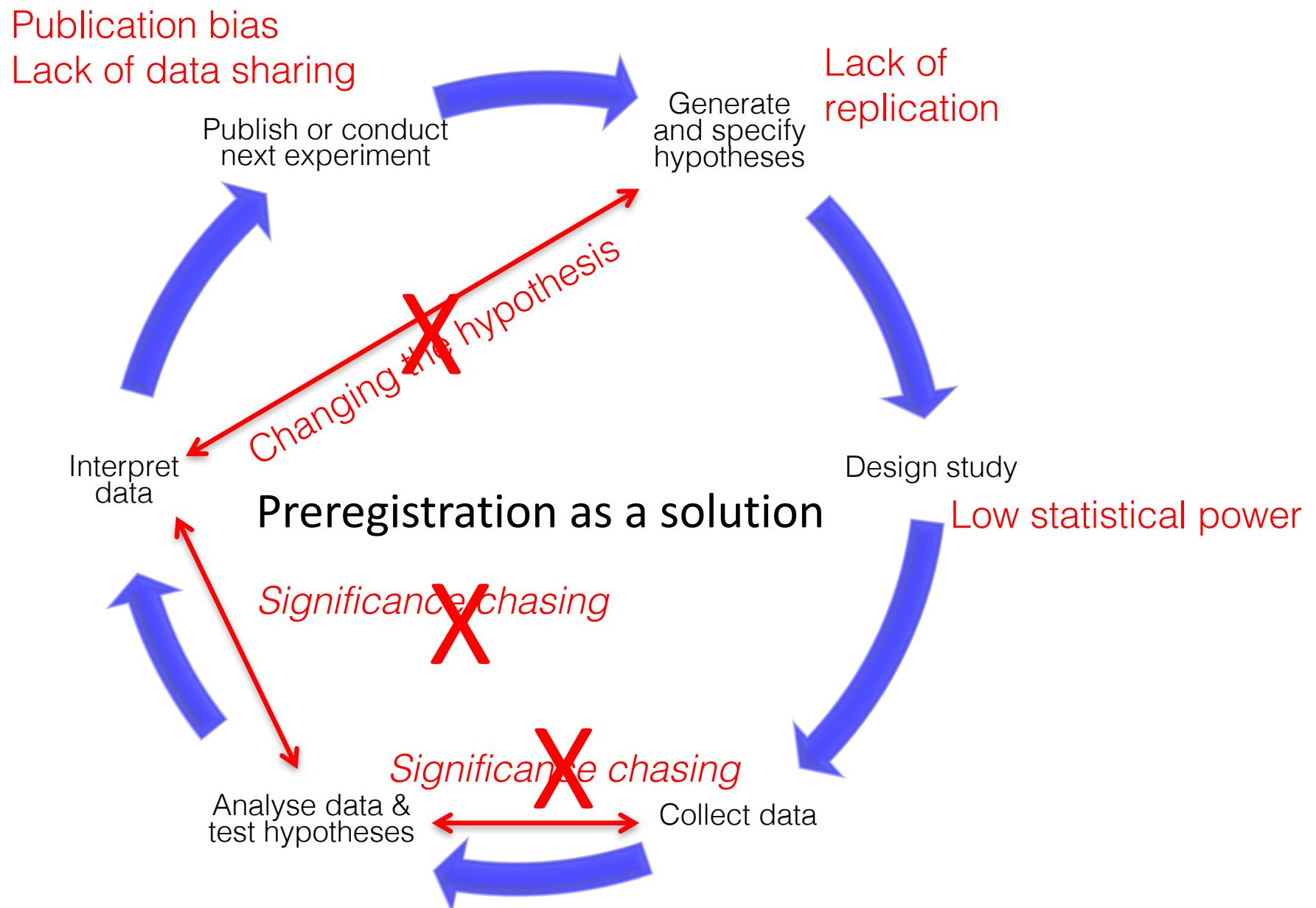


Preregistration

Psych 251

11/6/17

Hypothetico-deductive scientific method



Outline

- Why?
 - Berkowitz et al. (2015)
 - Barner et al. (2016)
- How?
 - Medical model and incentives
 - AsPredicted: Prereg “lite”
 - Open Science Framework registration
 - Registered reports
- Arguments and alternatives

Original report

RESEARCH | REPORTS

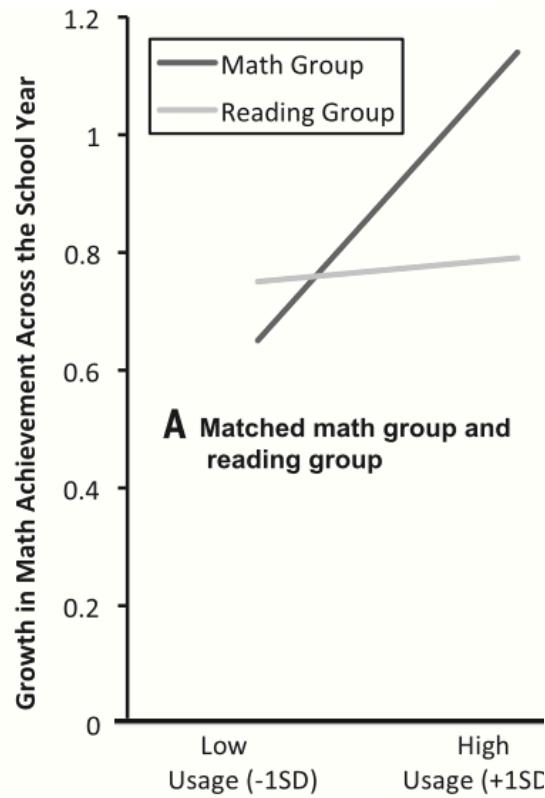
EDUCATION

Math at home adds up to achievement in school

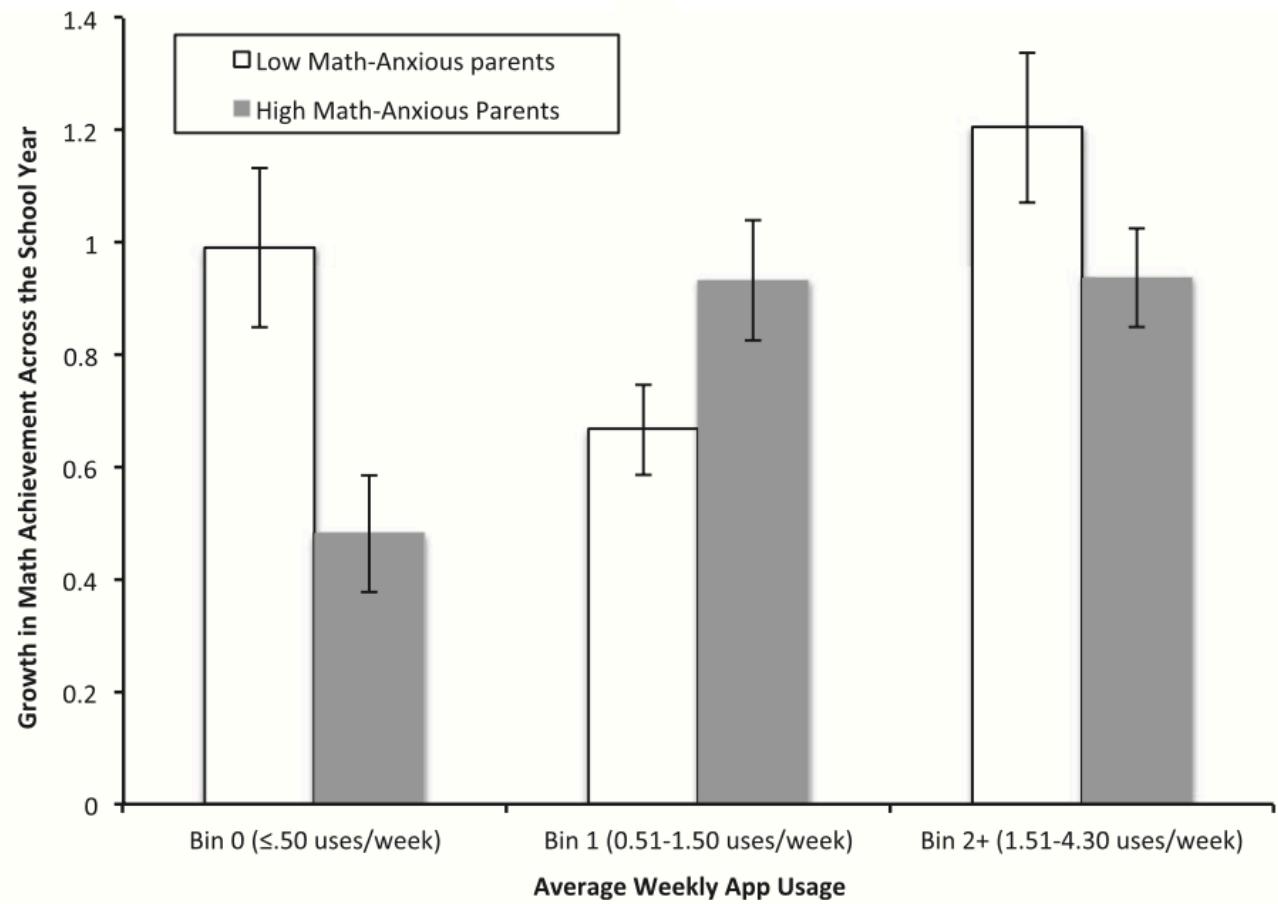
Talia Berkowitz,* Marjorie W. Schaeffer,* Erin A. Maloney, Lori Peterson,
Courtney Gregor, Susan C. Levine,† Sian L. Beilock†

With a randomized field experiment of 587 first-graders, we tested an educational intervention designed to promote interactions between children and parents relating to math. We predicted that increasing math activities at home would increase children's math achievement at school. We tested this prediction by having children engage in math story time with their parents. The intervention, short numerical story problems delivered through an iPad app, significantly increased children's math achievement across the school year compared to a reading (control) group, especially for children whose parents are habitually anxious about math. Brief, high-quality parent-child interactions about math at home help break the intergenerational cycle of low math achievement.

Data



A Matched math group and reading group



Response

RESEARCH

TECHNICAL COMMENT

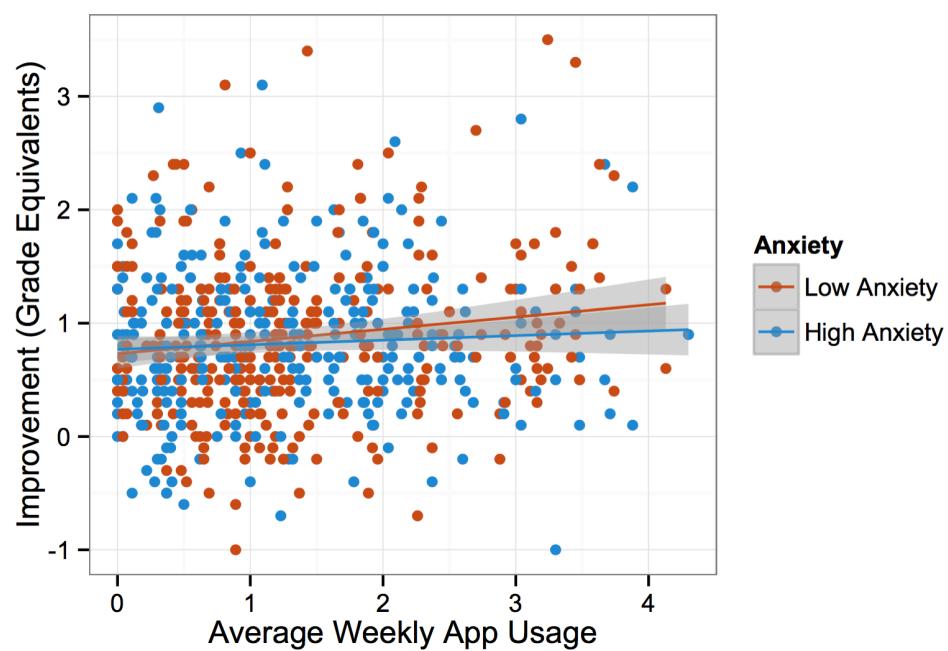
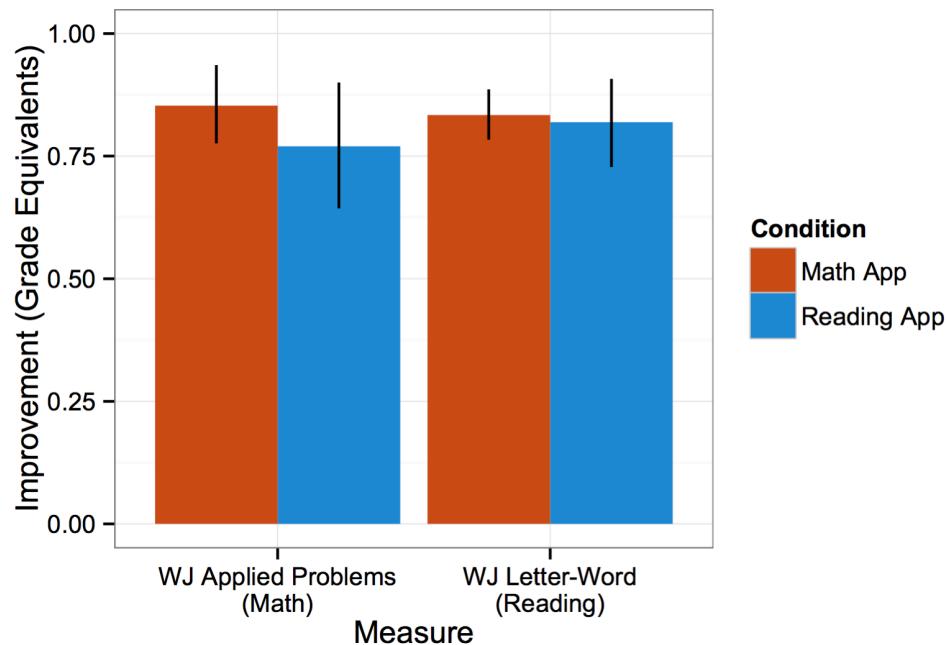
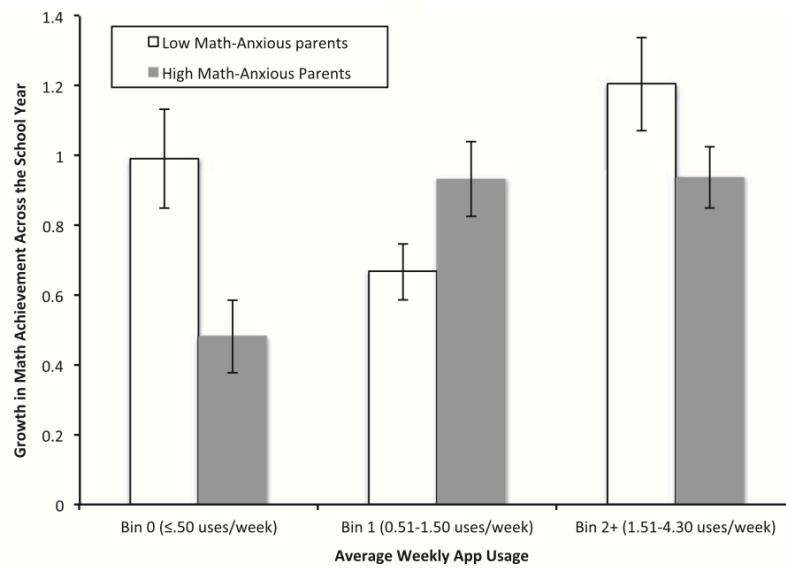
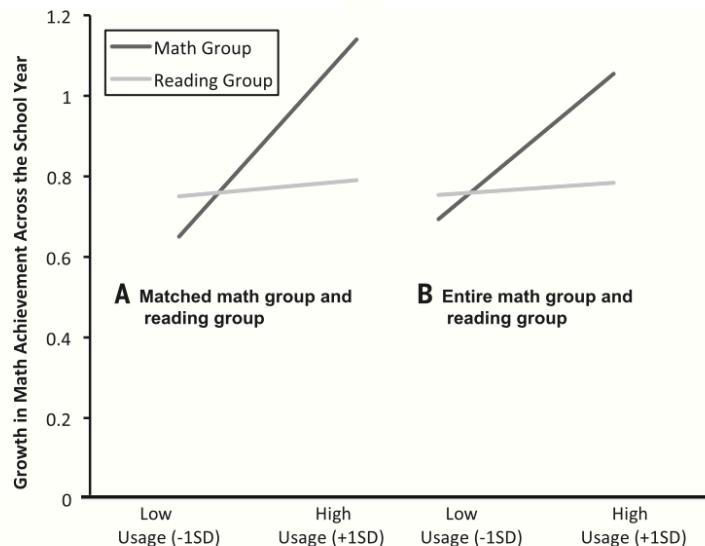
EDUCATION

Comment on “Math at home adds up to achievement in school”

Michael C. Frank*

Berkowitz *et al.* (*Reports*, 9 October 2015, p. 196) described a randomized field experiment testing whether a math app designed to increase parent-child interaction could also bring academic benefits. A reanalysis of the data suggests that this well-designed trial failed to find strong evidence for the efficacy of the intervention. In particular, there was no significant effect of the intervention on math performance.

Analyses



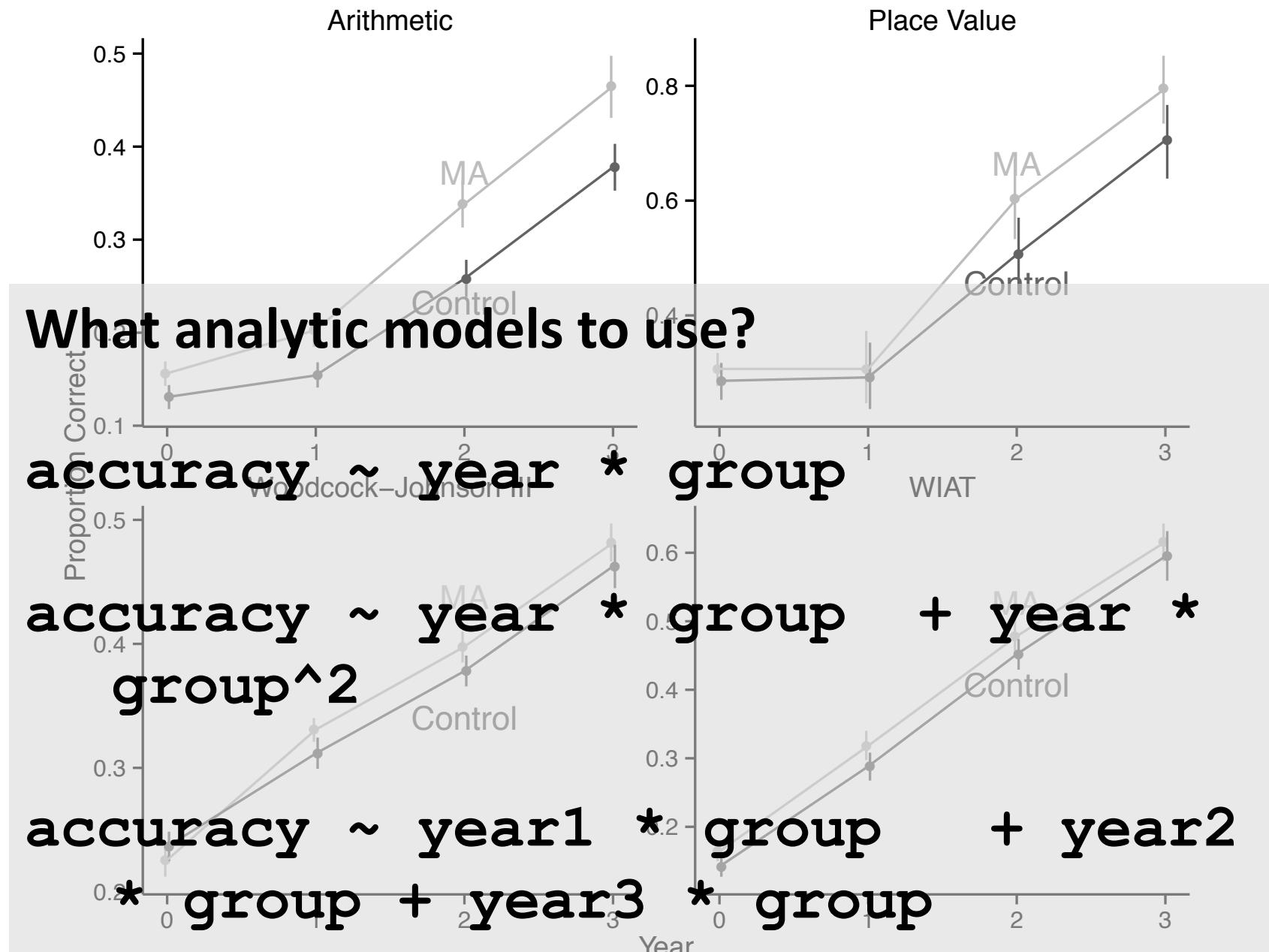
My broader points

- Although the authors may not have chosen to report statistical tests on the basis of the tests having produced significant results, their analysis strategy was nevertheless data-dependent.
- Consider the scenario in which the intervention as a whole had yielded a positive effect; in that case, the simple analysis in Fig. 1 would almost certainly have been a centerpiece of the report.
- This analytic situation, known as the “garden of forking paths” (Gelman & Loken 2014), leads to an inflation of Type 1 error just as if analyses were actively selected.
- Pre-registration of analytic hypotheses prior to data collection is currently the strongest method for protecting against this problem.

Does MA help students learn math?



Data



Points

- Not having thought things through ahead of time takes away **your own** confidence in the data analysis
- You can't unbias yourself
- And even the best thing you can do at this point still makes your paper weaker

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Medical model

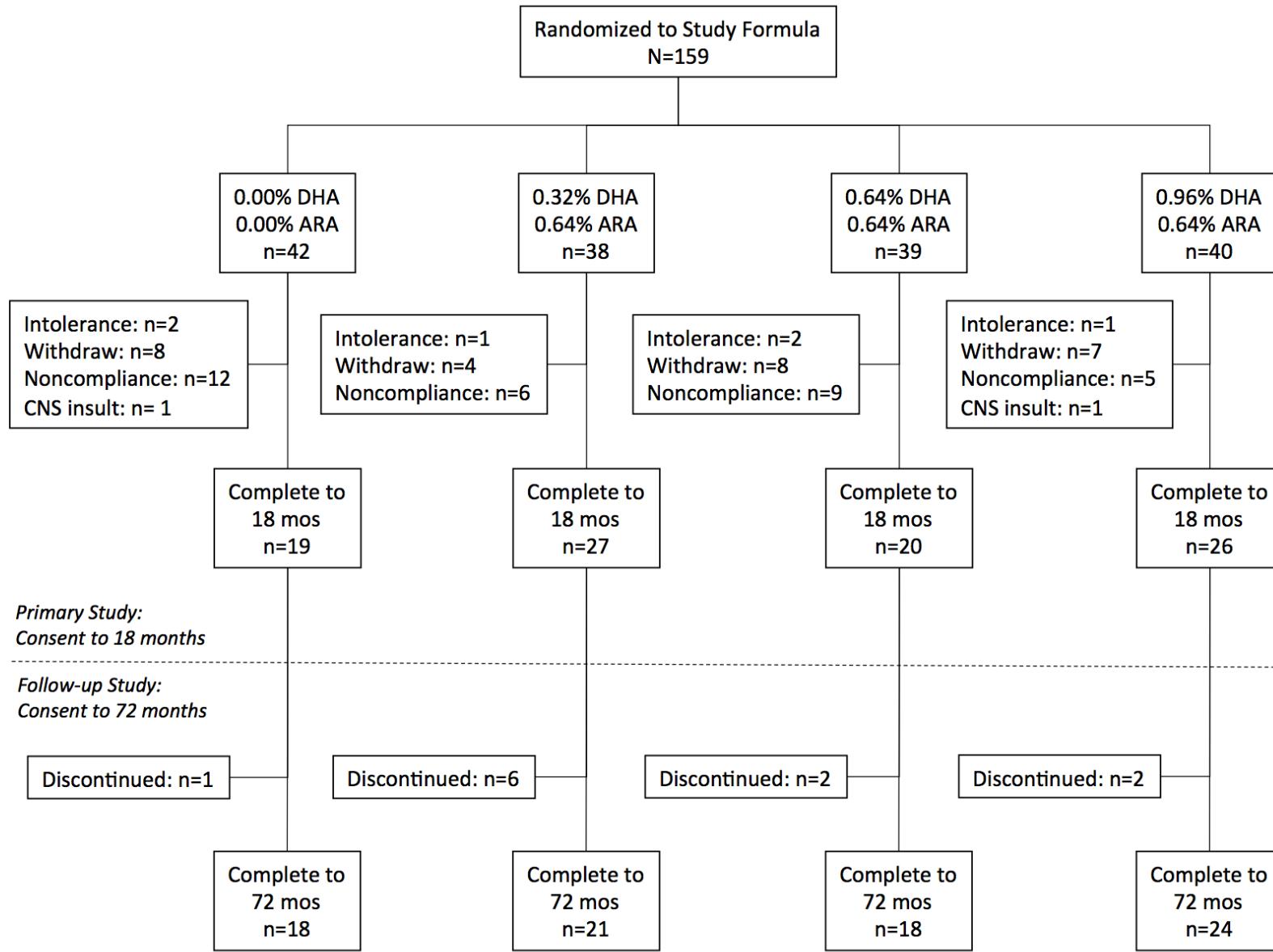
- A detailed protocol is developed and vetted prior to the conduct of the study
- Features of the study are documented and made public (i.e., registered) before research begins:
 - purpose (with hypotheses)
 - design and outcome measures
 - sample size
 - inclusion and exclusion criteria
- Origins of Clinical Trial Practices
 - 1997: FDA mandates registry for clinical trials
 - 2000: Launch of www.clinicaltrials.gov
 - 2007: Requirement for all trials on safety/efficacy of drugs/devices to be registered and maintained, including reporting of results

Next few slides courtesy John Colombo
<https://nyu.databrary.org/volume/239/slot/11764/-/asset/47176>

Conducting the trial

- Subjects are randomized to different “arms” (conditions)
- Group membership known and held by a third party, unknown to participants (single blind) or to participants and research staff (double blind)
- Data are checked and independently audited as they are stored
- Data set is checked, certified, and “locked” prior to the initiation of any analyses
- Initial intent-to-treat (ITT) analyses includes all participants enrolled and randomized to any of the arms of the study

CONSORT example



Colombo et al.
(AJCN, 2013)

“Prereg Lite”

Data Colada

Thinking about evidence and vice versa

12.01.15

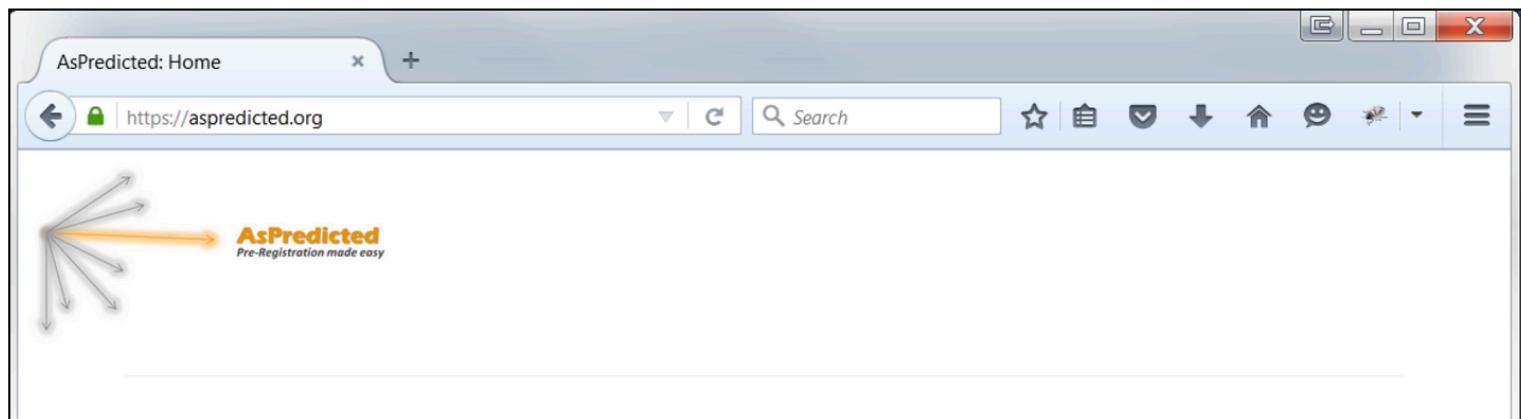
by Uri Joe Leif

[44] AsPredicted: Pre-registration Made Easy

Pre-registering a study consists of leaving a written record of how it *will* be conducted and analyzed. Very few researchers currently pre-register their studies. Maybe it's because pre-registering is annoying. Maybe it's because researchers don't want to tie their own hands. Or maybe it's because researchers see no benefit to pre-registering. This post addresses these three possible causes. First, we introduce [AsPredicted.org](https://aspredicted.org), a new website that makes pre-registration as simple as possible. We then show that pre-registrations don't actually tie researchers' hands, they tie reviewers' hands, providing *selfish* benefits to authors who pre-register. [1]

AsPredicted.org

The best introduction is arguably the home-page itself:



Open Science Framework

- Great tool for registration (essentially, time-stamping)
- All levels of specificity
 - AsPredicted template
 - All the way through full analytic script capture
- Live demo

Registered Reports

CORTEX 49 (2013) 609–610



Available online at www.sciencedirect.com

SciVerse ScienceDirect

Journal homepage: www.elsevier.com/locate/cortex



Editorial

Registered Reports: A new publishing initiative at Cortex

Christopher D. Chambers

Cardiff University Brain Research Imaging Centre (CUBRIC), School of Psychology, Cardiff University, United Kingdom

Four central aspects of the Registered Reports model:

- Researchers decide hypotheses, experimental procedures, and main analyses *before* data collection
- Part of the peer review process takes place before experiments are conducted
- Passing this stage of review virtually guarantees publication
- Original studies and high-value replications are welcome

Slides courtesy Chris Chambers

How it works

Authors submit **STAGE 1** manuscript with
Introduction, Proposed Methods &
Analyses, and Pilot Data (if applicable)



Stage 1 peer review

Are the hypotheses well founded?

Are the methods and proposed analyses feasible and sufficiently detailed?

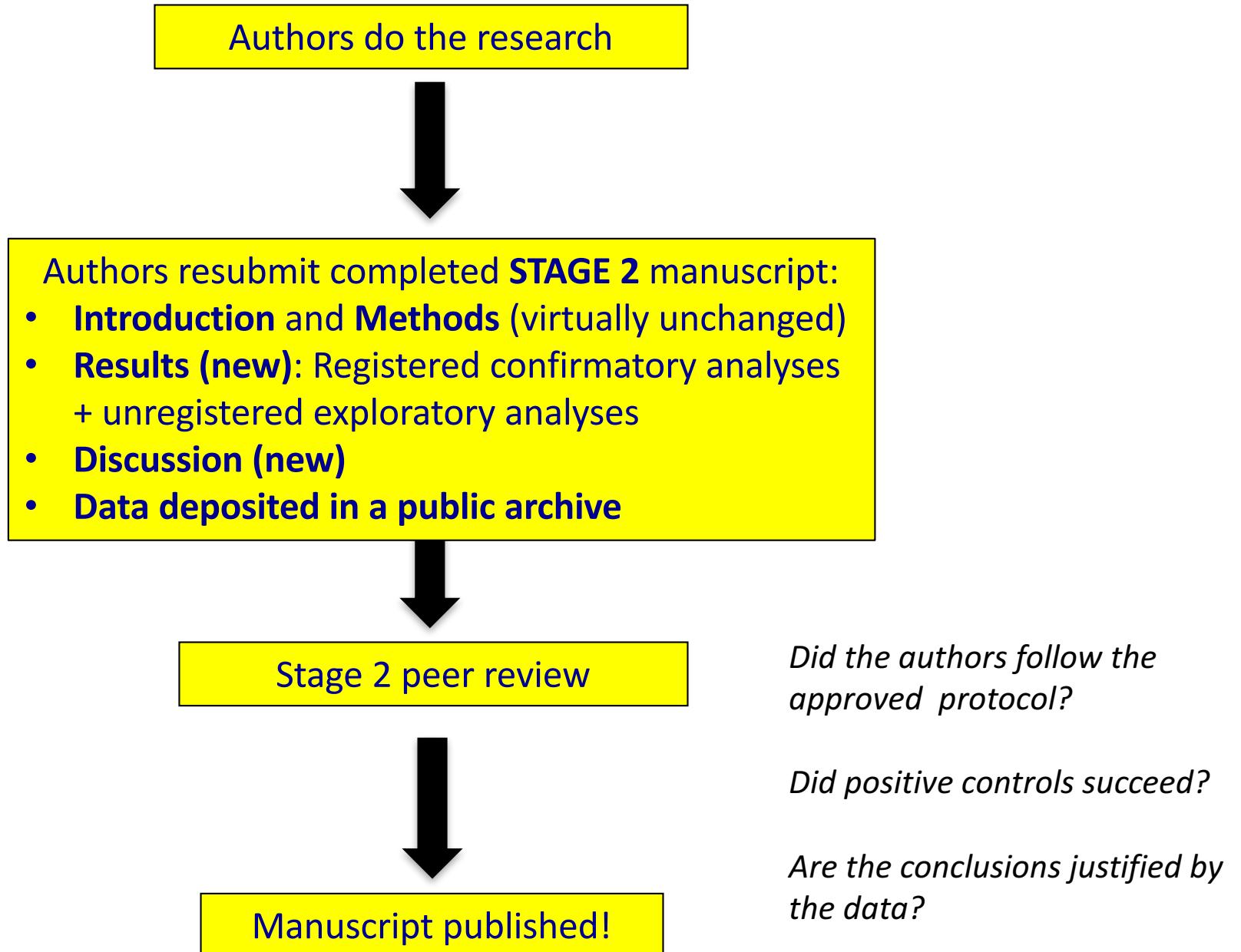
Is the study well powered? ($\geq 90\%$)

Have the authors included sufficient positive controls to confirm that the study will provide a fair test?

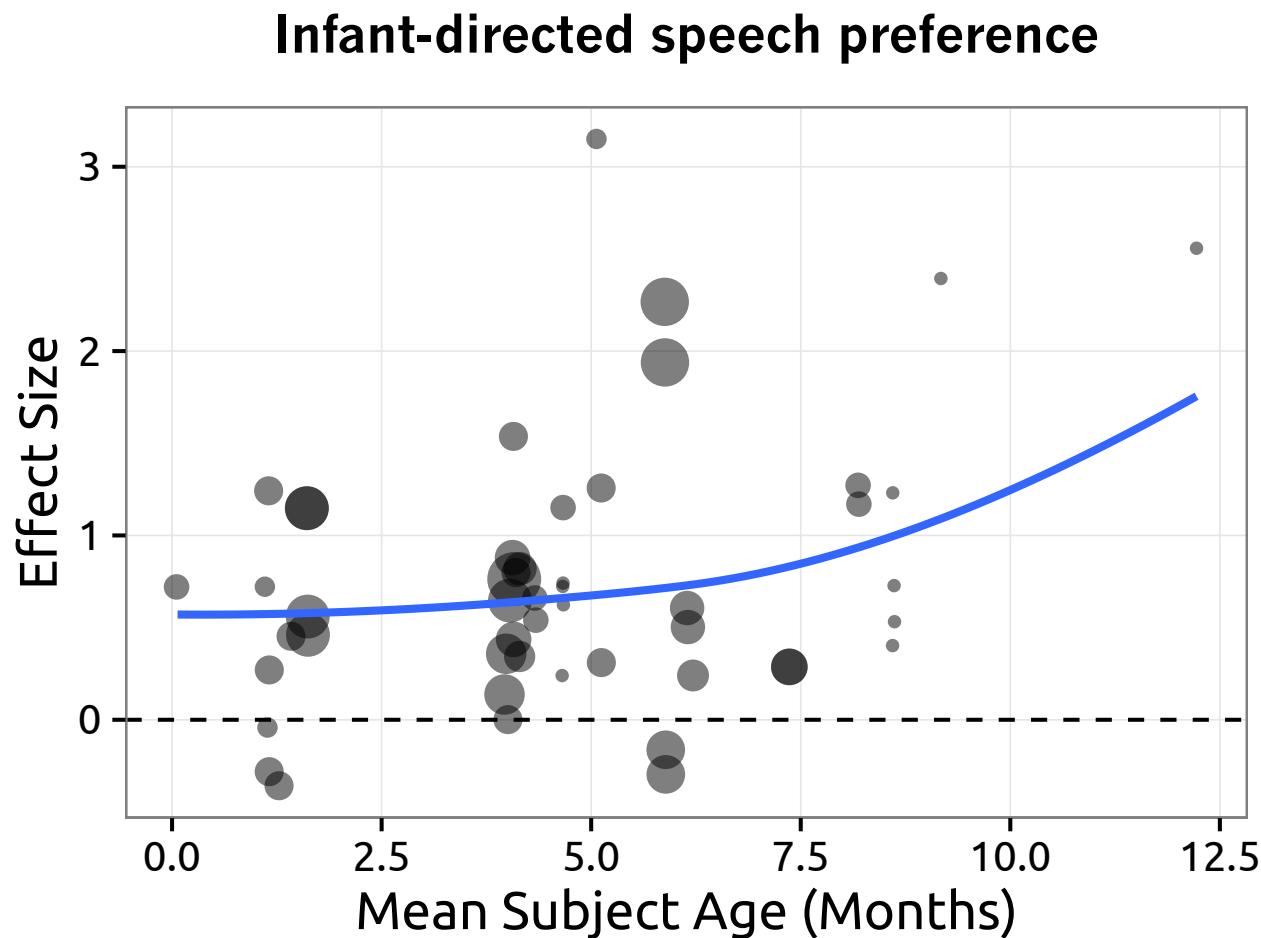


If reviews are positive then journal offers **in-principle acceptance (IPA)**, regardless of study outcome (*protocol not published yet*)

How it works



How do we estimate our effects more precisely?

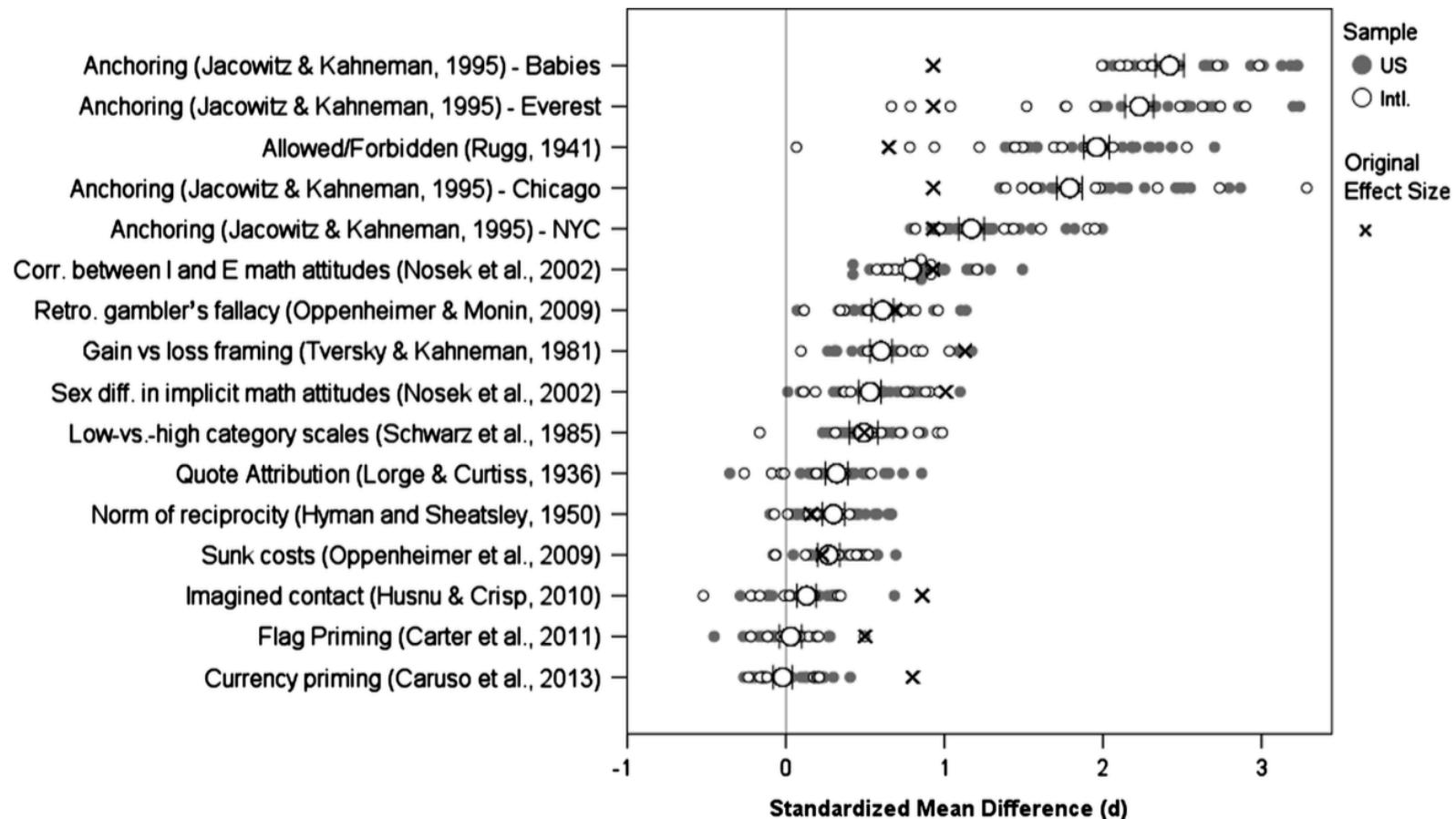


Inspired by “ManyLabs” studies

But this model requires modifications:

- Cost is much higher
- Ability to do multiple studies lower

So: focus on controversial effect(s)? or consolidate knowledge?



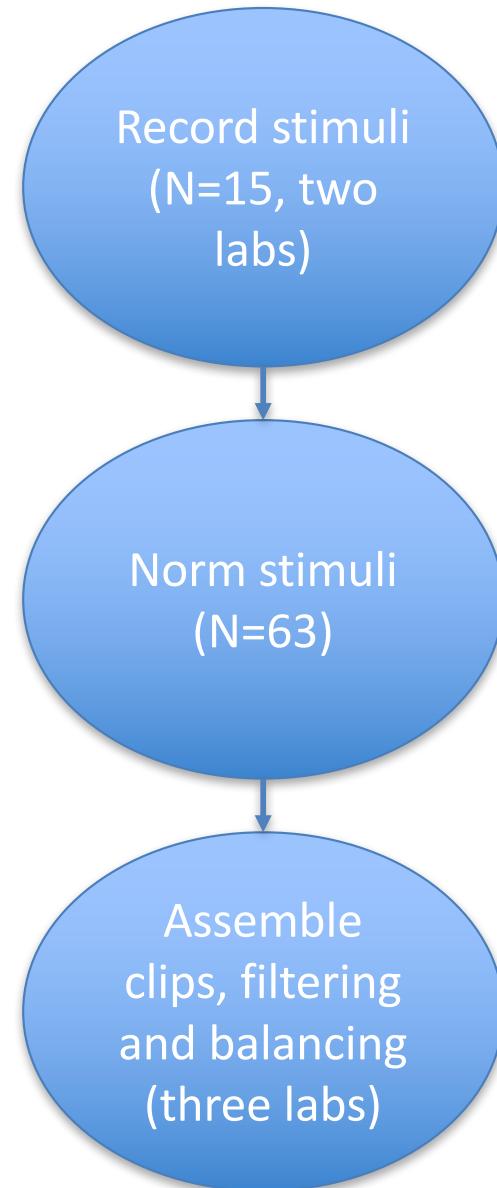
Klein et al. (2014)

ManyBabies – in progress

What proportion of variability in measurement is due to known moderators vs. measurement error?

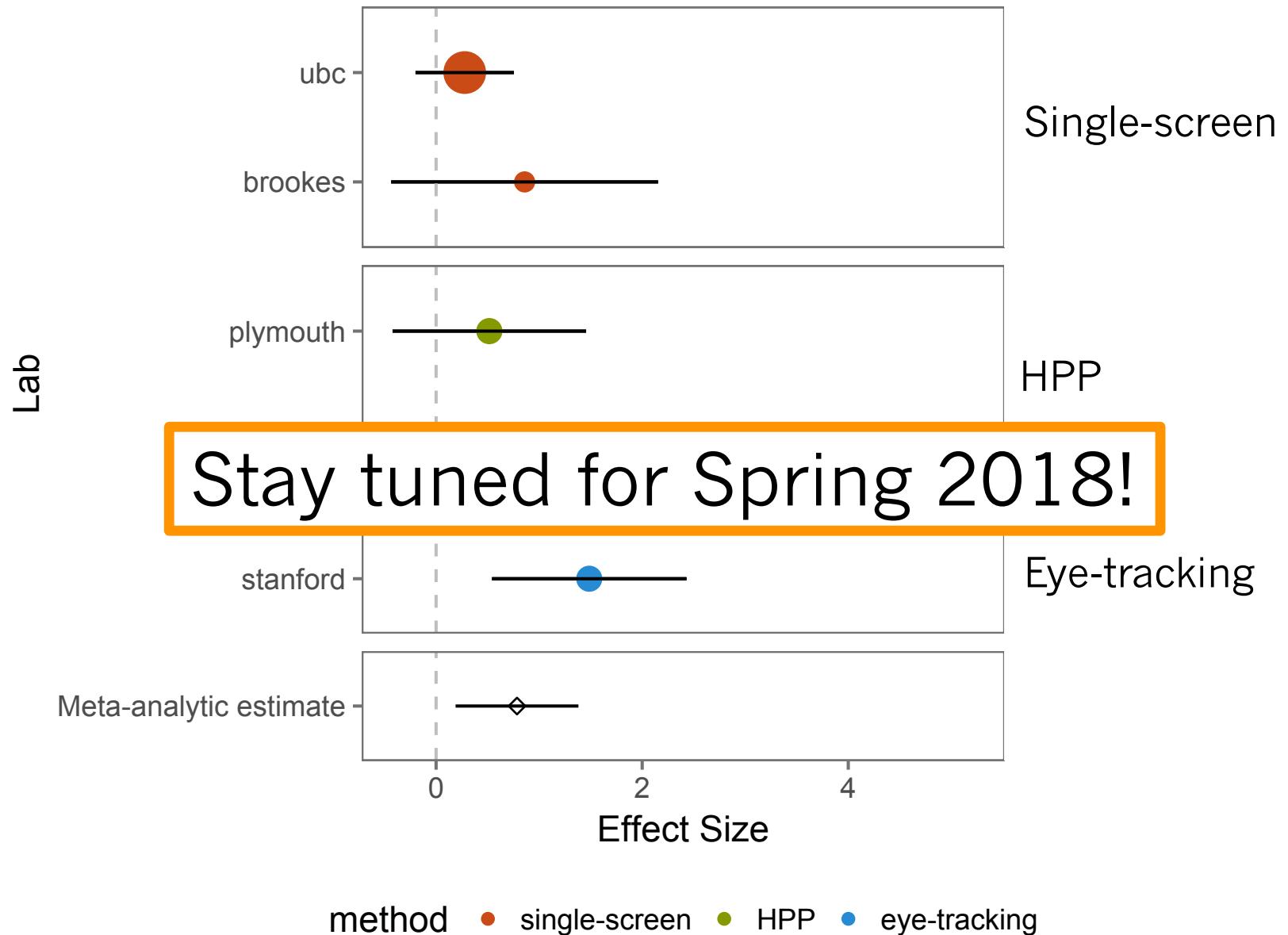
Work in progress on a large-scale (>30 labs) pre-registered experimental protocol

Practicalities of the study: preference for IDS/ADS assessed by looking time (e.g., head-turn, eye-tracker)



Pilot data

N=65



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Arguments 1

- Different preregistrations can have different levels of detail
 - Some: "24 participants in each condition, and exclude them if they don't finish."
 - Others: specify the full analytic model and the plots you want to make.
- Save a ton of time by having default analytic practices that don't need to be registered every time.
- Helps get confirmation on what's ready to run.
 - If it's registered, then I know that we're ready to collect data.
 - Coauthors need to sign off (e.g., aspredicted)

<http://babieslearninglanguage.blogspot.com/2016/07/preregister-everything.html>

Arguments 2

- **It increases confidence in analytic results.**
 - Once you have seen the analysis you planned come out as you said it would, you just feel really good.
- **It documents decisions you have to make anyway.**
 - Saves time on the writeup.
- **It's a really good exercise for students.**
 - If a student is running an internship project and can't answer the questions on AsPredicted, that's a good signal the project's not ready.
- **It doesn't stop you from exploring the data.**
 - Many folks feel like preregistrations decrease exploratory data analysis.
 - I just don't understand this one.

Alternative: Blind analysis

Blind analysis: Hide results to seek the truth

[Robert MacCoun & Saul Perlmutter](#)

07 October 2015

More fields should, like particle physics, adopt blind analysis to thwart bias, urge Robert MacCoun and Saul Perlmutter.



In sum

It costs nothing and makes you feel good.

Just try it.

It'll make you feel like a scientist.