

Social Thermoregulation: A Meta-Analysis

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Take Home Message 1

- Enough evidential value in the Social Thermoregulation (ST) literature
- Considerable heterogeneity in ST
- No evidence that effects are moderated by climate, but moderated by gender

Take Home Message 2

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- Strength of evidence differs across subfields/methodologies

Take Home Message 3

- Enough evidential value in the Social Thermoregulation (ST) literature
- Considerable heterogeneity in ST
- No evidence that effects are moderated by climate, but moderated by gender
- Strength of evidence differs across subfields/methodologies
- Literature messy (principles vs. theories)

Take Home Message 3

- Confirmatory Reports are required to combat publication bias
- Develop protocols (comparable to biology)
- Publish more Exploratory Reports
- Develop formal models

ST1

ST amongst humans: Modern social relations pleisomorphically organized around processes of body temperature regulation.

ST2

Or: Modern social relations built on top of more ancient processes of body temperature regulation...

ST3

Or: Modern social relations built on top of more ancient processes of body temperature regulation and temperature regulation is a main motivation for interpersonal attachments.

ST4

Thermoregulation and attachment (cf. Bowlby, 1969)...

ST5

Thermoregulation and attachment and co-regulation of temperature (e.g., Gottman & Levenson, 1992)

ST6

Thermoregulation and attachment and co-regulation of temperature and environmental demands (Beckes & Coan, 2011).

ST7

Homeothermic endotherms: Internal (but costly) regulation.

ST8

Other homeothermic endotherms: Personal heaters.

ST9

Case in point: Energy consumption of Octodon Degus (Nunez-Villega et al., 2014).

Empirical Work - Humans

- Link between thermoregulation and interpersonal attachments
- Temperature manipulated or assessed

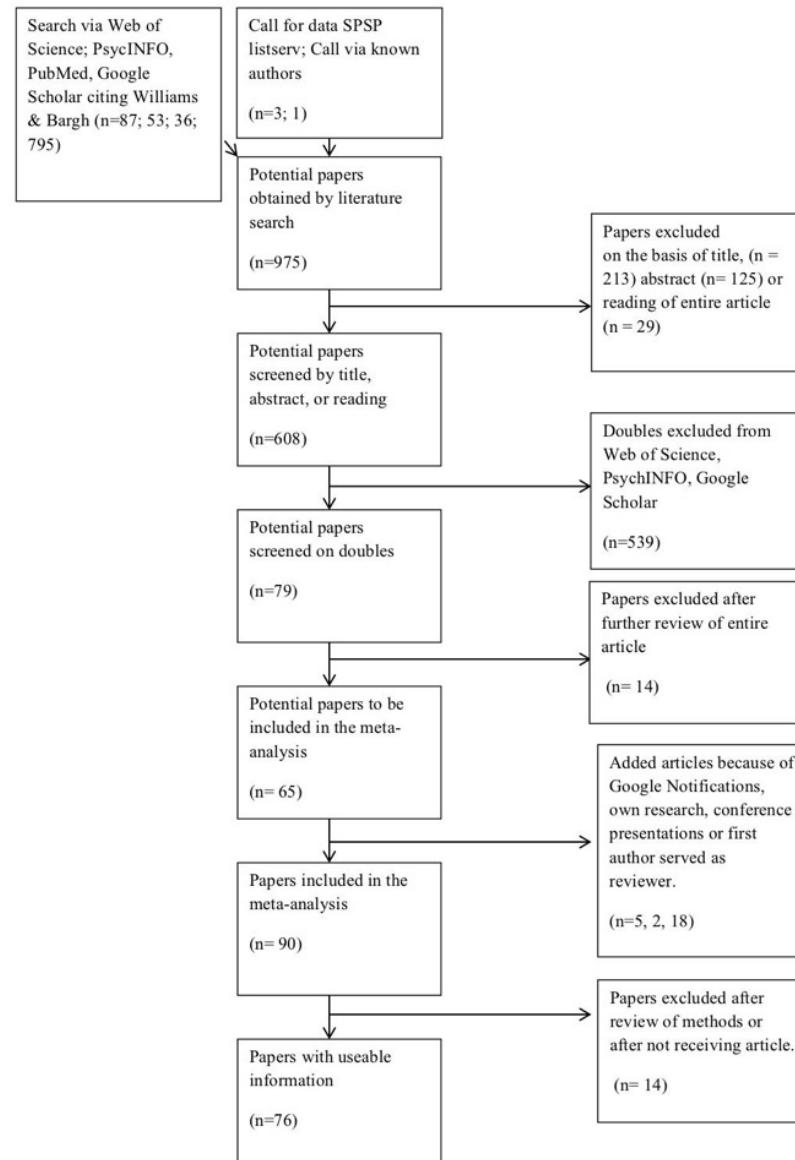
Quality Control

- Limited to studies on humans
- Data and code online: <https://osf.io/wdk3e/>
- Coding by two experts on ST
- Independent code review

Literature Search (2009 - 2017)

- "temperature" AND "social" AND "representation"
- "temperature" AND "embodiment" AND "social"
- "warmth" AND "embodiment" AND "interpersonal"
- "grounded cognition" AND "temperature"
- "embodied cognition" AND "warmth"
- "interpersonal" AND "physical warmth"

Flowchart



Reports on Social Thermoregulation

Between 2008-2017, 90 published and unpublished reports on ST appeared. Used 76 of those reports; total of 346 effect sizes. Out of these 202 met selection criteria.

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Extracted Variables

- Publication Year
- Journal H5 Index
- Location of Study
- Effect Size, dfs, total N, p-value
- Publication Status
- Proportion of Men/Women in study

Coding Methods/Categories

- Compensatory vs priming
- Manipulation / type of measure
- Sub-category of ST

Outlier Exclusion

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- Excluded 3 outliers (ES odds of 1 in 1,137 and 1 in 564,971, and 1 in 1,000,000,000)

Outlier Exclusion

- Influence diagnostics via Cook's distance, standardized residuals, and other leave-one-out statistics.
- Excluded 3 outliers (improbably large odds)
- Left one outlier in (with $N = 6,346,239$)

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- Influence diagnostics via Cook's distance, standardized residuals, and other leave-one-out statistics.
- Excluded 3 outliers (improbably large odds)
- Left one outlier in (with $N = 6,346,239$; ES: $g = .05$)

Analysis Strategy

- Multilevel random-effects meta-analysis model
- Restricted maximum-likelihood estimation estimation via Metafor (Viechtbauer, 2010)
- Model accounts for nested model with multiple effects within studies (allowing for correlated true effects)
- Dependencies accounted for by robust sandwich-type variance estimation (RVE), applied to estimated variance-covariance matrix of within-study ES.

Analysis Strategy

- We did not investigate whether publication bias existed, but assumed it
- Employed several methods to mitigate bias

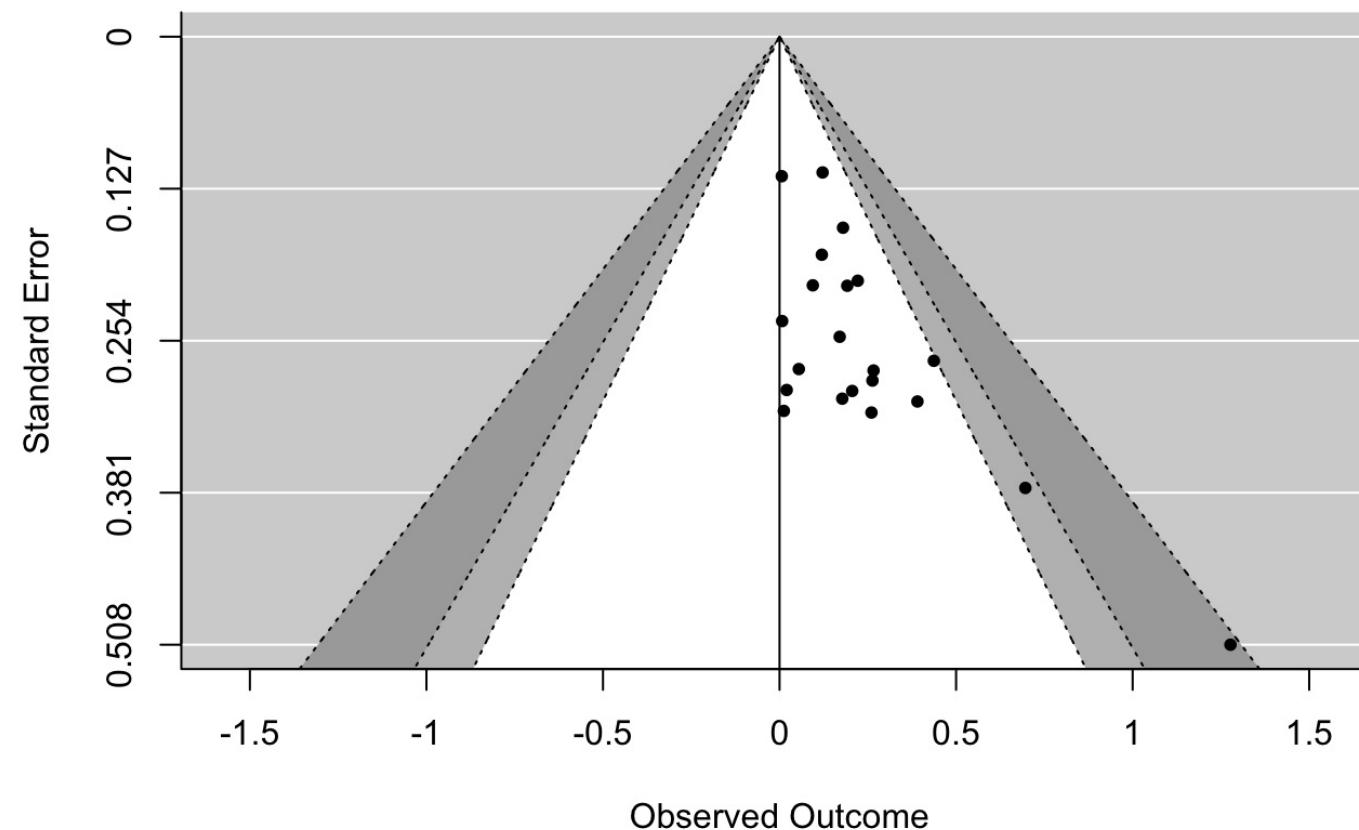
Mitigate Bias

- Estimate evidential value
- Estimate bias-corrected average ES I
- Estimate bias-corrected average ES II

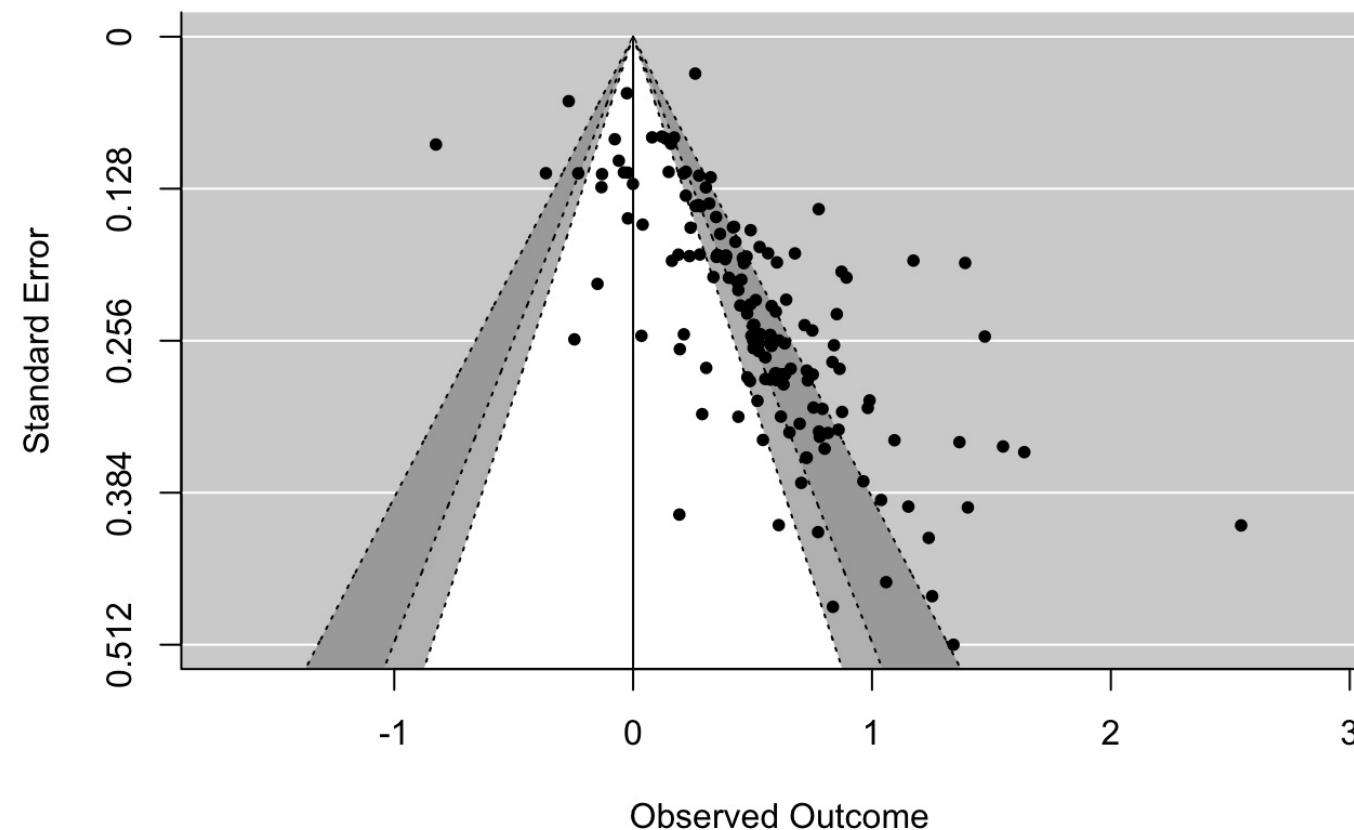
Mitigate Bias

- Estimate evidential value: P-curve for evidential value (1PSM). Disclosure table:
<https://osf.io/2kz5q/files>.
- Estimate bias-corrected average ES: 3PSM
- Estimate bias-corrected average ES: PET-PEESE

Temperature-Mood



Global Funnel Plot (No Mood)



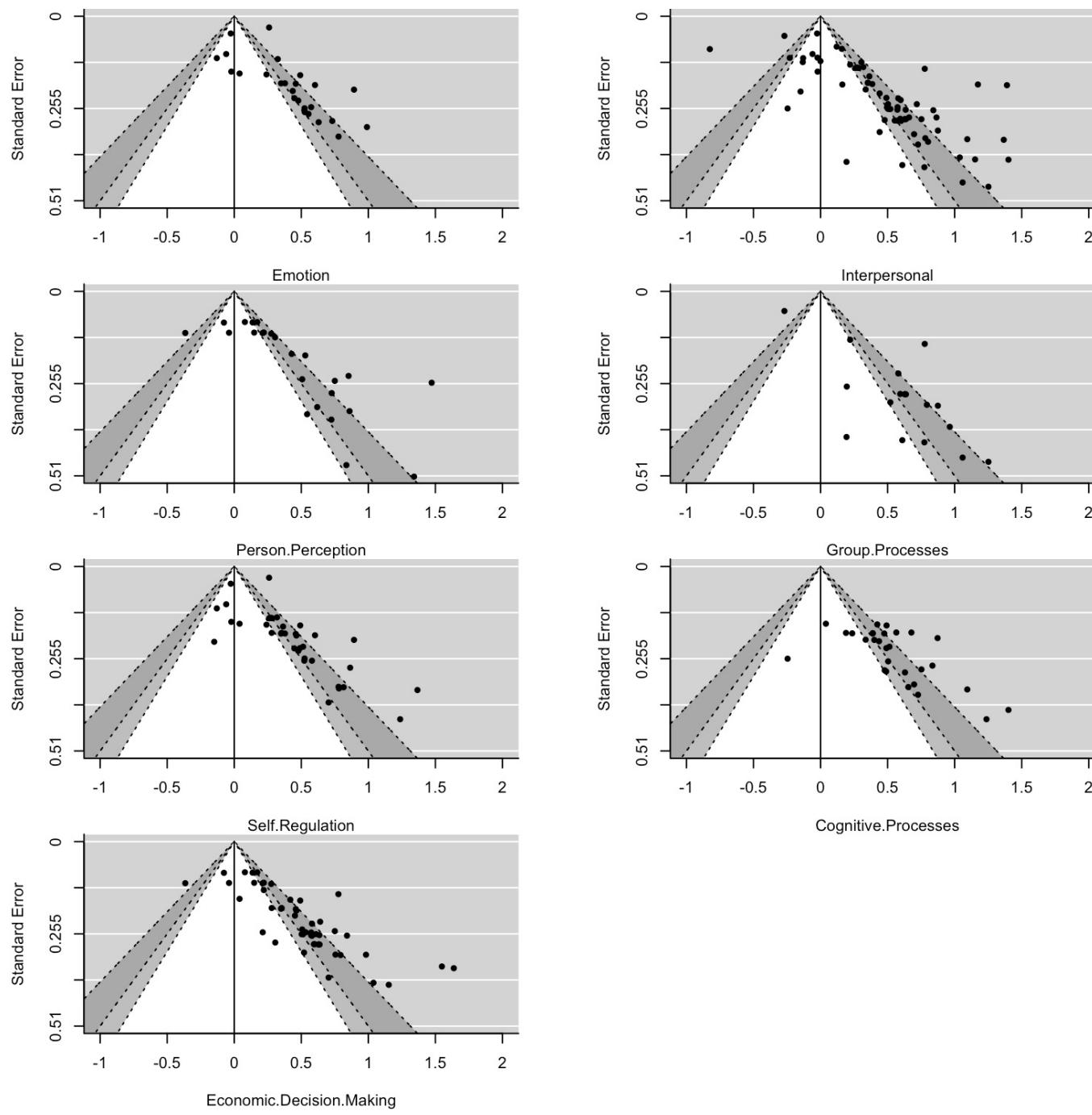
Global Funnel Plot (no mood)

- Globally: Publication Bias
- 69% of effects were significant
- Overall naive Hedges $g = .45 (.38 - .51)$

Global Funnel Plot (no mood)

- 3PSM: indicated effect (est. = .22; 95CI (.13 .30))
- 3PSM: 17.9% of ns effect to enter literature
- PEESE: indicated effect (est = .13; 95CI (.06 .20))
- Median power is only 11.6%/24.1% (severely underpowered)

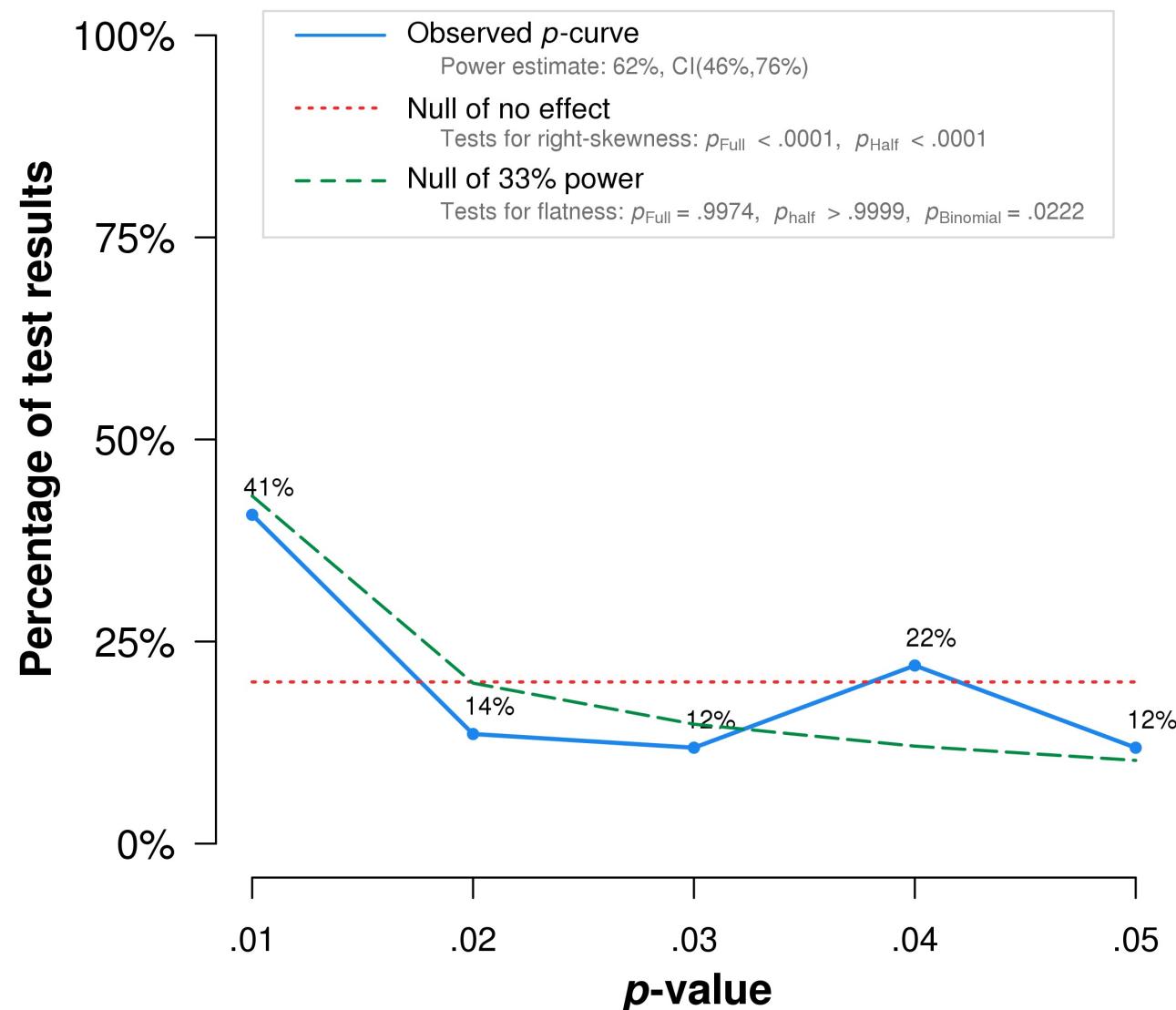
Global Funnel Plot (No Mood)



P-curve - Categories

- P-curve can reject evidential value (not support evidential value)
- What it can also do is show if "p-hacking" is present

P-Curve Example 1

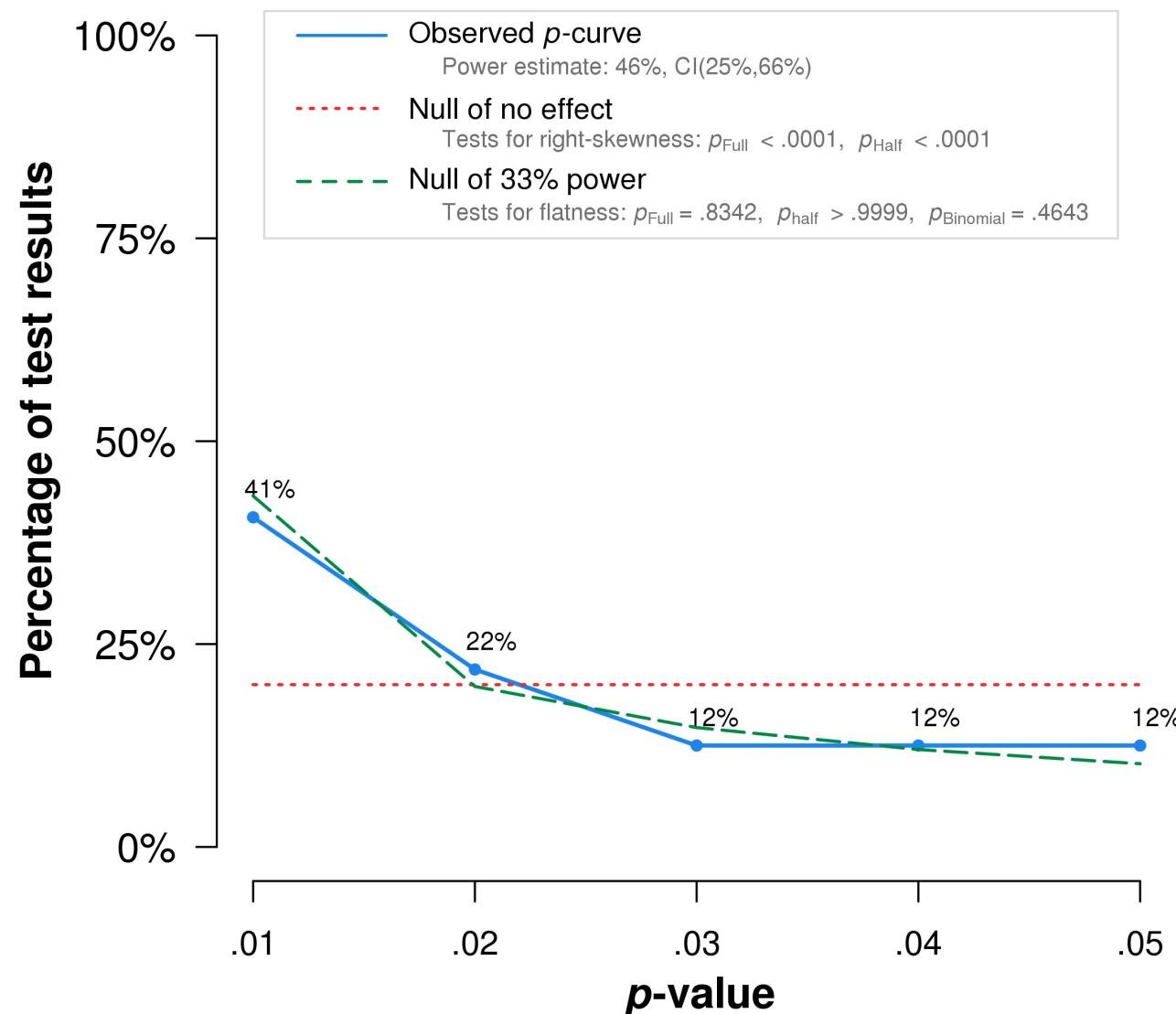


Note: The observed p-curve includes 59 statistically significant ($p < .05$) results, of which 34 are $p < .025$. There were 26 additional results entered but excluded from p-curve because they were $p > .05$.

P-Curve Example 1

- Interpersonal Processes
- ($N = 11405$; $k = 71$; Clusters = 57)

P-Curve Example 2



Note: The observed p-curve includes 32 statistically significant ($p < .05$) results, of which 22 are $p < .025$. There were 11 additional results entered but excluded from p-curve because they were $p > .05$.

P-Curve Example 2

- Judgment and Decision Making
- N = 7454; k = 53; Clusters = 27

Comparison Priming vs. Compensatory

meta	k	ES	SE	tau	I2	3PSM estimate	3PSM p-value	PEESE est	PEESE p-value
Compensatory	41	0,319	0,049	0,207	73,06 %	.14 [.04, .25]	0,007	.06 [-.04, .17]	0,24
Priming	127	0,484	0,04	0,322	85,92 %	.23 [.13, .34]	< .001	.16 [.07, .25]	0,001

Physical vs. Non-Physical

meta	k	ES	SE	tau	I2	3PSM estimate	3PSM p-value	PEESE estimate	PEESE p-value
Non-physical manipulation	90	0,381	0,038	0,268	89,23	.22 [.12, .32]	< .001	.15 [.08, .23]	< .001
Physical manipulation	81	0,509	0,057	0,347	70,39	.21 [.06, .35]	0,005	.03 [-.13, .18]	0,75

Physical vs. Non-Physical

meta	k	ES	SE	tau	I2	3PSM estimate	3PSM p-value	PET-PEESE estimate	PET-PEESE p-value
Visual.Verbal.Temperature.Prime.	17	0,407	0,034	0	0	.24 [.19, .30]	< .001	.27 [.11, .42]	0,001
Outside.Temperature.	14	0,443	0,123	0,392	95,51	.44 [.11, .77]	0,009	.12 [-.17, .41]	0,424
Temperature.Estimate.	23	0,465	0,072	0,265	71,95	.12 [-.09, .34]	0,269	-.15 [-.33, .03]	0,105
Subjective.Warmth.Judgment	8	0,111	0,083	0,209	86,39	.23 [-.10, .56]	0,166	.02 [-.64, .69]	0,934

Physical vs. Non-Physical

meta	k	ES	SE	tau	I2	3PSM estimate	3PSM p-value	PET-PEESE estimate	PET-PEESE p-value
Emotion	26	0,315	0,051	0,2	74,18	.05 [-.10, .19]	0,528	-.06 [-32, .19]	0,621
Interpersonal	75	0,423	0,053	0,362	82,88	.21 [.06, .36]	0,005	.08 [-.05, .20]	0,225
Person.Perception	31	0,471	0,088	0,342	83,23	.35 [.14, .56]	0,001	.15 [.00, .30]	0,046
Group.Processes	18	0,554	0,07	0,186	43,9	.39 [.21, .58]	< .001	.34 [.16, .53]	0
Self.Regulation	41	0,346	0,055	0,242	76,1	.18 [.05, .30]	0,006	.06 [-.04, .16]	0,249
Cognitive.Processes	29	0,499	0,054	0,154	32,76	.29 [.13, .46]	< .001	.22 [.05, .38]	0,011
Economic.Decision.Making	60	0,439	0,058	0,287	85,05	.20 [.08, .33]	0,002	.04 [-.04, .12]	0,367

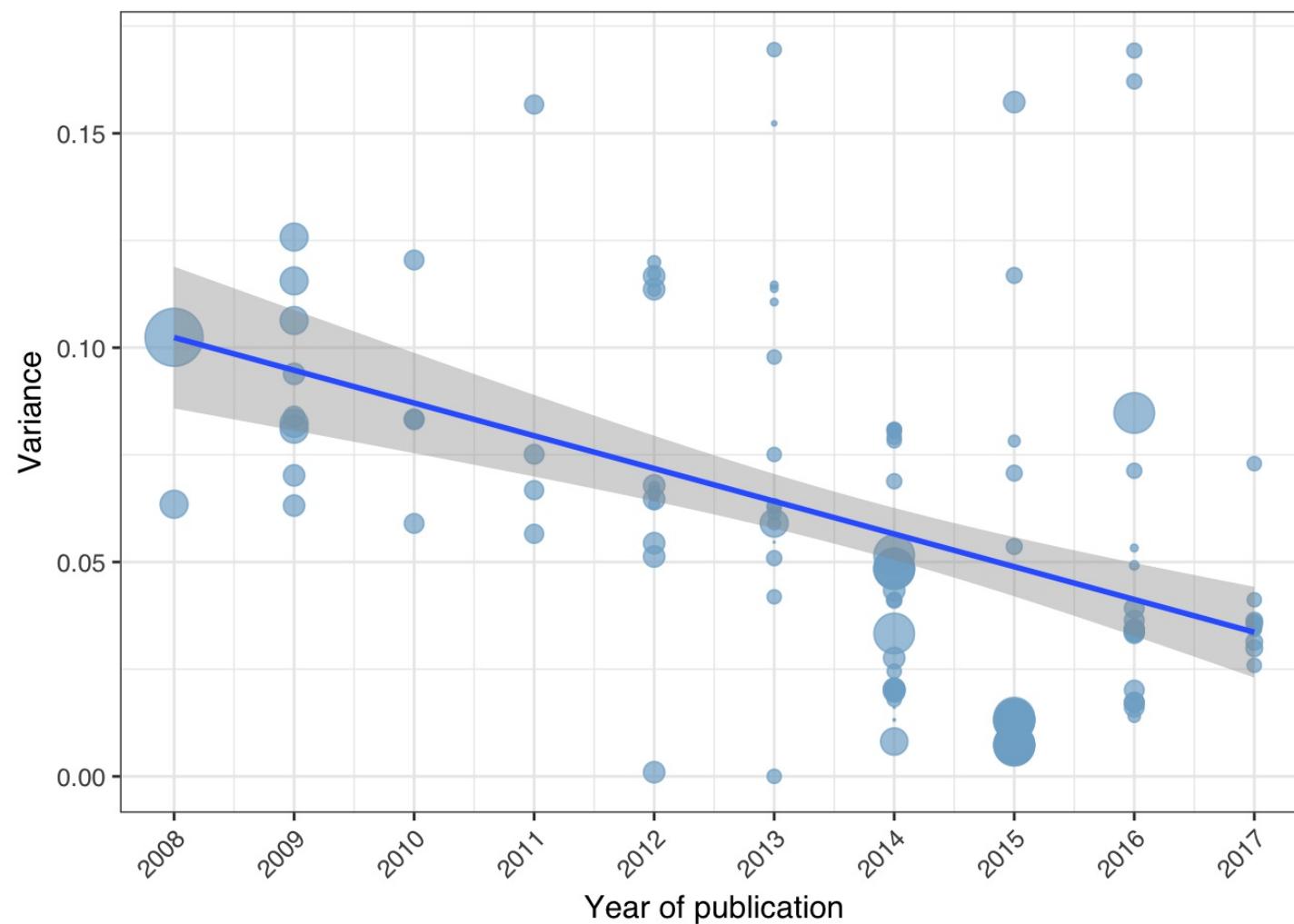
General Observations 1

- No effect of latitude ($\beta = .02$, $t = 0.55$, $p = .58$).
- Greater ES when greater proportion of females in sample ($\beta = .11$, $t = 3.10$, $p = .003$).

General Observations 2

- H5 Index not associated with sampling error ($\beta = -.13$, $t(89.9) = 1.27$, $p = .209$)
- SE is associated with citations ($\beta = .36$, $t(88.0) = 3.19$, $p = .002$)
- Higher number of citations; larger effects ($\beta = .09$, $t = 2.88$, $p = .005$)
- H5 index inversely related to the ES ($\beta = -.10$, $t = -2.70$, $p = .008$)
- No decline effect ($\beta = .16$, $t(97.8) = 1.86$, $p = .066$)

Improving Research Practices?



Conclusions

- Overall ST literature has evidential value
- Very unlikely to be explained by selective reporting alone
- Strength of evidence differs by subfield/method

Conclusions

- Overall ST literature has evidential value
- Very unlikely to be explained by selective reporting alone
- Strength of evidence differs by subfield/method
- Why differs by subfield?

Selective Reporting

- Likely moderations exist (e.g., IJzerman et al., 2016, 2018)
- We pay insufficient attention to conditions under which effects emerge
- Focus on generating formal theories (e.g., via mathematical/AB models)

Specifics 1

- Priming > Compensatory
- My inference: unlikely to hold
- Replicated studies in literature are related to compensatory effects (IJzerman, Neyroud et al., 2018)

Specifics 2

- Priming > Compensatory
- My inference: unlikely to hold
- Replicated studies in literature are related to compensatory effects (IJzerman, Neyroud et al., 2018)
- No effects on mood
- Mood signal for the organism's state

Generalisations

- No effect of latitude - why?
- IJzerman et al., 2018: Social networks protect against cold climates (with latitude as predictor)
- Effect size of recent, pre-registered replication - Southern France < Netherlands

Generalisations

- No effect of latitude - why?
- IJzerman et al., 2018: Social networks protect against cold climates (with latitude as predictor)
- Effect size of recent, pre-registered replication - Southern France < Netherlands
- Literature too messy to be able to figure this out.

Methodological Conclusions

- Visual/Verbal manipulations supported
- Physical manipulations inconclusive
- Temperature estimates as dv inconclusive

Methodological Conclusions

- Visual/Verbal manipulations supported
- Physical manipulations inconclusive - same problem
- Temperature estimates as dv inconclusive - same problem

Recommendations

- Even when research practices are improving, still a lot of imprecision.
- Confirmatory Reports vs. Exploratory Reports

Confirmatory Reports



Confirmatory Reports at IRSP: Guidelines for Authors

Confirmatory Reports (CRs; previously and elsewhere Registered Reports; see <https://cos.io/rr/>) is a form of empirical article in which the methods and proposed analyses are reviewed and pre-registered prior to the research being conducted. This format is designed to minimise bias in deductive science, while also allowing flexibility to conduct and report exploratory (unregistered) analyses.

The philosophy of the editorial team with respect to CRs rests on continuous exchanges and discussions with the authors. We are aware that not all social psychologists are familiar with this publication format and we are certainly happy to help in this process. One of the ways we plan to reduce the workload for authors, editors, and reviewers, is by letting our editors create a project on the Open Science Framework (OSF) after a first-page overview submitted to the journal. This project will include the hypotheses, data, and scripts to analyze the data. This will allow authors and reviewers to work more efficiently by adopting a transparent “research workflow”. All reviews and editorial letters will be stored and will be open to our readers.



Exploratory Reports



Exploratory Reports at IRSP: Guidelines for Authors

Exploratory Reports (ERs) is a format for empirical submissions that tend to address relatively open research questions, without strong *a priori* predictions of hypotheses. These studies are abductive (=often starting with an observation) and inductive/hypothesis-generating (=going from data to hypothesis). This means that authors can do as many analyses as they would like on a dataset, as long as they openly report it. These analyses should however generate predictions, and in some cases, these predictions can and should already be tested. At this stage, we are limiting the ER to two types: Machine learning and cross-validation (We include machine learning as a separate ER type, even though it often includes cross-validation (but not always, as in the case of conditional random forests or autoencoding)).

Cross-validation can be done using more traditional, inferential statistics, machine learning, or another analysis approach. For research using cross-validation, we expect authors to submit a results-blind submission for the validation part of their manuscript. At least one validation set is required, a second validation set highly encouraged. The analyses for the validation sets will be blinded to reduce publication bias. Authors are also asked not to analyze data in their validation sets prior to submission. For those unfamiliar with exploratory research, we recommend reading Yarkoni and Westfall, viewing Rick Klein's

Our Solution 1

CO-RE Lab Workspace

Contributors: Hans IJzerman, Richard A. Klein, Lison Neyroud
Date created: 2017-11-17 09:26 AM | Last Updated: 2018-10-02 01:53 PM
[Create DOI](#)
Category: Project
Description: Add a brief description to your project
License: Add a license

Wiki

This OSF page is the homepage for researchers working in the CO-RE lab. You can find the necessary tools to build up your project in this page. The place to start is with the [Research Milestones Sheet](#) (RMS). Once you have started the RMS, please start a new OSF project by using the Research Template for [Exploratory](#) or [Confirmatory](#) Studies.

Files

Click on a storage provider or drag and drop to upload

Name ▾ ▾ Modified ▾ ▾

CO-RE Lab Workspace

Make Private Public ⚡ 9 ...

Citation

Components Add Component Link Projects

Research Template to Start New Project (Exploratory) ✖ ⓘ
IJzerman, Klein & Neyroud
This template is intended to guide researchers in the CO-RE lab to run exploratory studies. Please use this template alongside the Research Milestone ...

Research Template to Start New Project (Confirmatory) ✖ ⓘ
IJzerman, Klein & Neyroud
This template is intended to guide researchers in the CO-RE lab to run confirmatory studies. Please use this template alongside the Research Miles she...



Our Solution 2

A	B	C	D	E	F	G	H	I	J
Research Milestones Form									
Completed Prior to Registration of Project									
In case a study is exploratory, indicate this on the page where usually hypotheses are included.									
Project Name	PI	Order of authors	OSF Project Page	OSF Page Public? (Yes/No)	OSF - Study Rationale + Hypotheses	Power Calculation	OSF - Methods, Procedures, Scales	OSF Data Analytic Plan	Ethics Application?
Student Projects 2017-2018									
Social Thermoregulation and Energy Usage	SUBATLI Tiffany		https://osf.io/anr6j/	NO	https://osf.io/7ydnw/	https://osf.io/d4qfb/	https://osf.io/qnc5k/		N/A
Conformity and Thermoregulation	LACKNER Zoé		https://osf.io/e4aby/	NO	https://osf.io/gwm4a/		https://osf.io/rcuk5/		N/A
Social Thermoregulation and Attraction	BARBOSA Vivian		https://osf.io/vamld8/	NO	https://osf.io/pws2y/	https://osf.io/6wne8/	https://osf.io/tkag8/		N/A
2018-2019									
Stress Regulation in Modern Times: Technologically Mediated Reduction of Coldness and Stress	KAFAEE Nazanin		https://osf.io/cp6k2/	NO	https://osf.io/49rhu/		https://osf.io/kxuq7/		YES
Ongoing Projects									
Social Thermoregulation in Romantic Relationships	KLEIN Rick		https://osf.io/s3yev/	NO	https://osf.io/rsb3a/	https://osf.io/6zxj9/	https://osf.io/vcu7b/	https://osf.io/yr62f/	N/A
EMBR Wave	Justin Mah		https://osf.io/mtdwi/	NO	https://osf.io/ae8bs/wiki/home/		https://osf.io/svbtm/wiki/home/		N/A
Social Thermoregulation and Personality (Explorato)	WITTMANN Adrien		https://osf.io/z8w3e/	NO					

ST Solution

Minimum Requirements:

1. Let participants fill in the Social Network Index (Cohen et al., 1997), the Experiences in Close Relationships Scale (Fraley et al., 2011), and the Social Thermoregulation and Risk Avoidance Questionnaire (Vergara et al., 2019).
2. Record participants' height, weight, native language, sex, age, and whether they are in a romantic relationship or not.
3. Ask whether people smoke (and, if yes, how many cigarettes per day) and whether they use medication (and, if so, which kind of medication).
4. Record the study location's or participant's latitude and longitude.
5. Record the minimum and maximum temperature of the day of the location the participant took part in the study.
6. For women, include a forward counting question to predict next menstrual onset, measured, ideally, at time of recruitment and during the study (cf., Gangestad et al., 2016).

Ideal Requirements:

1. Record the second-to-second ambient temperature of the room in which participants completed the study.
2. Record participants' second-to-second peripheral temperature.
3. Record participants' second-to-second core body temperature.
4. For women, assay estradiol, progesterone, and testosterone to estimate ovulatory cycle (cf., Gangestad et al., 2016).



Rhonda Hadi



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Rick Klein



Nick Coles



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Co-Regulation (CORE) Lab.

We study co-regulation in romantic relationships. We study social thermoregulation. We rely on open science ideals. We collaborate with researchers around the world, but are located at the Université Grenoble Alpes.



<http://www.corelab.io>



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Papers

Check out publications and/or preprints from the lab. We ensure all our work is available to the public, so if you can't find a paper let us know!

[ACCESS PAPERS](#)



Open Data/Materials

To the extent possible we make materials, data, and analysis scripts publicly available on the Open Science Framework. These may be used for re-analysis or for novel hypotheses.

[FIND OUR DATASETS](#)



Lab Philosophy

Doing science is really hard. Here, we document the workflow of the lab and expectations for lab members. Includes templates for OSF projects to make open science easier.

[DOWNLOAD](#)

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