

Social Thermoregulation in Modern Times

Using Smartphones, Sensors, and Actuators

Hans Ijzerman

LIP/PC2S



Social Thermoregulation in Modern Times

Outline of today's talk

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- Social thermoregulation in humans and other animals: basic principles

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- Discussion hackathon

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- Discussion hackathon
- Applying social thermoregulation in everyday life

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- Research challenges - our solution (confirmatory -> exploratory)
- Discussion hackathon
- Applying social thermoregulation in everyday life
- Opening up floor to discuss how to study/apply social thermoregulation

Social Thermoregulation

Basic Principles

Basic principles

Central point: Thermoregulation is one important motive for bonding/attachment

Basic principles

Temperature regulation is omnipresent.

Basic principles

Temperature regulation is omnipresent. We constantly regulate our temperature.

Basic principles

Temperature regulation is omnipresent. We constantly regulate our temperature and only in (evolutionarily) very recent times do we rely less on others to help regulate temperature.

Basic principles

Broadly speaking: Thermoregulation relies on homeostasis (i.e., returning to baseline levels)

Basic principles

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

Basic principles

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

Basic principles

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.

Basic principles

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

Basic principles

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

Basic principles

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

Basic principles

Homeothermic endotherms: Internal (but costly) regulation.

Basic principles

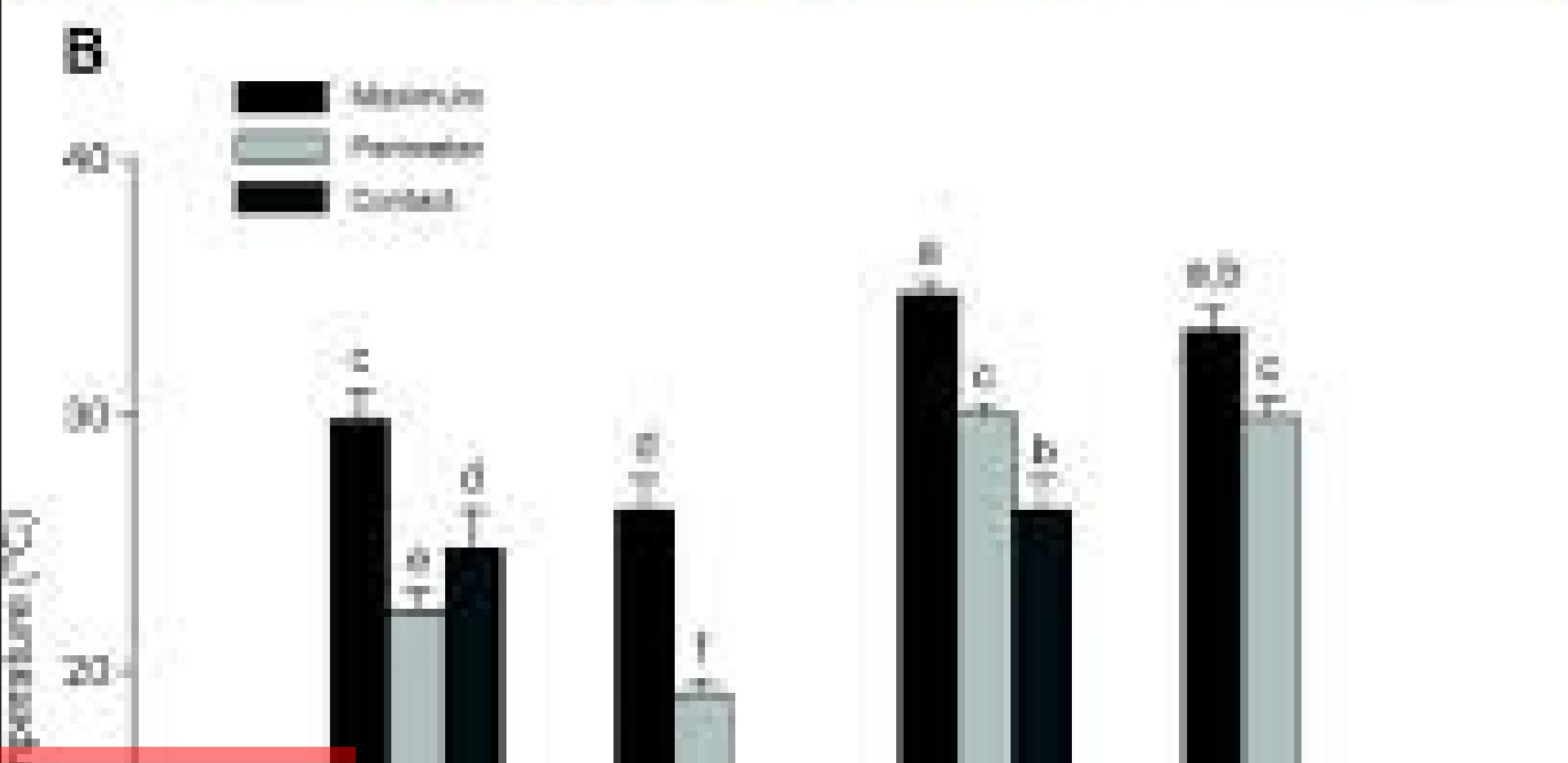
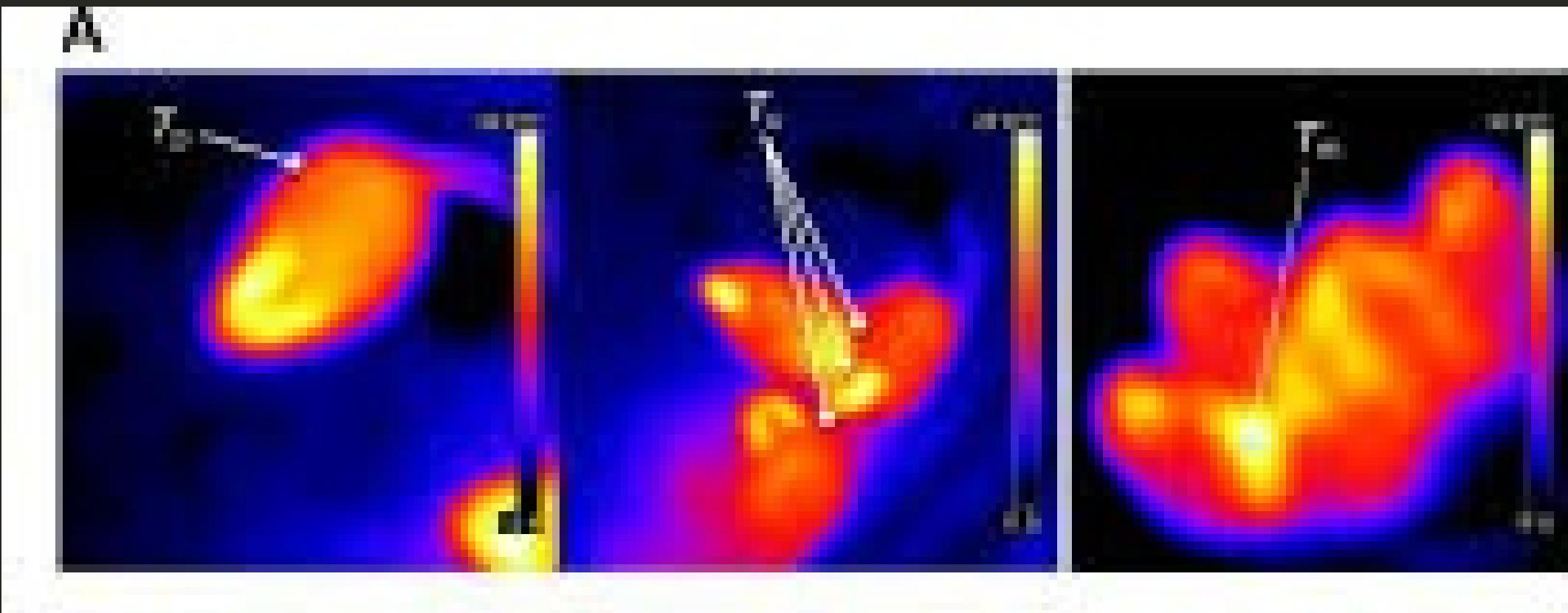
Other homeothermic endotherms: Personal heaters.

Basic principles

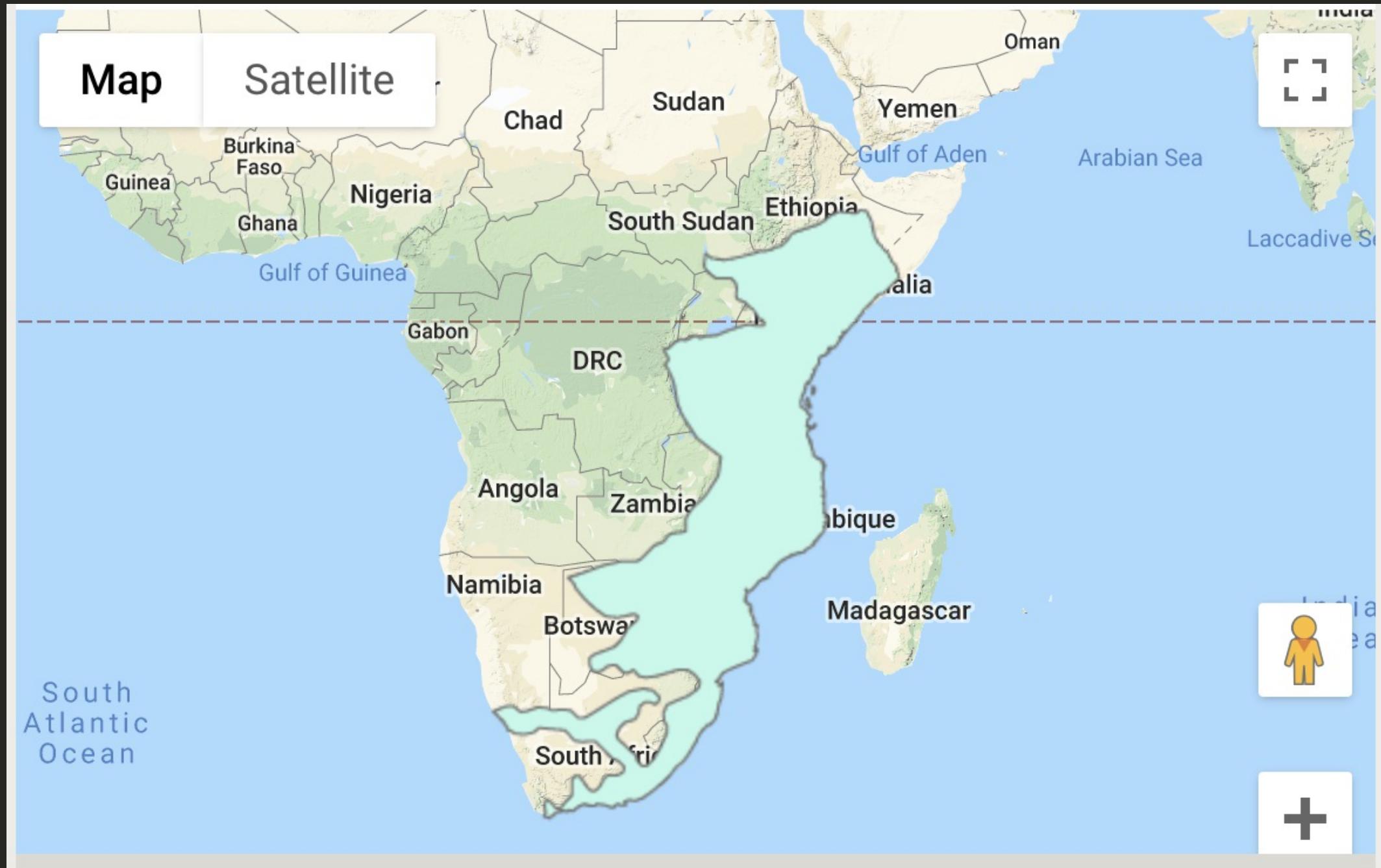
Case in point: Energy consumption of Octodon Degus (Nunez-Villega et al., 2014).













Social Thermoregulation and Human Attachment



Rodrigo Vergara



Cristobal Hernández



Francisco Jaume-Guazzini



Siegwart Lindenberg



Rick Klein

Social Thermoregulation and Human Attachment

12-country sample shows that desire to socially thermoregulate (e.g., warming one's hands with someone; McDonald's Omega = .81) relates reliably (and negatively) to attachment avoidance ($r = -.31$; Vergara et al., 2019)

Social Thermoregulation and Attachment

12-country sample shows that desire to socially thermoregulate (e.g., warming one's hands with someone; McDonald's Omega = .81) relates reliably (and negatively) to attachment avoidance, which we replicated out-of-sample in France.

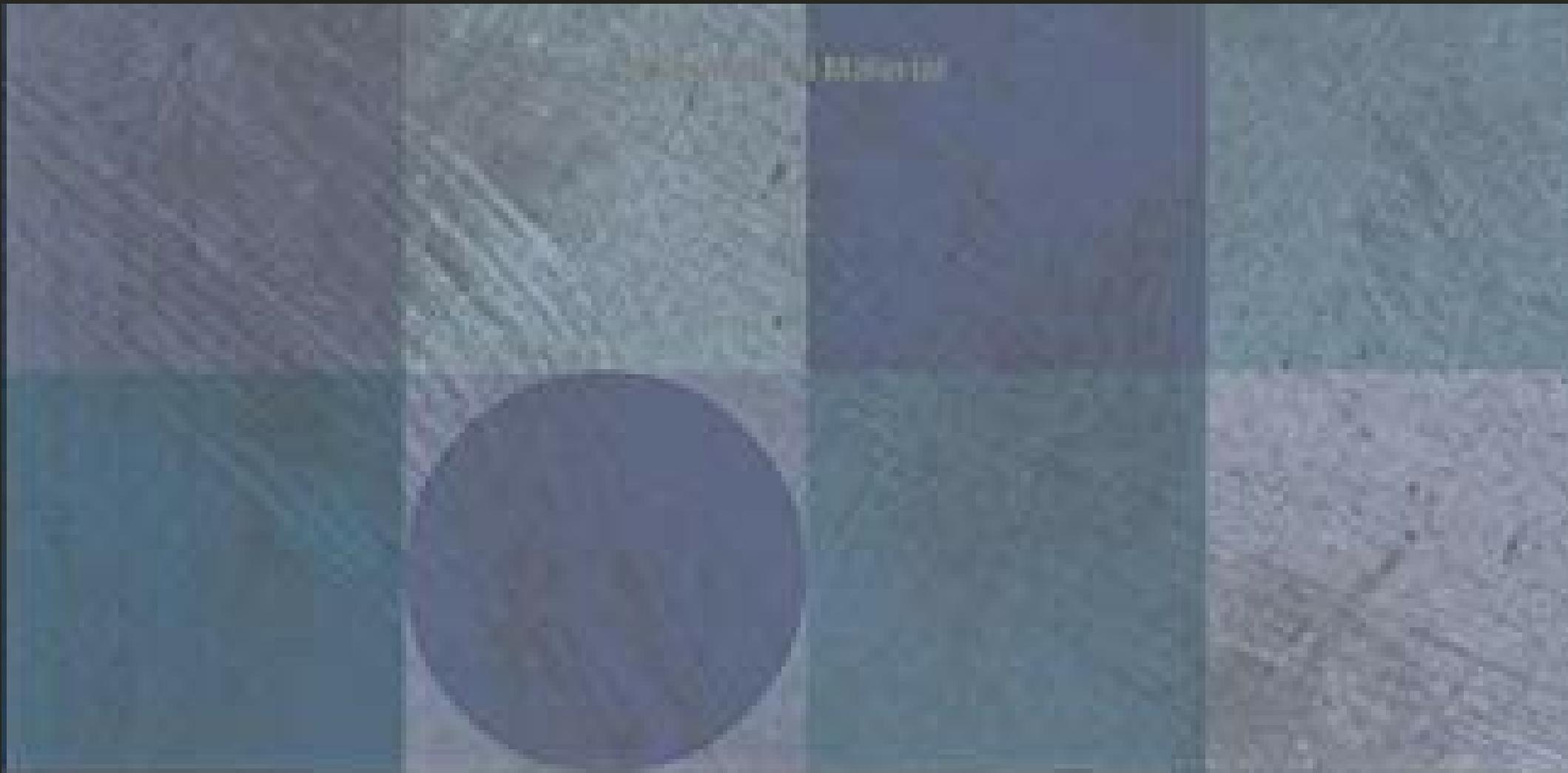
Data: <https://osf.io/2rm5b/>

Preprint: <https://psyarxiv.com/bm9ta/>

What is it not?

What is it not?

- Warm = positive/Cold = Negative



M E T A P H O R S

W E L I N W E B Y

Social Thermoregulation

Empirical Evidence

Empirical Evidence

- What do we know?
- Doubts - replicability
- Fixes will partly be in technology, allowing easy application



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ScienceDirect

Journal of Consumer Psychology 24, 2 (2014) 241–250



Research Article

Warmth and conformity: The effects of ambient temperature on product preferences and financial decisions

Xun (Irene) Huang ^{a,*}, Meng Zhang ^b, Michael K. Hui ^b, Robert S. Wyer Jr. ^b

^a Lingnan College, Sun Yat-sen University, China

^b CUHK Business School, The Chinese University of Hong Kong, Hong Kong

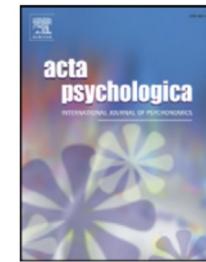
Received 27 August 2012; received in revised form 10 September 2013; accepted 12 September 2013

Available online 29 September 2013

Warm It Up with Love: The Effect of Physical Coldness on Liking of Romance Movies

JIEWEN HONG
YACHENG SUN

Are romance movies more desirable when people are cold? Building on research on (bodily) feeling-as-information and embodied cognition, we hypothesize that physical coldness activates a need for psychological warmth, which in turn leads to an increased liking for romance movies. Four laboratory experiments and an analysis of online movie rental data provide support for our hypothesis. Specifically, studies 1A and 1B show that physical coldness increases the liking of and willingness to pay for romance movies. Study 2 shows that the effect of physical coldness on liking of romance movies only occurs for people who associate romance movies with psychological warmth. Study 3 shows that people correct for the influence of physical coldness on their liking of romance movies when physical coldness is made salient. In study 4, using data on online movie rentals and historical temperature, we found a negative relationship between weather temperature and preference for romance movies.



Cold-blooded loneliness: Social exclusion leads to lower skin temperatures

Hans IJzerman ^{a,b,*}, Marcello Gallucci ^c, Wim T.J.L. Pouw ^b, Sophia C. Weiβgerber ^b,
Niels J. Van Doesum ^b, Kipling D. Williams ^d

^a Tilburg University, The Netherlands

^b VU University, The Netherlands

^c University of Milano-Bicocca, Italy

^d Purdue University, United States

ARTICLE INFO

Article history:

ABSTRACT

Being ostracized or excluded, even briefly and by strangers, is painful and threatens fundamental needs. Recent



Available online at www.sciencedirect.com

ScienceDirect

Journal of Consumer Psychology 24, 2 (2014) 234–240



Research Article

Embodied cognition and social consumption: Self-regulating temperature through social products and behaviors

Seung Hwan (Mark) Lee ^{a,*}, Jeff D. Rotman ^b, Andrew W. Perkins ^b

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Received 19 February 2013; received in revised form 20 August 2013; accepted 16 September 2013

Available online 27 September 2013

However...

However...

Psychology faced a replication crisis

Replication Crisis

Ioannidis (2005) conducted simulations and predicted on the basis of this that the majority of published research is false (ALL research), particularly for low N studies, studies with considerable flexibility in designs/outcomes, high reward studies (etc.)

Replication Crisis

- RP:Psychology - 40/100 of findings replicated
- ManyLabs1 (Klein et al., 2014): 10/13 replicated
- ManyLabs2 (Klein et al., 2018): 14/28 replicated
- ManyLabs3 (Ebersole et al., 2016): 3/10 replicated
- ManyLabs4 (Klein et al., in prep)
- ManyLabs5 (Ebersole et al., in prep)

Replication

Replication of “Experiencing Physical Warmth Promotes Interpersonal Warmth” by Williams and Bargh (2008)

Dermot Lynott,¹ Katherine S. Corker,² Jessica Wortman,³ Louise Connell,¹ M. Brent Donnellan,³ Richard E. Lucas,³ and Kerry O’Brien^{4,5}

¹Lancaster University, UK, ²Kenyon College, Gambier, OH, USA, ³Michigan State University, USA,
⁴Monash University, USA, ⁵University of Manchester, UK

Abstract. We report the results of three high-powered, independent replications of Study 2 from Williams and Bargh (2008). Participants evaluated hot or cold instant therapeutic packs before choosing a reward for participation that was framed as a prosocial (i.e., treat for a friend) or self-interested reward (i.e., treat for the self). Williams and Bargh predicted that evaluating the hot pack would lead to a higher probability of making a prosocial choice compared to evaluating the cold pack. We did not replicate the effect in any individual laboratory or when considering the results of the three replications together (total $N = 861$). We conclude that there is no evidence that brief exposure to warm therapeutic packs induces greater prosocial responding than exposure to cold therapeutic packs.

Keywords: embodied cognition, social cognition, replication, temperature



Physical Warmth and Perceptual Focus: A Replication of IJzerman and Semin (2009)

Janneke D. Schilder^{1,2}, Hans IJzerman^{2*}, Jaap J. A. Denissen¹

1 Department of Developmental Psychology, Tilburg University, Tilburg, The Netherlands, **2** Department of Social Psychology, Tilburg University, Tilburg, The Netherlands

Abstract

With the changing of modal research practices in psychology, the grounded cognition perspective (sometimes categorized under the more popular term of “social priming”) has become heavily criticized. Specifically, LeBel and Campbell (2013) reported a failed replication of a study involving what some would call “social priming.” We sought to replicate a study from our own lab (IJzerman & Semin, 2009), to investigate the reproducibility of the reported effect that physical warmth leads to a greater focus on perceptual relations. We also improved our methods to reduce potential experimenter’s bias (cf. Doyen, Klein, Pichon, & Cleeremans, 2012). We successfully replicated the finding that a simple cue of physical warmth makes people more likely to adopt a relational focus.

Citation: Schilder JD, IJzerman H, Denissen JJA (2014) Physical Warmth and Perceptual Focus: A Replication of IJzerman and Semin (2009). PLoS ONE 9(11): e112772. doi:10.1371/journal.pone.0112772

Editor: Brock Bastian, University of New South Wales, Australia

Received December 23, 2013; **Accepted** October 20, 2014; **Published** November 17, 2014

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Funding: The authors have no support or funding to report.

Competing Interests: The authors have declared that no competing interests exist.

**Research on social thermoregulation has slowly
improved**

RESEARCH ARTICLE

Maintaining Warm, Trusting Relationships with Brands: Increased Temperature Perceptions after Thinking of Communal Brands

Hans IJzerman^{1*}, Janneke A. Janssen², James A. Coan³

1 VU University, Department of Clinical Psychology, Amsterdam, the Netherlands, **2** Tilburg University, Department of Social Psychology, School of Social & Behavioral Sciences, Tilburg, the Netherlands, **3** University of Virginia, Department of Psychology, Charlottesville, Virginia, United States of America

* h.ijzerman@gmail.com

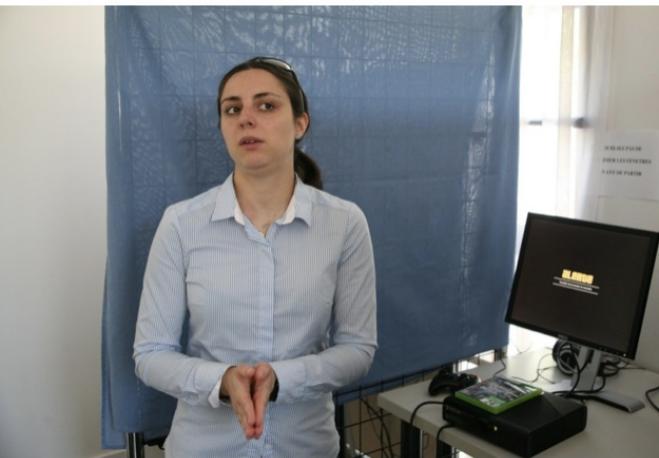


Abstract

Meta-Analysis



Rhonda Hadi



Elisa Sarda



Rick Klein



Nick Coles



Ivan Ropovik

Meta-Analysis Conclusions

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- Overall, literature shows evidence for a link between temperature and social behavior

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- Overall, literature shows evidence for a link between temperature and social behavior
- No evidence for link between temperature and discrete emotions

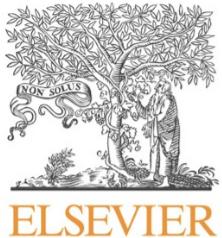
Meta-Analysis Conclusions

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- Evidence for link between temperature and interpersonal processes/JDM/self-regulation is inconclusive

Meta-Analysis Conclusions

- Overall, literature shows evidence for a link between temperature and social behavior
- No evidence for link between temperature and discrete emotions
- Evidence for link between temperature and interpersonal processes/JDM/self-regulation is inconclusive
- Evidence for link between temperature and person perception/group processes/cognitive processes is provided

Why our confidence on interpersonal processes?



Contents lists available at [ScienceDirect](#)

Journal of Experimental Social Psychology

journal homepage: www.elsevier.com/locate/jesp



Socially thermoregulated thinking: How past experiences matter in thinking about our loved ones



Hans IJzerman^{a,*}, Lison Neyroud^a, Rémi Courset^a, Michel Schrama^c, Jorick Post^b, Tila M. Pronk^b

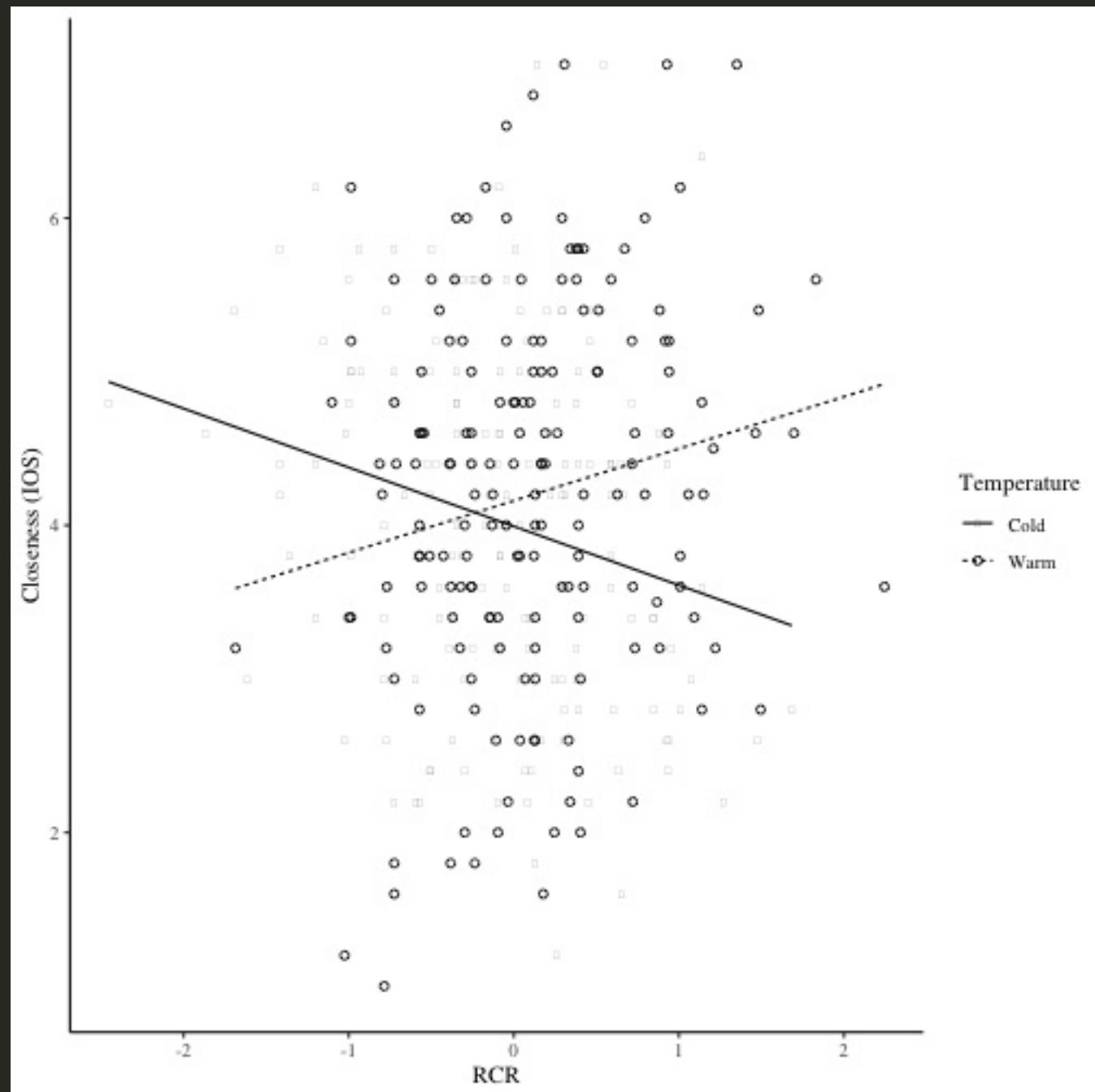
^a Université Grenoble Alpes, France

^b Tilburg University, the Netherlands

^c Independent Researcher

A B S T R A C T

Body temperature regulation is of crucial importance for nonhuman and human animals. Because other animals are crucial in helping to regulate body temperature, temperature differences likely determine how humans think about their social environment. Since 2008, the psychological literature on *social thermoregulation* has flourished with approximately 80 reports, ranging from economic decision-making to self-regulation. However, questions have arisen over its robustness and about underlying mechanisms, particularly in relation to differences in past relationship experiences. In this report, the authors used an inductive approach, *exploring* individual differences to identify items that alter the temperature-social thought relationship in a pilot (Study 1), and confirming the effects in Study 2 (total N for 1 and 2 = 366), both of which were not pre-registered. After a first review with the present journal, we preregistered our replication and successfully replicated our effects in a French sample (N = 350). Coldness (vs. warmth) makes people think about closer others when past relationship experiences were positive, while the reverse is true for negative past relationship experiences. These robust results provide future directions for the field of social thermoregulation.



Social networks and temperature regulation

Social networks and temperature regulation

- In vervet monkeys, network size determines core body temperature

Social networks and temperature regulation

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- Similar in humans?

Social networks and temperature regulation

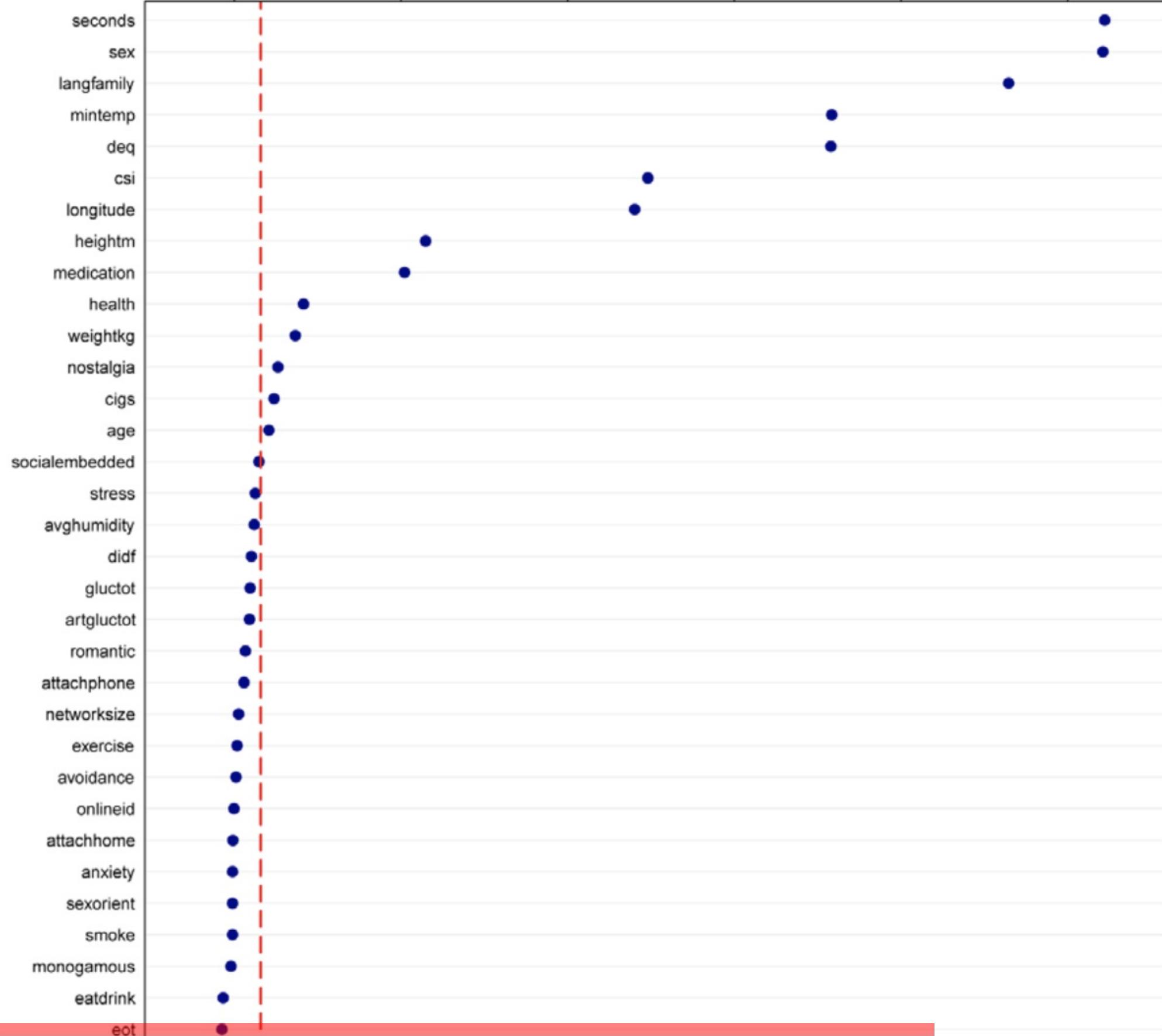
- In vervet monkeys, network size determines core body temperature
- Similar in humans?
- Pilot work suggests that social connection links to core body temperature (Inagaki et al., 2014)

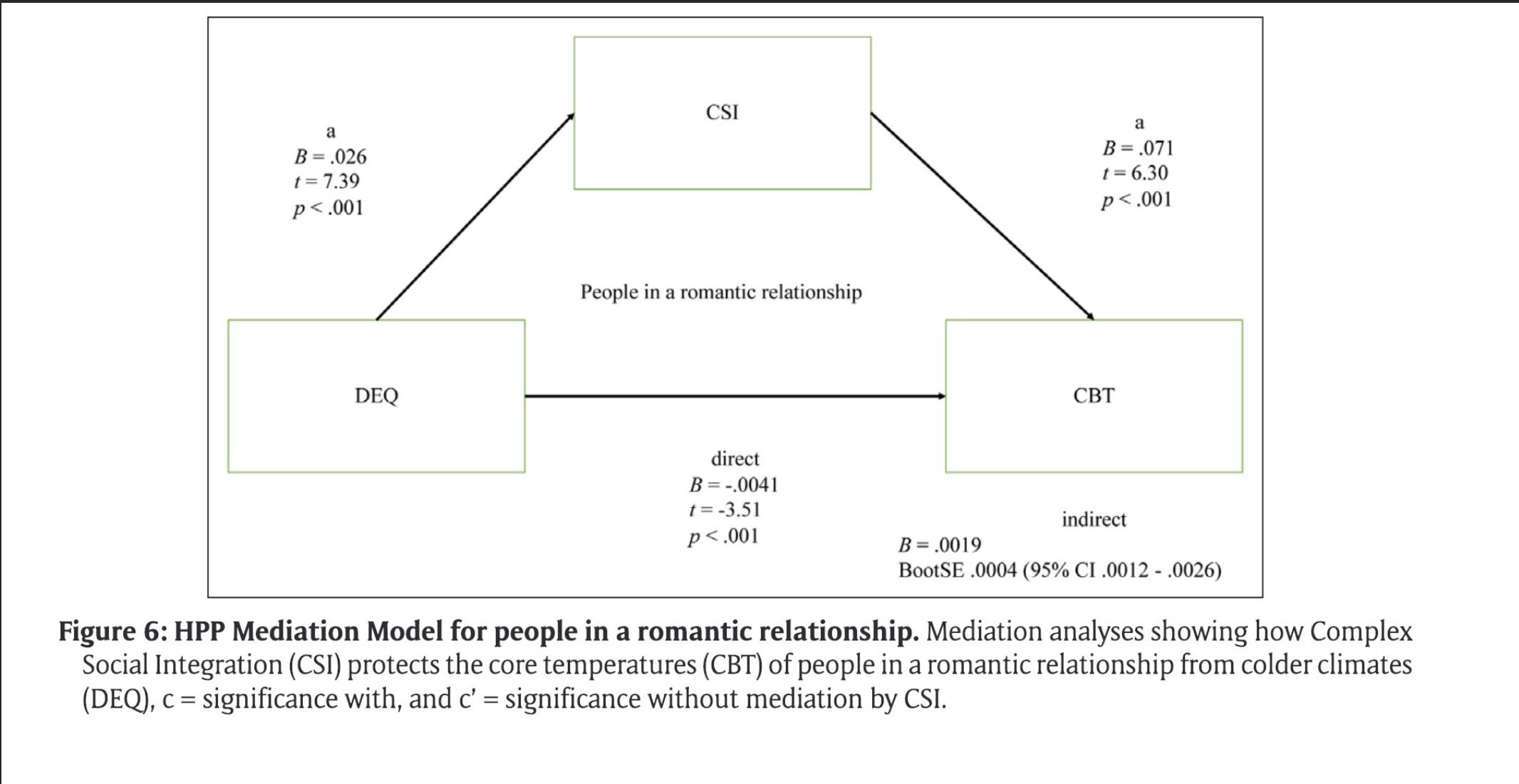
ORIGINAL RESEARCH REPORT

The Human Penguin Project: Climate, Social Integration, and Core Body Temperature

Hans IJzerman*, Siegwart Lindenberg^{†,‡}, İlker Dalgar[§], Sophia S. C. Weissgerber^{||}, Rodrigo C. Vergara[¶], Athena H. Cairo^{**}, Marija V. Čolić^{††}, Pinar Dursun^{‡‡}, Natalia Frankowska^{§§}, Rhonda Hadi^{¶¶}, Calvin J. Hall^{**}, Youngki Hong^{¶¶¶}, Chuan-Peng Hu^{***}, Jennifer Joy-Gaba^{**}, Dušanka Lazarević^{††}, Ljiljana B. Lazarević^{††}, Michal Parzuchowski^{§§}, Kyle G. Ratner^{¶¶¶}, David Rothman^{**}, Samantha Sim^{†††}, Cláudia Simão^{‡‡‡}, Mengdi Song^{***}, Darko Stojilović^{††}, Johanna K. Blomster^{§§§}, Rodrigo Brito^{¶¶¶¶}, Marie Hennecke^{¶¶¶¶}, Francisco Jaume-Guazzini^{****,††††}, Thomas W. Schubert^{†††,****}, Astrid Schütz^{§§§§}, Beate Seibt^{§§§} and Janis H. Zickfeld^{§§§}

Social thermoregulation theory posits that modern human relationships are pleiomorphically organized around body temperature regulation. In two studies ($N = 1755$) designed to test the principles from this theory, we used supervised machine learning to identify social and non-social factors that relate to core body temperature. This data-driven analysis found that complex social integration (CSI), defined as the number of high-contact roles one engages in, is a critical predictor of core body temperature. We further used a cross-validation approach to show that colder climates relate to higher levels of CSI, which in turn relates to higher CBT (when climates get colder). These results suggest that despite modern affordances for regulating body temperature, people still rely on social warmth to buffer their bodies against the cold.





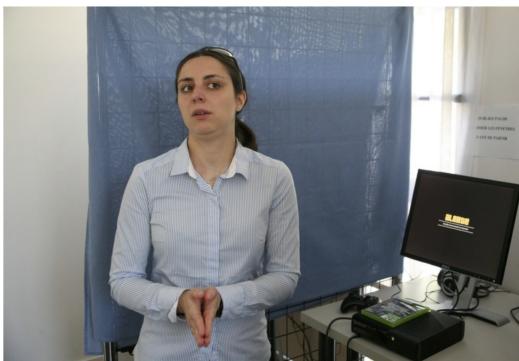
Proximal Mechanisms: Co-Regulation?



Rick Klein



Ivan Ropovik



Elisa Sarda



Fieke Wagemans



Emily Butler

Social networks and temperature co-regulation

- Pilot studies that show that people's peripheral temperature rises when viewing sad partner face.
- Currently planning high-powered registered replication.

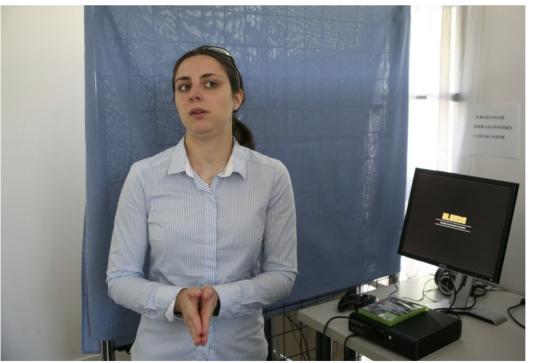
Research Challenges

Research Challenges

- Research is often low tech
- Power low (not many participants or measurements)
- Temperature changes are likely linked to other behaviors that follow the fluctuations
- Poor formal theories

Research Challenges

Our Solution



Elisa Sarda



Rick Klein

Our Solution

- We know that thermoregulation is connected to social relationships

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- We suspect that people "co-regulate"

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Our Solution

- We know that thermoregulation is connected to social relationships
- We suspect that people "co-regulate"
- Development of an app to communicate temperature to a server
- Measurement in daily life of temperature in couples
- Turning via deep learning into an algorithm to adjust temperature in dyads (Hackathon)
- Iteratively increasing complexity of algorithm (Hackathon)

 co-relab / bioapp

Watch 3 Star 0 Fork 0

Code Issues 0 Pull requests 0 Projects 0 Wiki Insights Settings

App under development for measuring participants' temperature, experience sampling, and other data collection through Android smartphones and connected sensors. Developed by the CORE Lab (corelab.io) at Université Grenoble Alpes. [Edit](#)

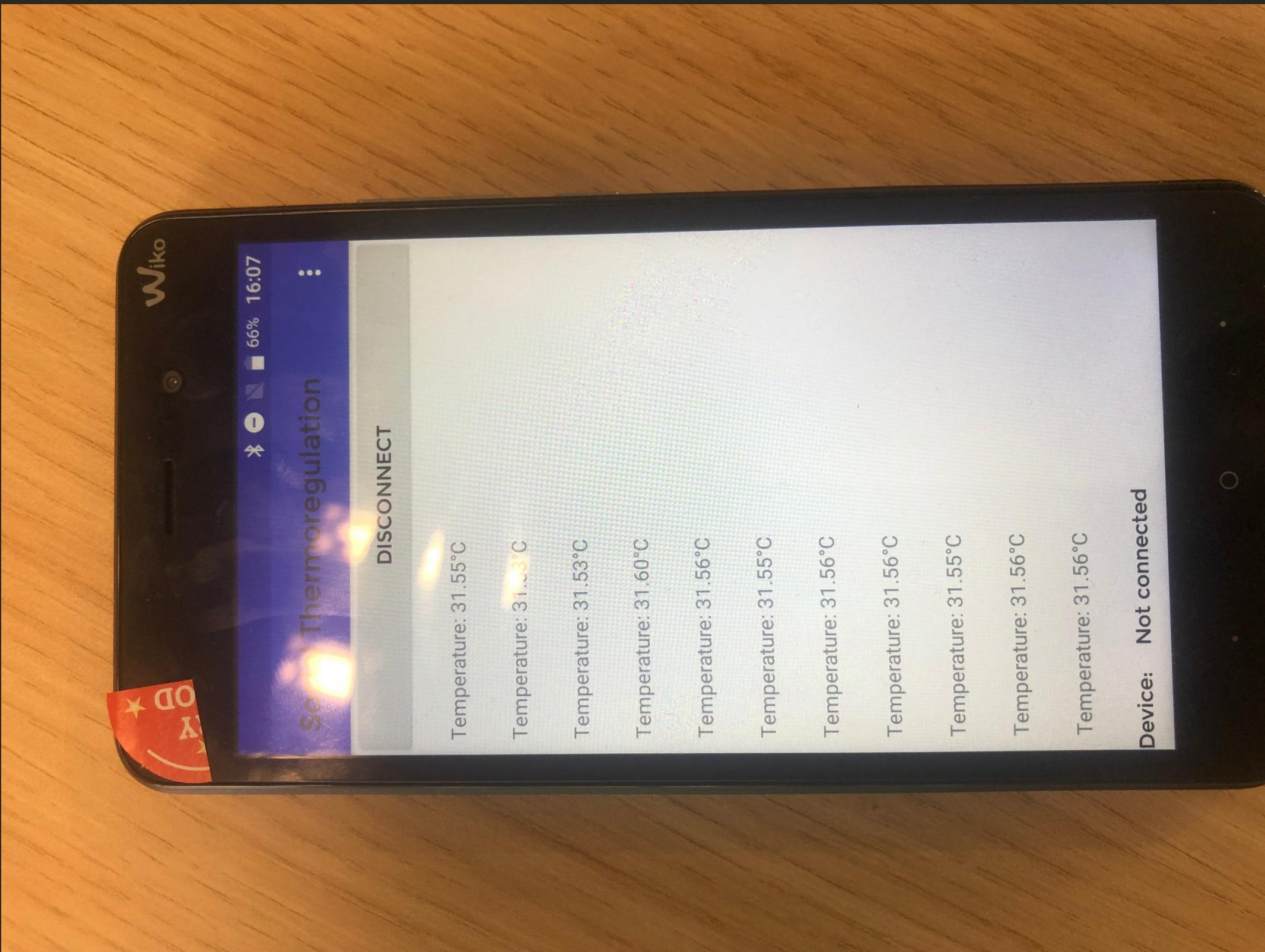
Manage topics

26 commits 2 branches 0 releases 2 contributors

Branch: master New pull request Create new file Upload files Find File Clone or download

anthonydallagnola	Merge branch 'release/1.0.2-all-modules'	Latest commit f48501f 8 days ago
.idea	add dial phone app	8 days ago
.settings	WIP	6 months ago
CordovaLib	finish embr wave	13 days ago
app	finish embr wave	13 days ago
closeness	add dial phone app	8 days ago
crydetector	finish embr wave	13 days ago
embrwave	add dial phone app	8 days ago
experienceSampler	add dial phone app	8 days ago
flower	finish embr wave	13 days ago
gradle/wrapper	update dependencies	7 months ago
mediarec	add iml files	23 days ago
node_modules/cordova-plugin-console	add experienceSampler new questions and notifications	23 days ago
shimmerAndroidInstrumentDriver	finish embr wave	13 days ago
shimmerDriver	add iml files	23 days ago





Hackathon Discussion

- Demonstration of sensors/actuators
- During hackathon a lot of trouble shooting/cleaning up app/firmware
- Current research app is on GitHub (BAB/integration with commercial app?)
- Developers can keep working on this after

Hackathon Brainstorm

- Making thermoregulation responsive to social interaction and individual (e.g., in therapy)
- Thermoregulation-related notifications (and let people report their feelings at that moment)
- Using thermal sensations instead of vibrotactile notifications as notifications for social interactions
- Combining thermal experiences with digital social experiences.
- Social VR could be augmented with sensations of warm and cool.

Hackathon Brainstorm

- Using thermal sensations instead of vibrotactile notifications as notifications for social interactions
- Combining thermal experiences with digital social experiences. Social VR could be augmented with sensations of warm and cool.
- Making thermoregulation responsive to social interaction and individual (e.g., in therapy)
- E-mail/text message from partner that causes EmbrWave to heat/cool

Applying Thermoregulation in Daily Life

Applying Thermoregulation

- Rich Slatcher (Harlow/responsiveness); Kerem Besim Durbin (touch intervention). Sensing/manipulating during EFT.

Applying Thermoregulation

- Rich Slatcher (Harlow/responsiveness); Kerem Besim Durbin (touch intervention). Sensing/manipulating during EFT.
- Justin Garcia: we removed many of the senses when we are looking for partners online

Applying Thermoregulation

- Rich Slatcher (Harlow/responsiveness); Kerem Besim Durbin (touch intervention). Sensing/manipulating during EFT.
- Justin Garcia: we removed many of the senses when we are looking for partners online
- Loving/Balzarini: Immersiveness in social interactions often visual -> omnipresence of thermoregulation.

Applying Thermoregulation

- Rich Slatcher (Harlow/responsiveness); Kerem Besim Durbin (touch intervention). Sensing/manipulating during EFT.
- Justin Garcia: we removed many of the senses when we are looking for partners online
- Loving/Balzarini: Immersiveness in social interactions often visual -> omnipresence of thermoregulation. - Connecting EmbrWave to phone so that it warms up when partner is physically proximate

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>



@hansijzerman



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](#)

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>



@hansijzerman



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