Measuring the Happiness, Health, & Stories of Society

Chris Danforth @chrisdanforth

Burack Lecture, November 13, 2023

Outline

Happiness & Society
- StoryWrangler
- Hedonometer
- Social Movements
- Science of Stories
- Mental Health & Nature
- Sleep & Well-being
- Thanks

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Hedonometer
Social Movements
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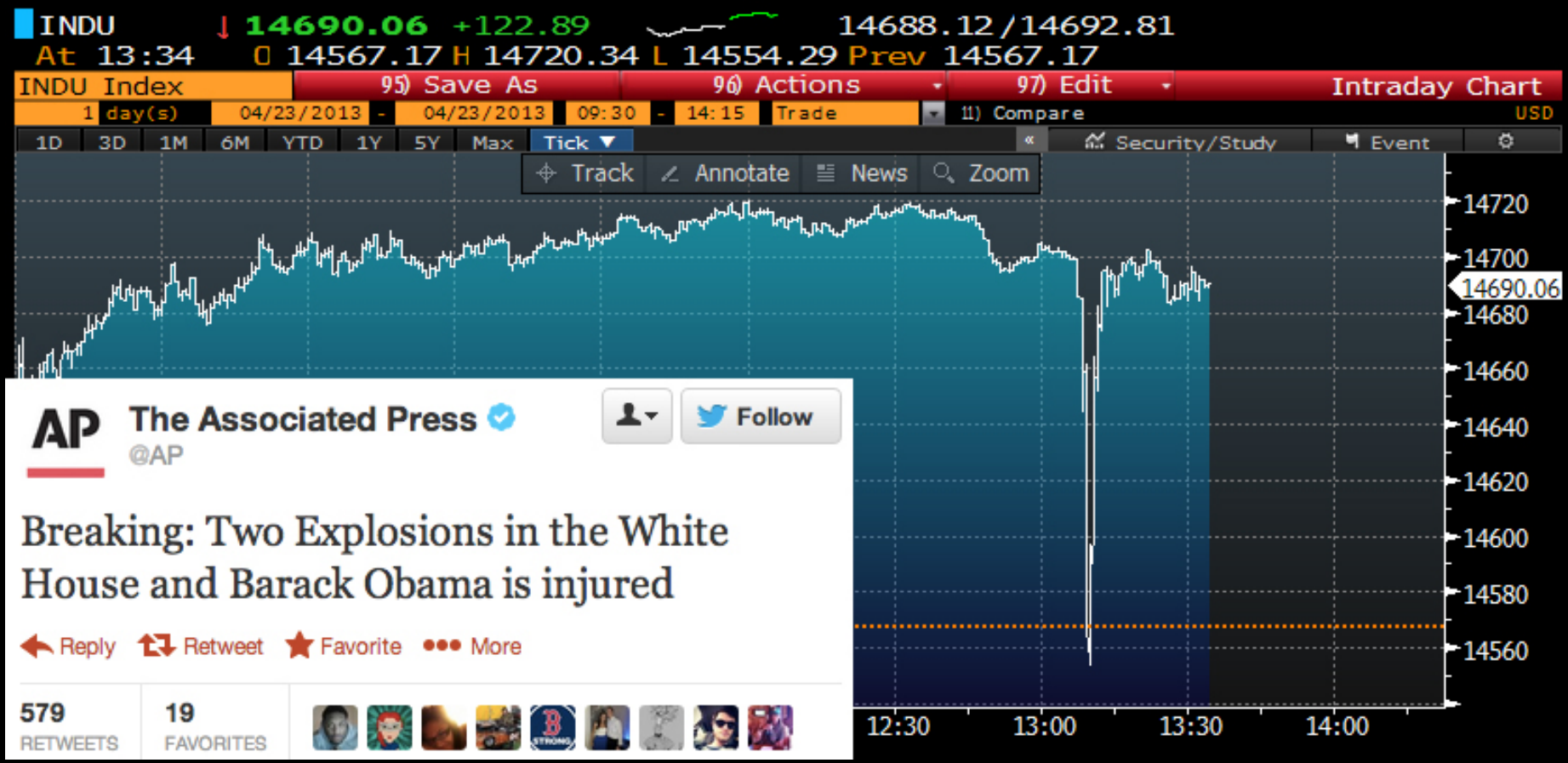
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11) Compare
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Security/Study
Event
Track
Annotate
News
Zoom
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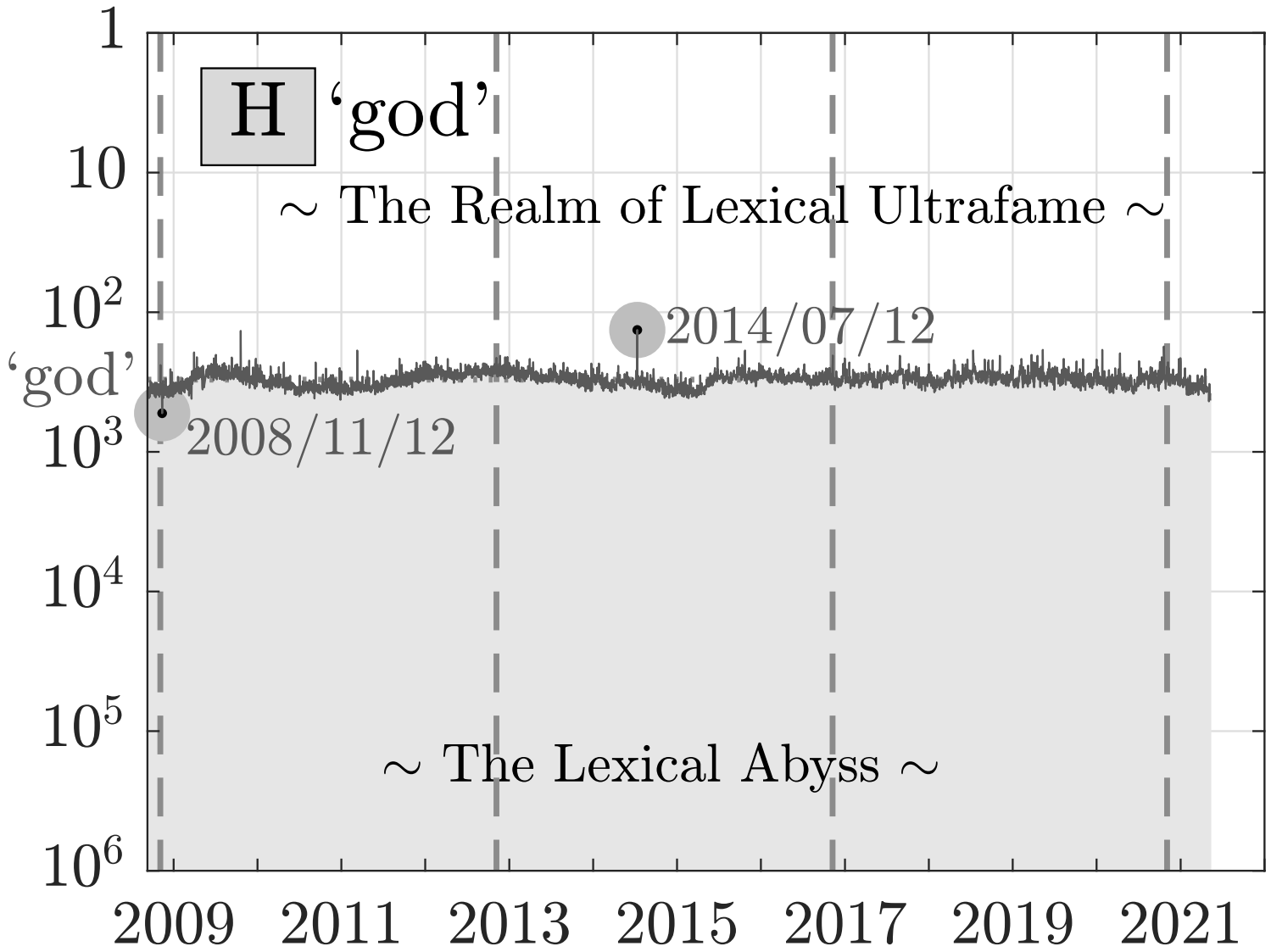

Dodds et al. "Fame and Ultrafame: Measuring and comparing daily levels of 'being talked about' for United States' presidents, their rivals, God, countries, and K-pop." Journal of Quantitative Description. 2022.

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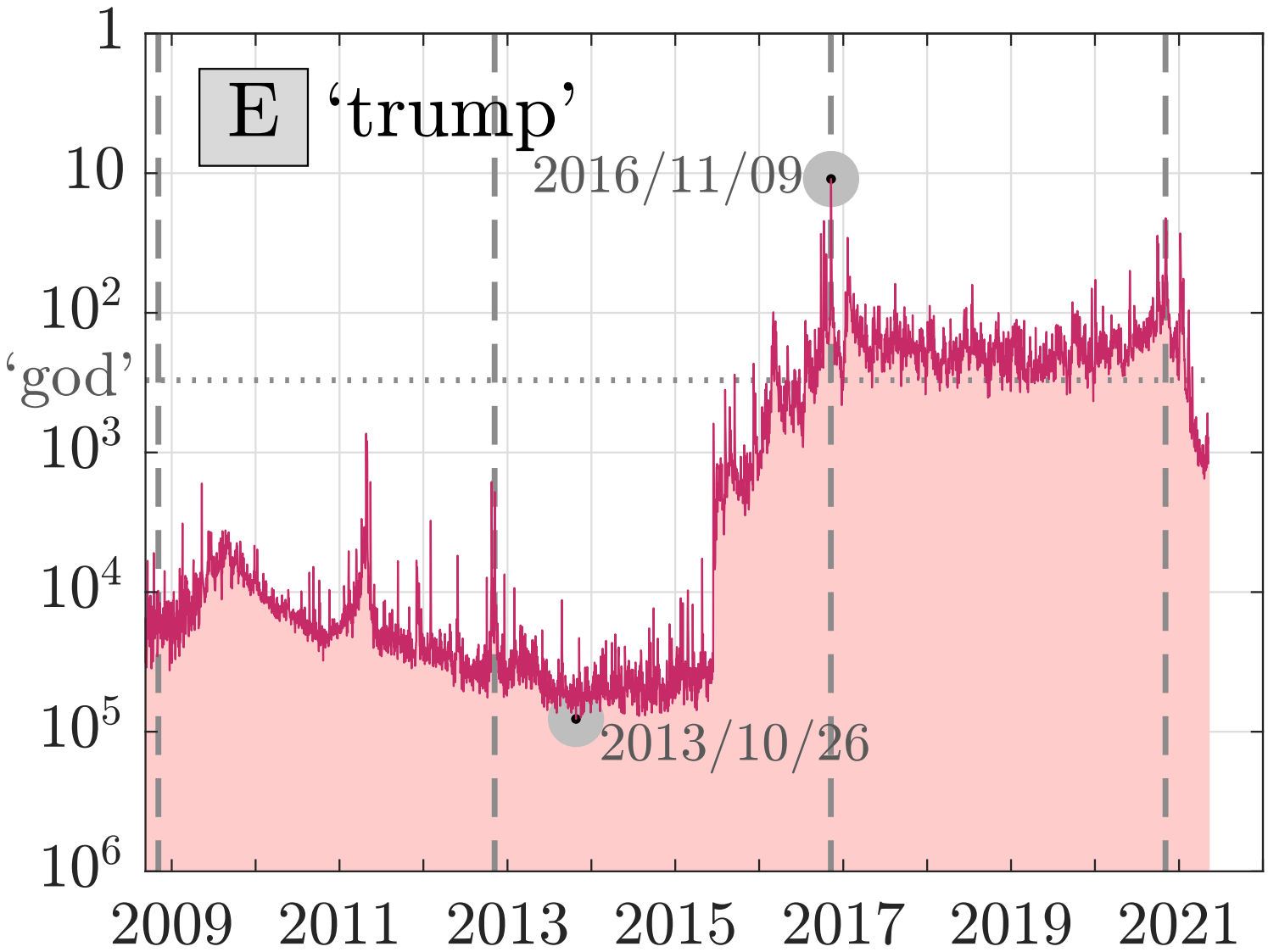

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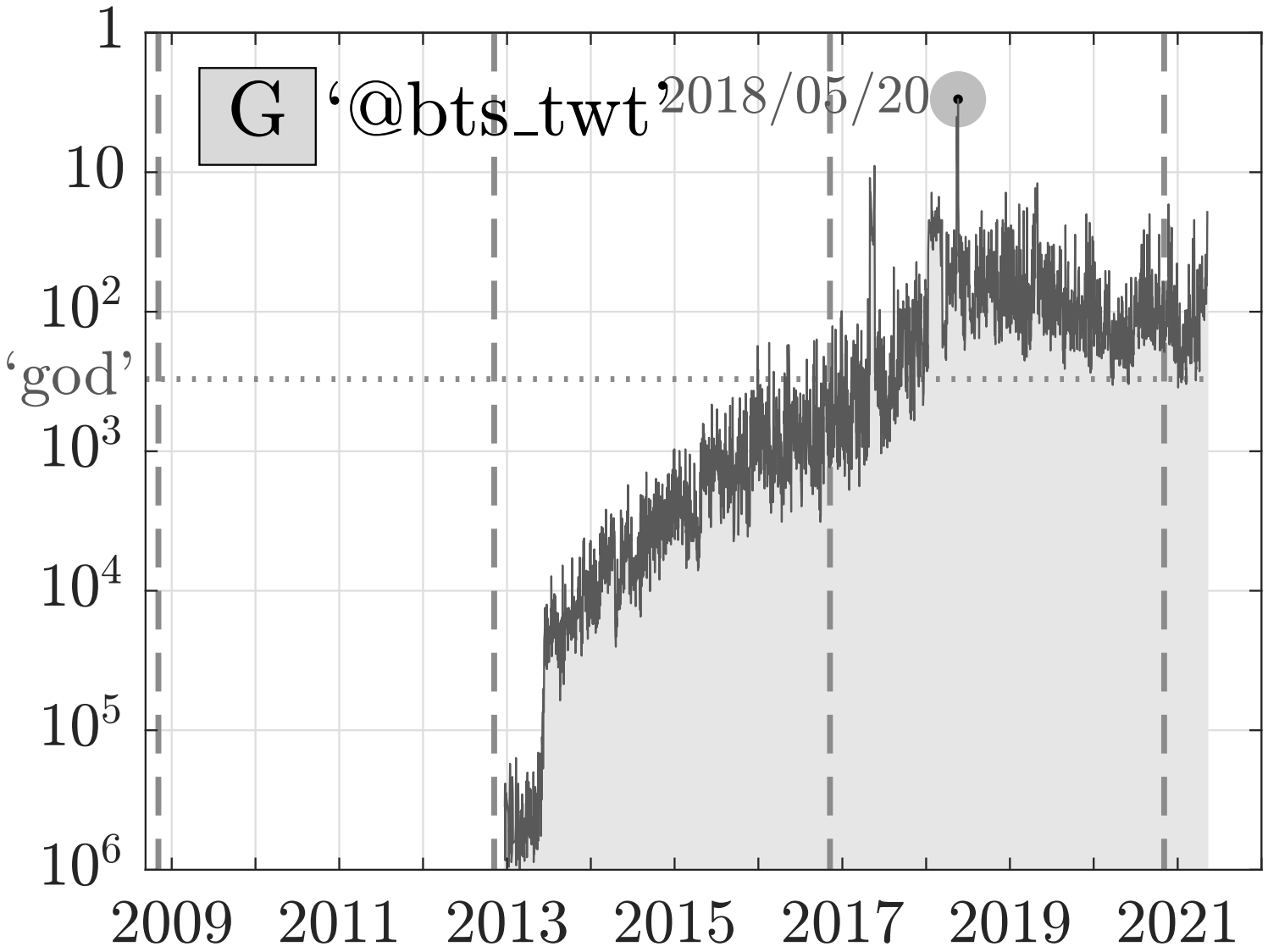

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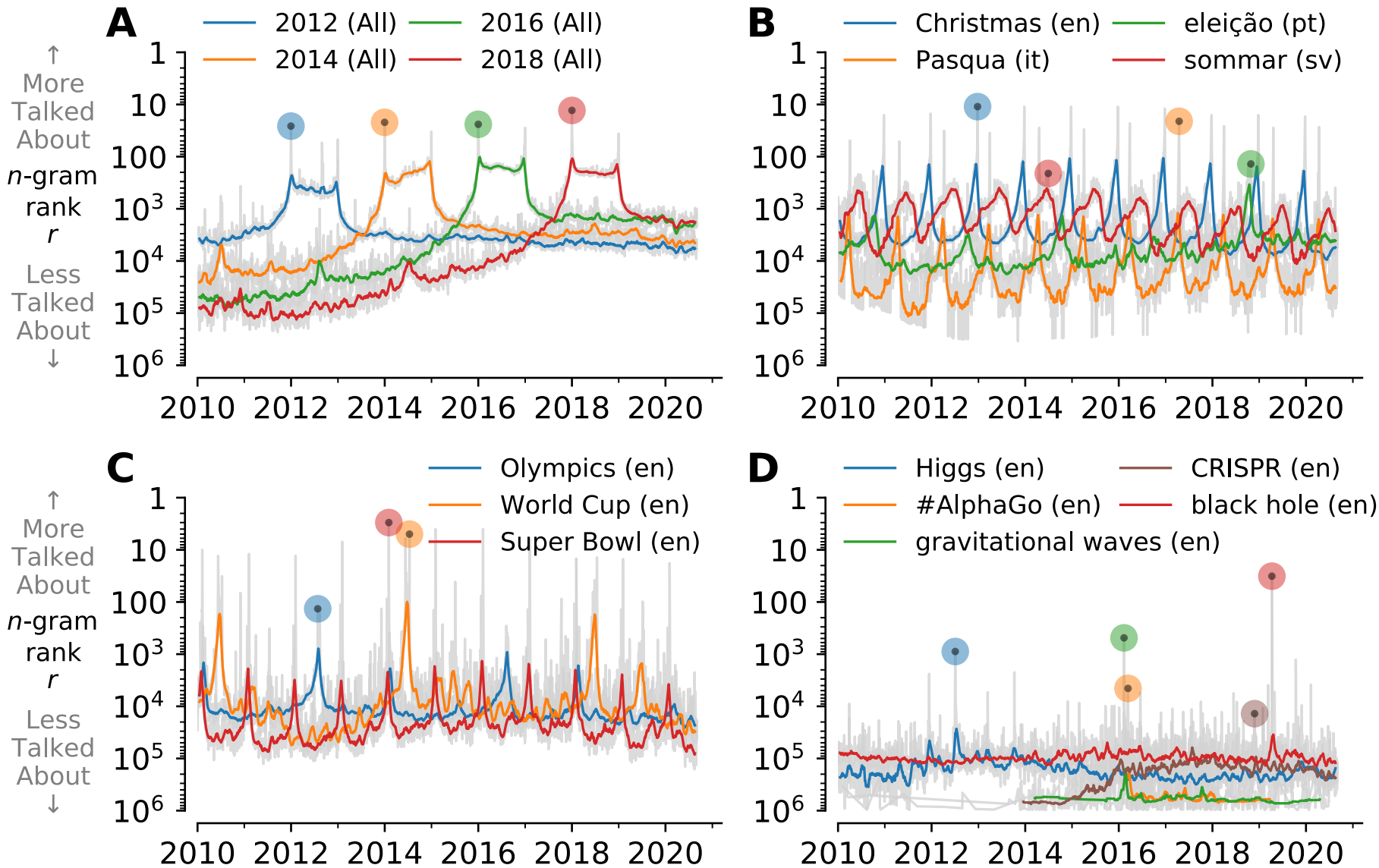
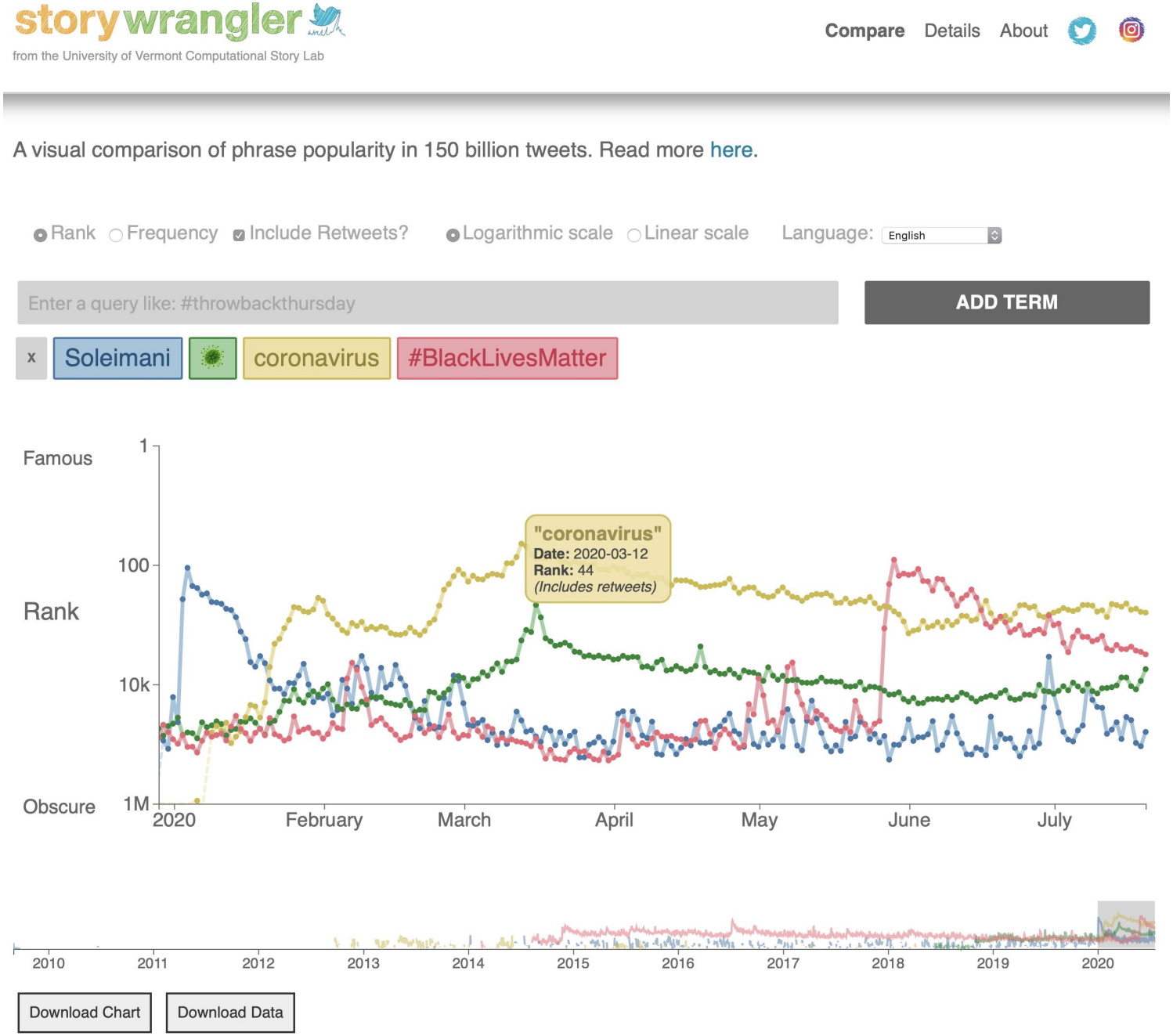


"Storywrangler: A massive exploratorium for sociolinguistic, cultural, socioeconomic, and political timelines using Twitter", Alshaabi et al., Science Advances. 2021.



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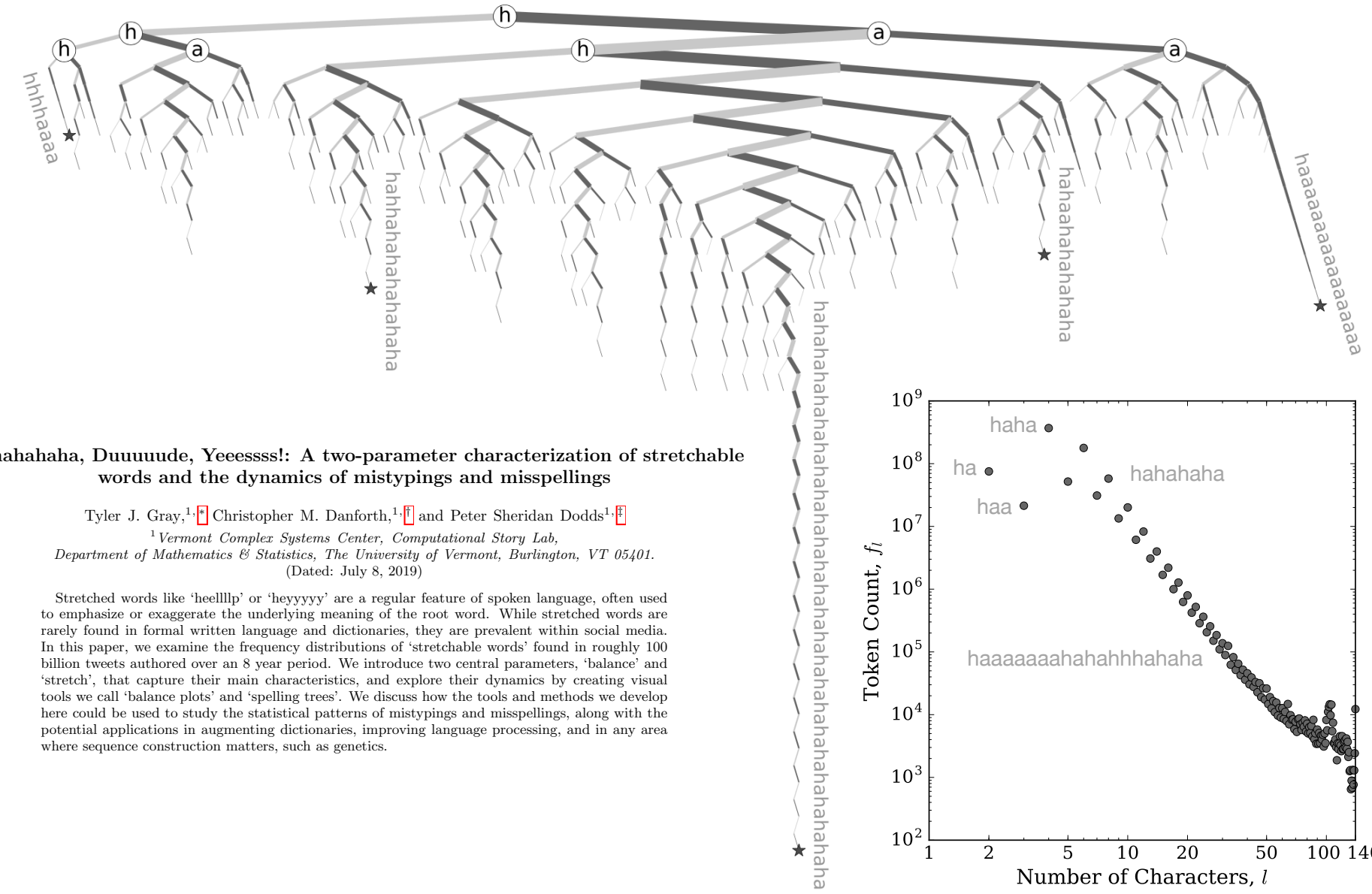
Fractal laughter on the internet



Hahahahaha, Duuuuude, Yeeessss!: A two-parameter characterization of stretchable words and the dynamics of mistypings and misspellings

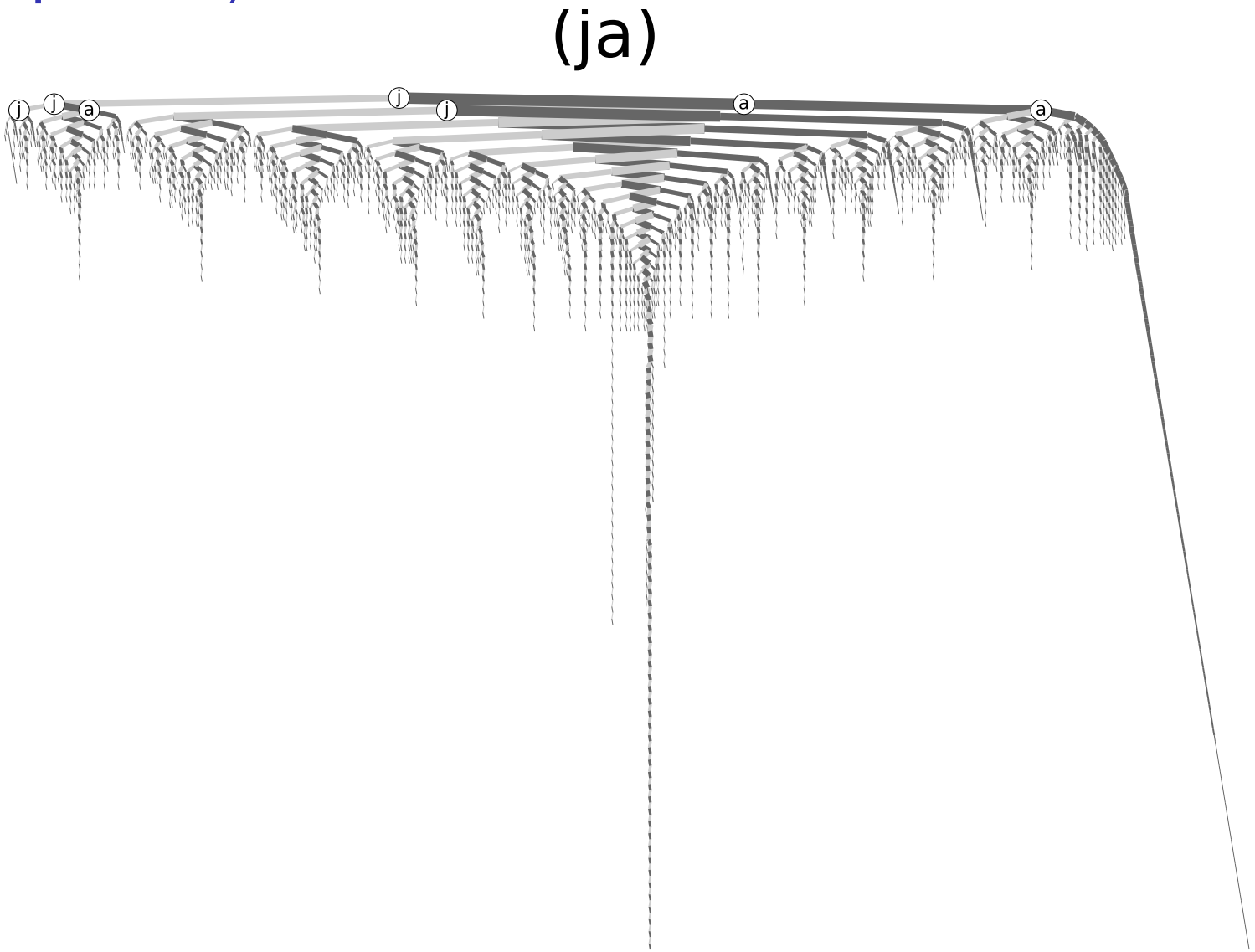
Tyler J. Gray,[1,*] Christopher M. Danforth,[1,†] and Peter Sheridan Dodds[1,‡]

[1] *Vermont Complex Systems Center, Computational Story Lab, Department of Mathematics & Statistics, The University of Vermont, Burlington, VT 05401.*

(Dated: July 8, 2019)

Stretched words like 'heellllp' or 'heyyyyy' are a regular feature of spoken language, often used to emphasize or exaggerate the underlying meaning of the root word. While stretched words are rarely found in formal written language and dictionaries, they are prevalent within social media. In this paper, we examine the frequency distributions of 'stretchable words' found in roughly 100 billion tweets authored over an 8 year period. We introduce two central parameters, 'balance' and 'stretch', that capture their main characteristics, and explore their dynamics by creating visual tools we call 'balance plots' and 'spelling trees'. We discuss how the tools and methods we develop here could be used to study the statistical patterns of mistypings and misspellings, along with the potential applications in augmenting dictionaries, improving language processing, and in any area where sequence construction matters, such as genetics.

The tree of laughter is language independent (Spanish)



Tyler Gray et al. "Hahahahaha, Duuuuude, Yeeessss!: A two-parameter characterization of stretchable words and the dynamics of mistypings and misspellings" 2019

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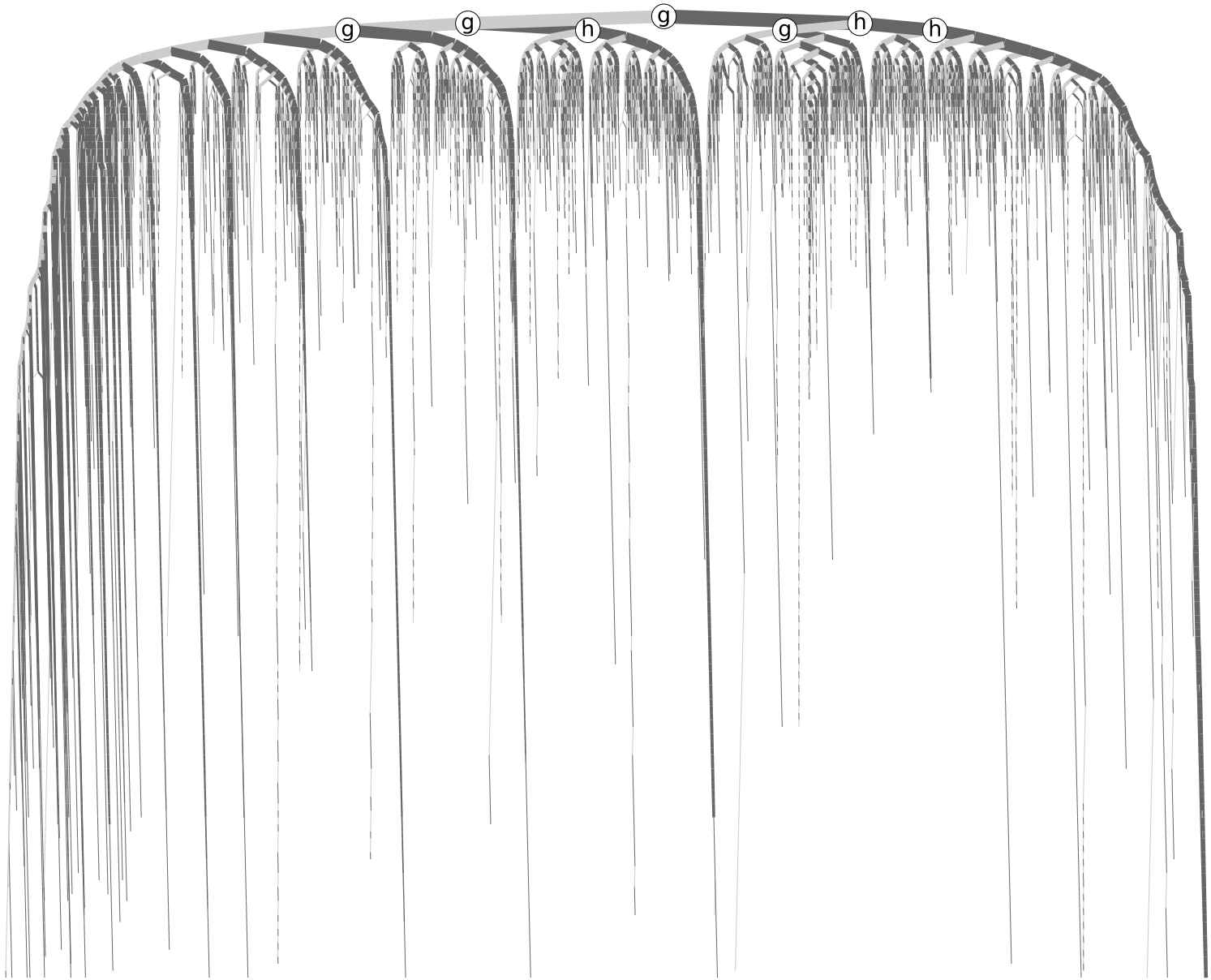
The fractal willow tree of screaming: aaaaaaaaggggggggggHHHHHHHHHHH!!!!!!!!!



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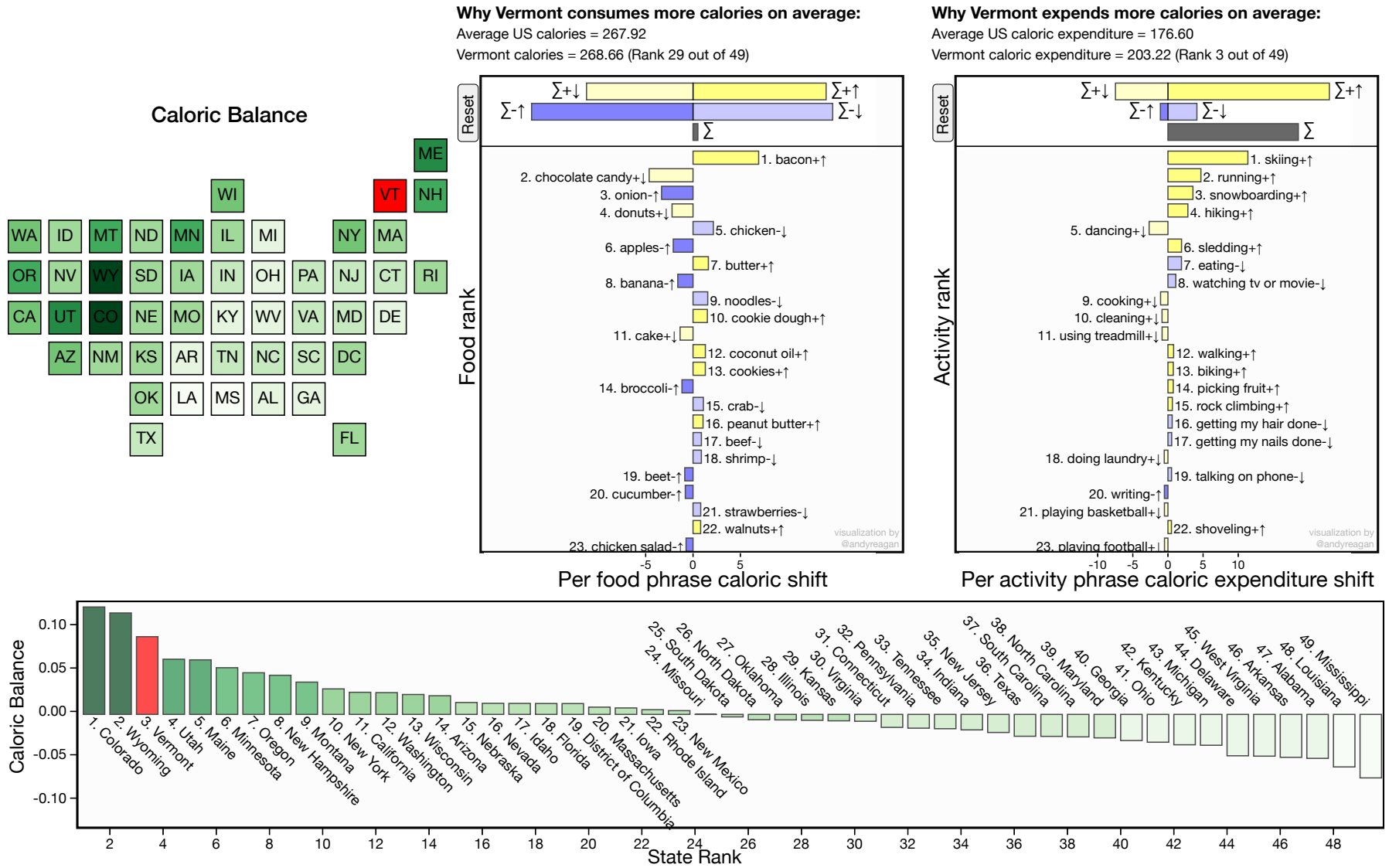
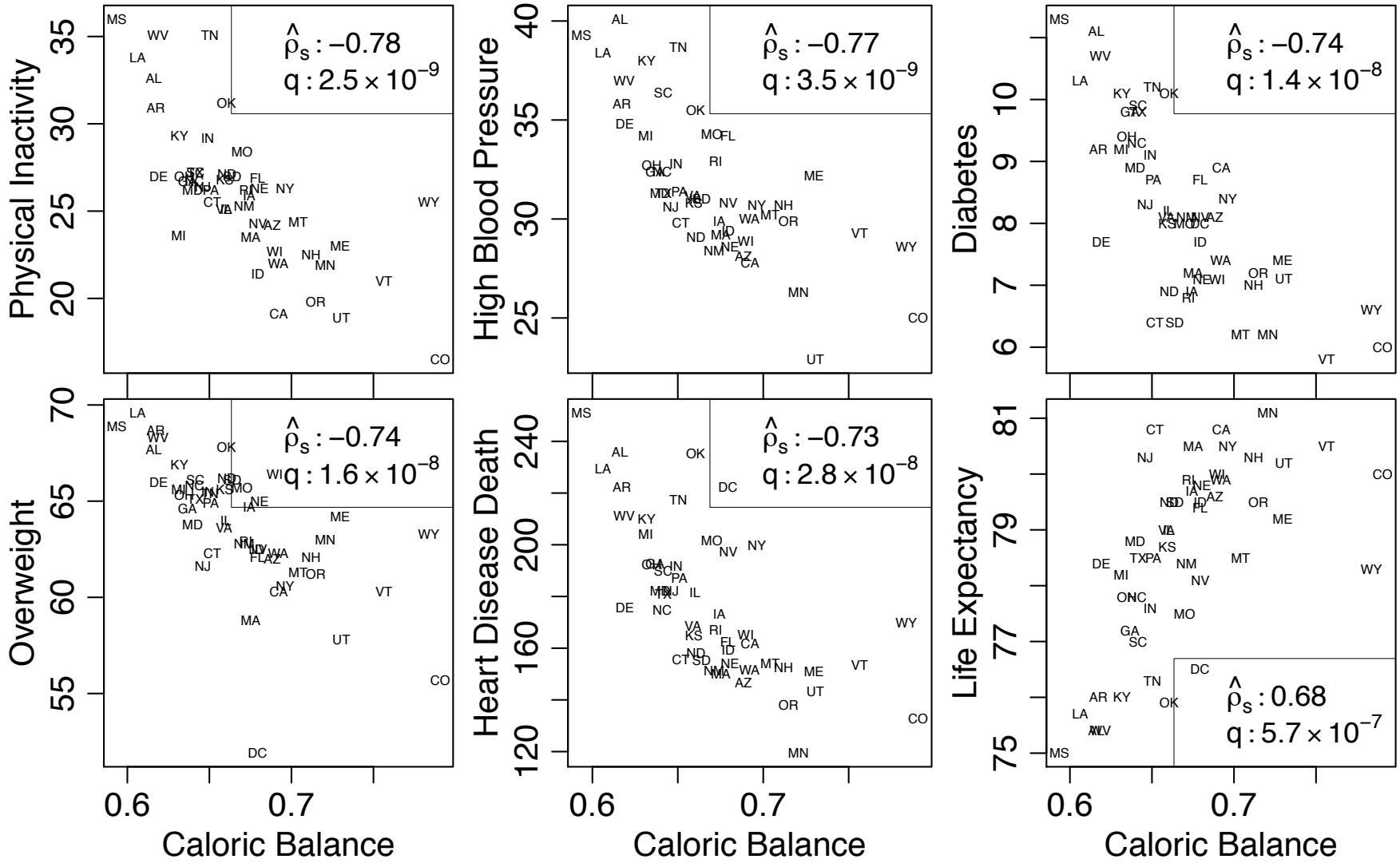


Alajajian et al.,
"The Lexicocalorimeter: Gauging public health through caloric input and output on social media"
PLoS ONE, 2017



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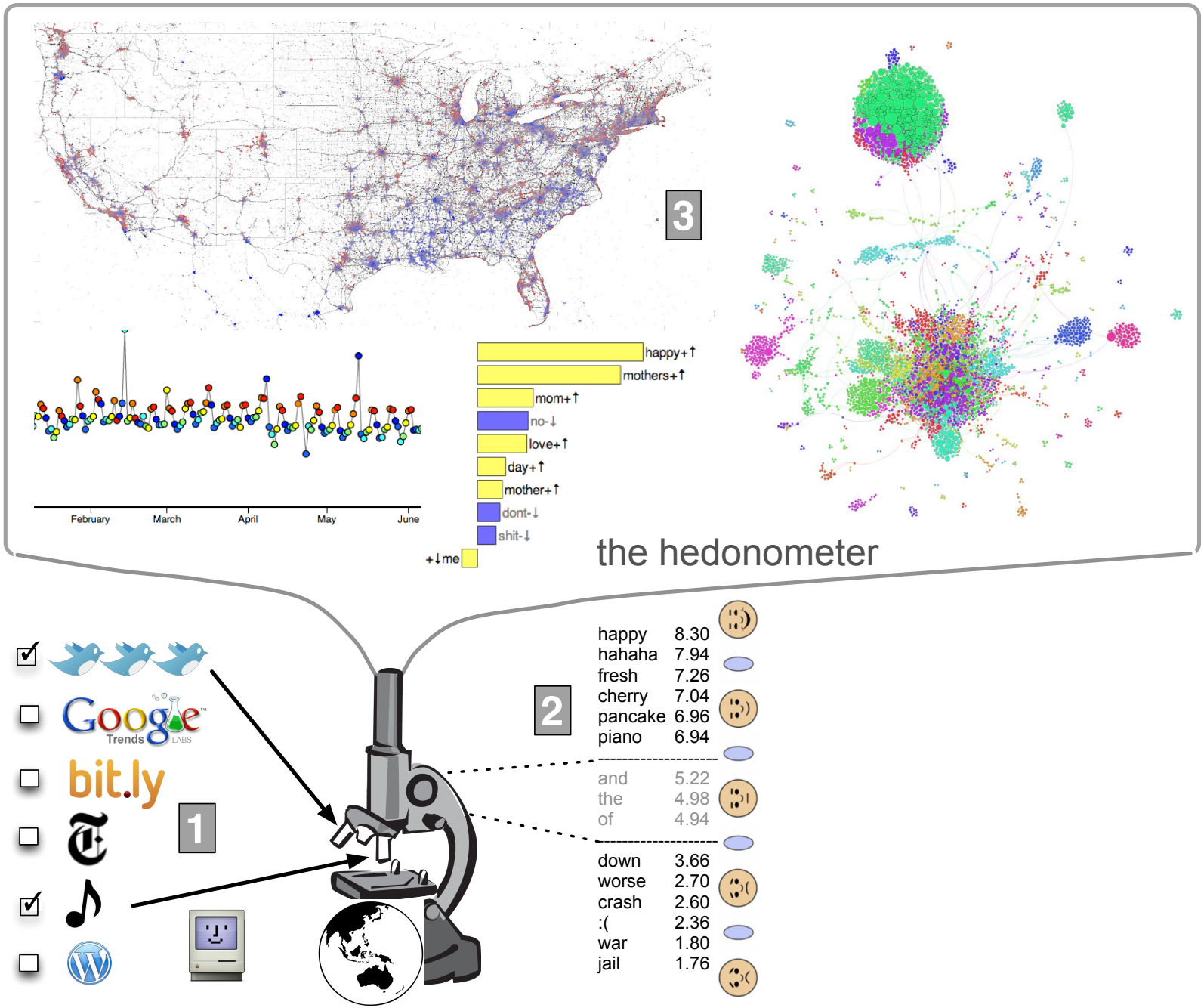
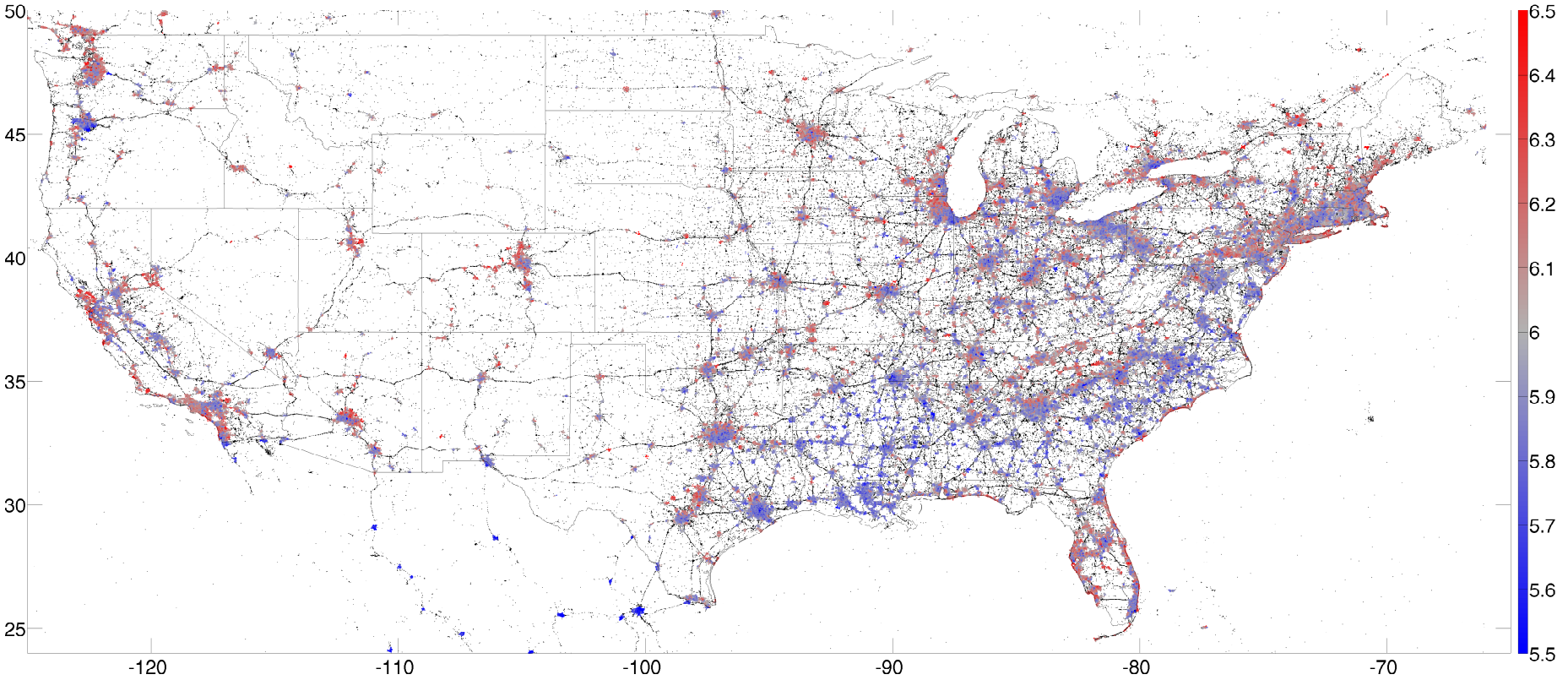

3
February
March
April
May
June
happy+↑
mothers+↑
mom+↑
no-↓
love+↑
day+↑
mother+↑
dont-↓
shit-↓
+↓me
the hedonometer
1
2
happy 8.30
hahaha 7.94
fresh 7.26
cherry 7.04
pancake 6.96
piano 6.94
and 5.22
the 4.98
of 4.94
down 3.66
worse 2.70
crash 2.60
:(2.36
war 1.80
jail 1.76

Happiness of Cities from Twitter



Mitchell et al. PLoS ONE 2013

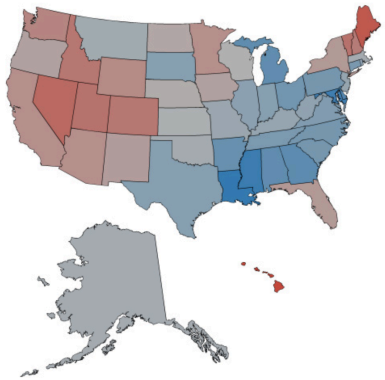
Happiness of Cities from Twitter

The Atlantic

The Geography of Happiness According to 10 Million Tweets

ALEXIS C. MADRIGAL | FEB 19 2013, 12:59 PM ET

The happiest city in America is Napa, California -- and the saddest all swear too much.



Happiness of Cities from Twitter

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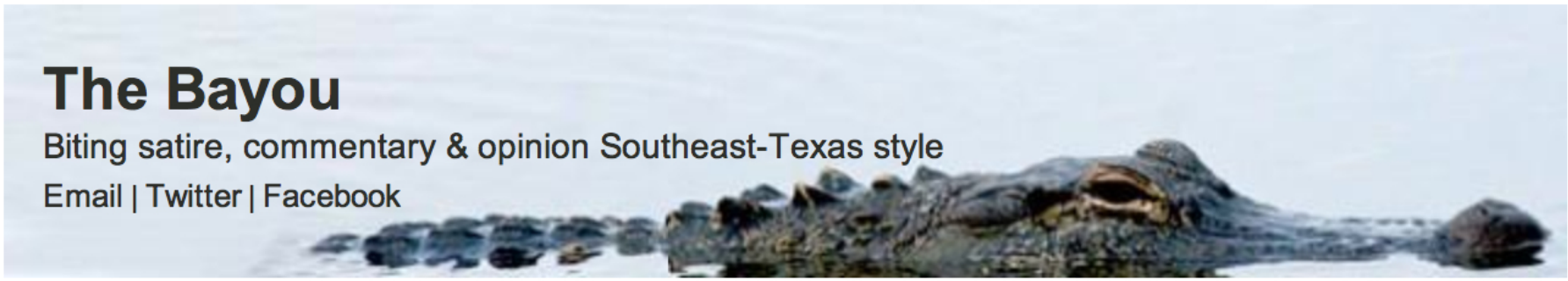


Eggheads find Beaumont IS the 'saddest city'

Tuesday, February 19, 2013 *by:* gator

Comments(4) | Email | Print | Share 55 | +1 0

That's what some eggheads at the Department of Mathematics and Statistics at the University of Vermont have determined.

Happiness of Cities from Twitter

rednnneecckckkkkkkkk

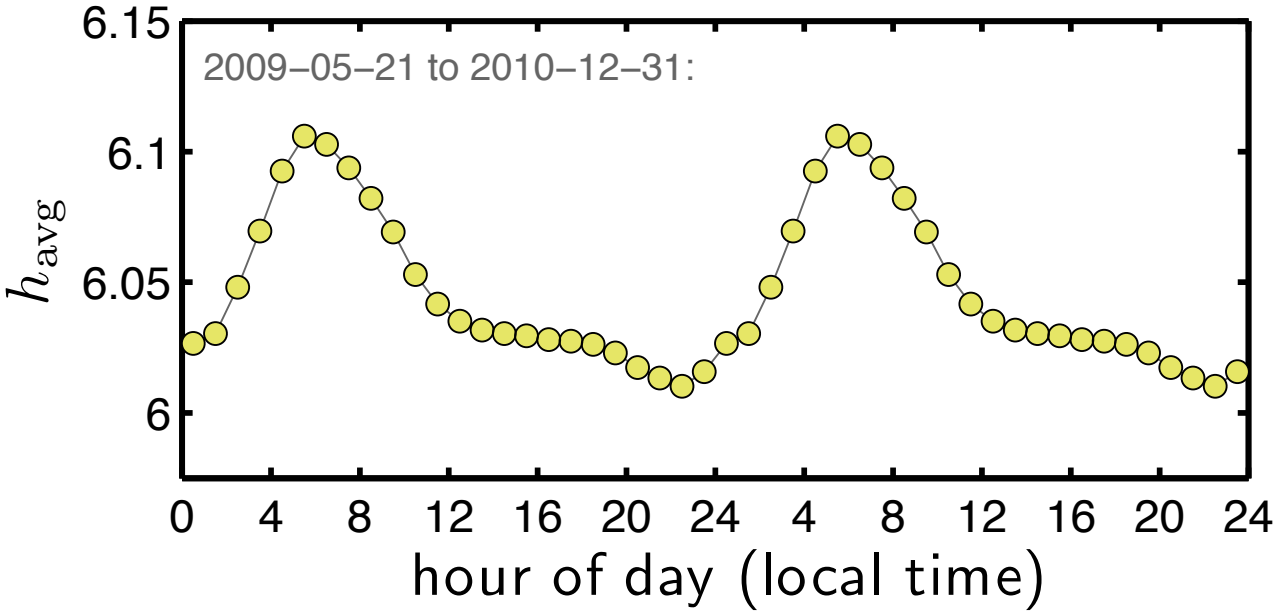
2013/02/18 at 8:53 pm (Edit)

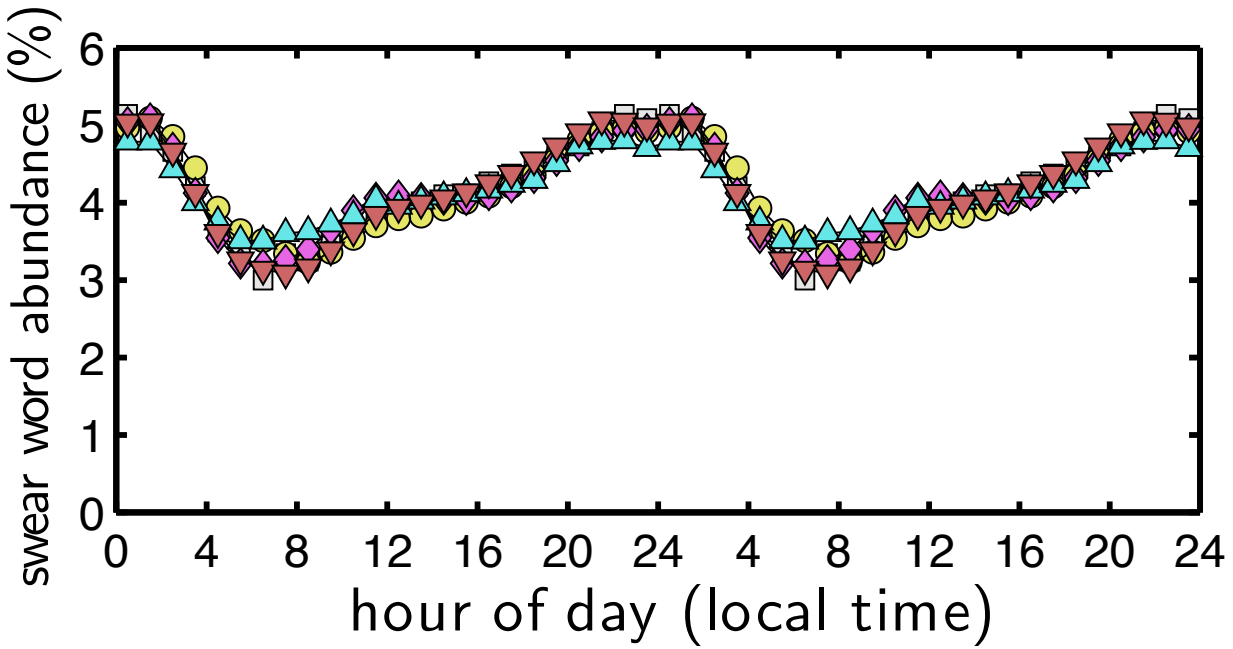
I've lived in quite a few places. The most recently Beaumont, TX. Its a pure hellhole. Hot, humid, trashy, terrible schools, corrupt government, lots of crime, no public parks or activities, terrible culture (other than crawfish boils), completely lacks diversity. This study confirms my suspicions that cities don't get any more miserable than this.

Reply

ONE WAY
Beaumont
is
not
sad

The Daily Unravelling of the Human Mind





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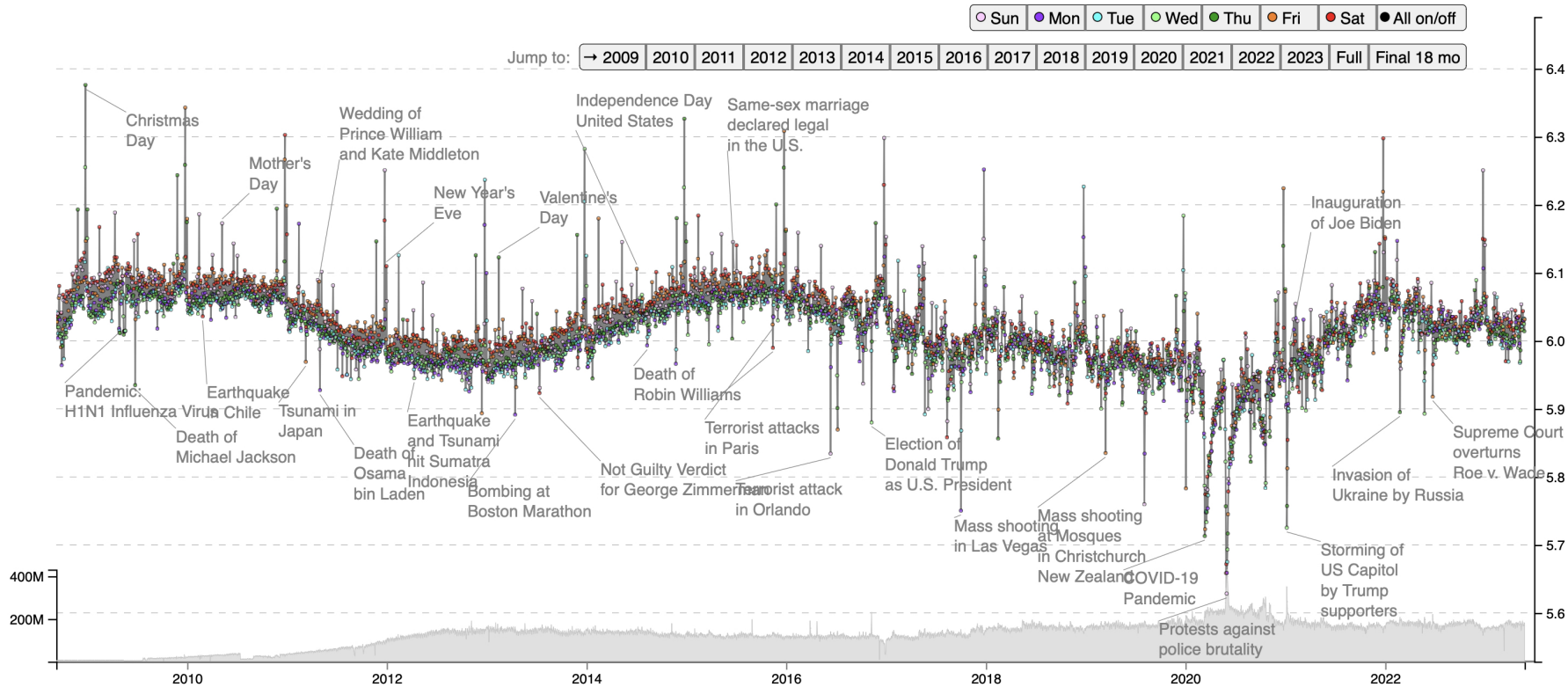
Average Happiness for Twitter

All Tweets in English.



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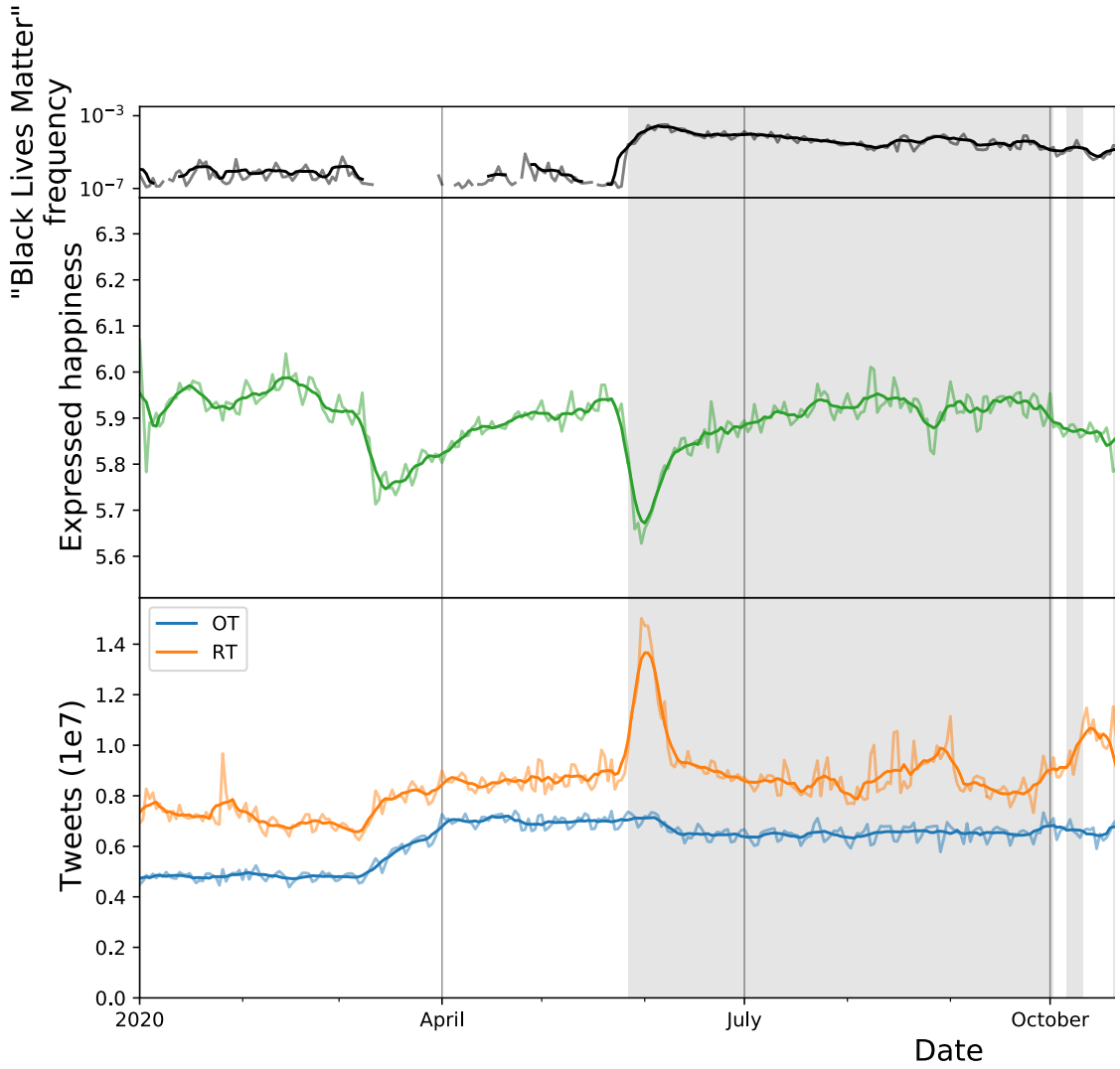
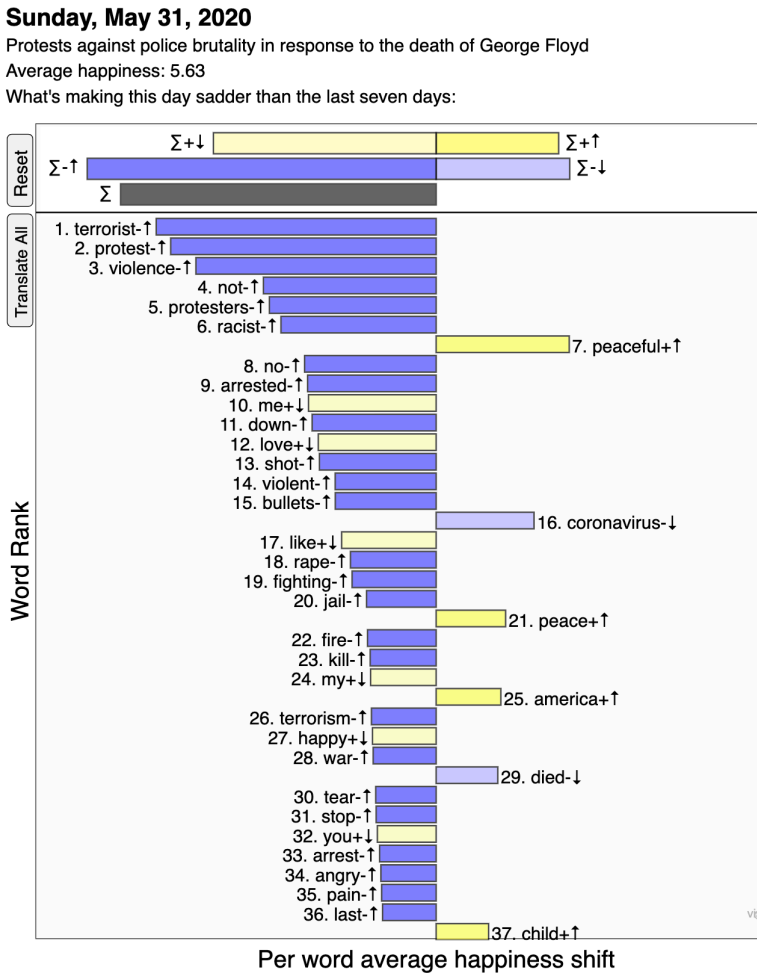
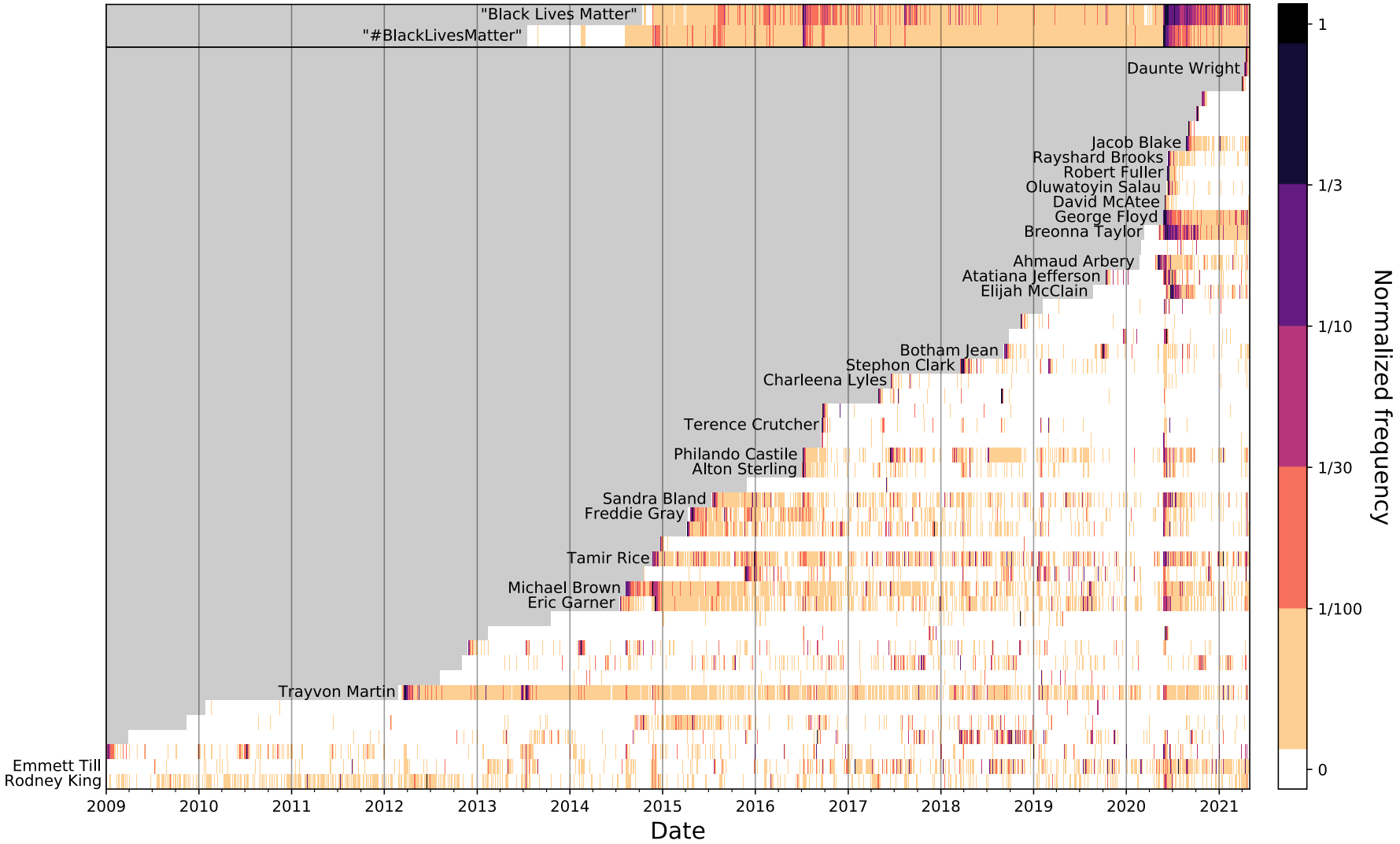
Black Lives Matter





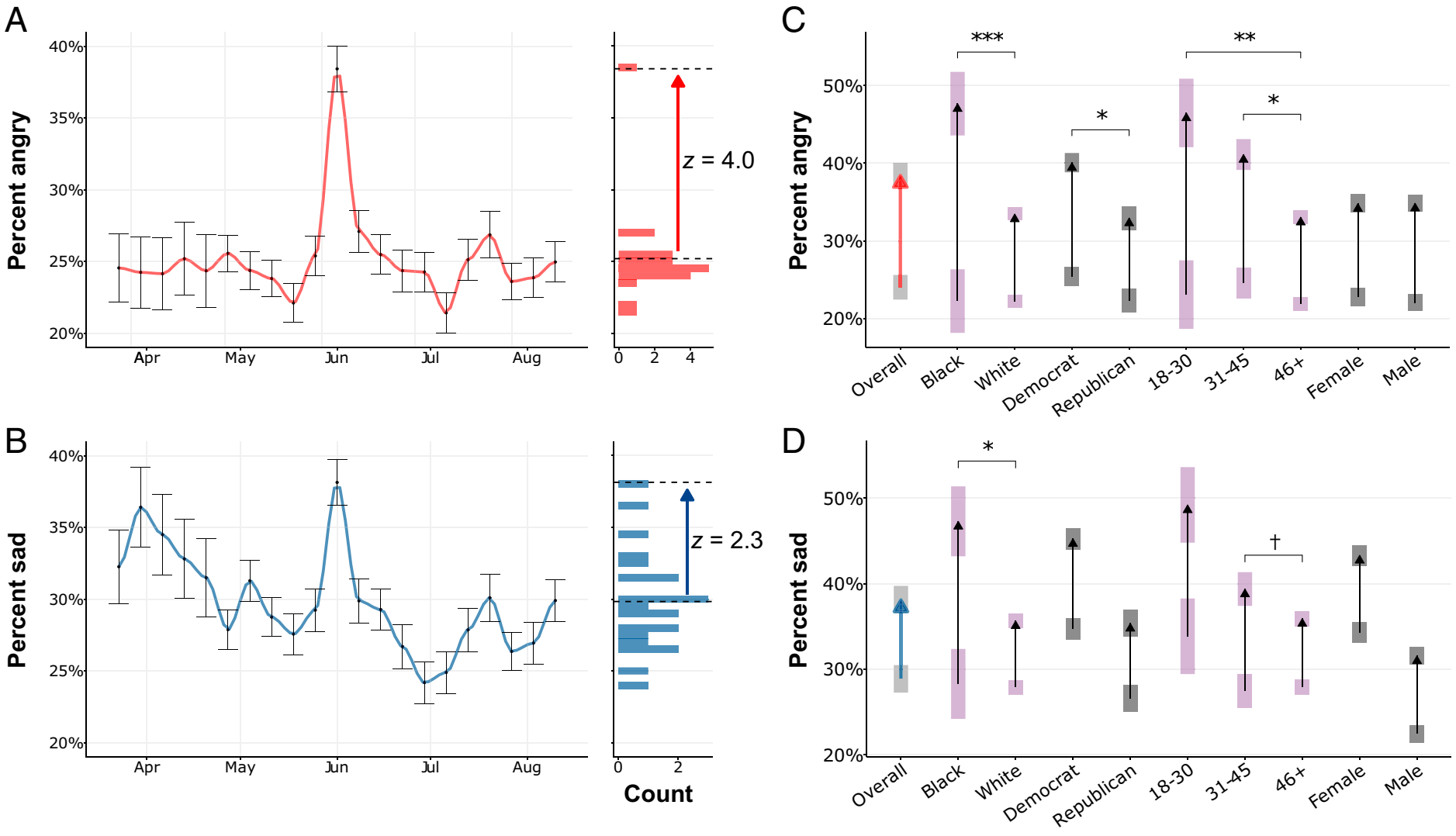
"Say Their Names: Collective Attention Toward Black Victims of Police Violence Following the Death of George Floyd". Wu et. al., PLOS ONE. 2023.

Black Lives Matter

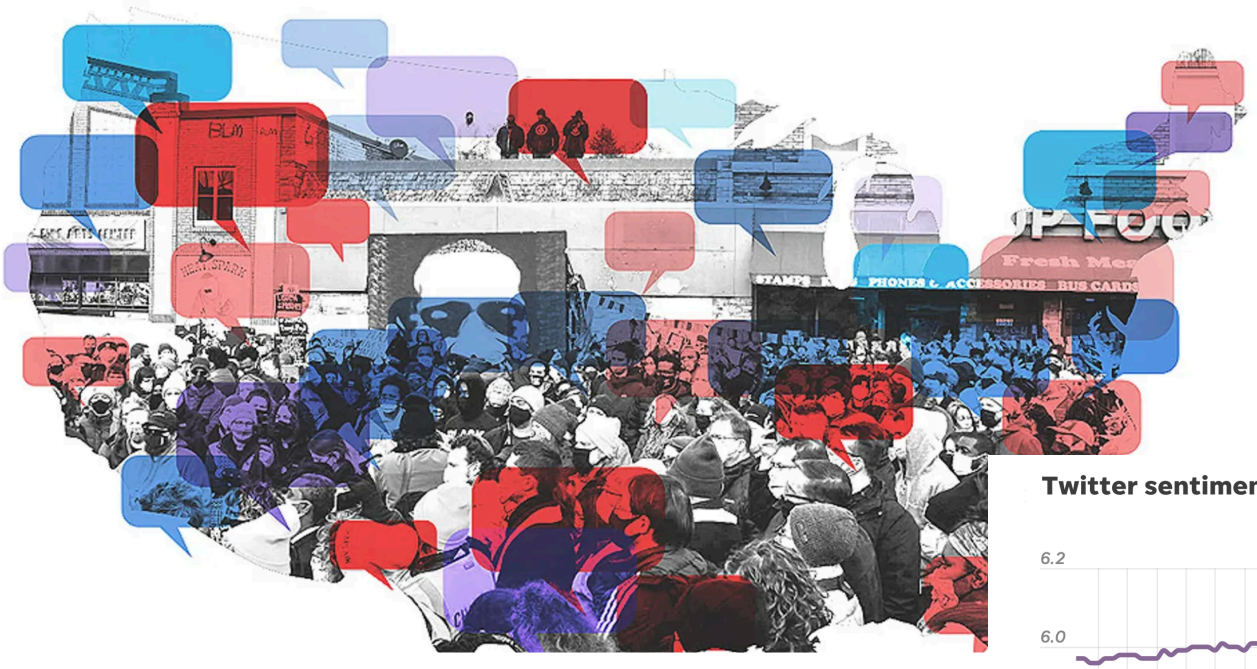


"Say Their Names: Collective Attention Toward Black Victims of Police Violence Following the Death of George Floyd". Wu et. al., PLOS ONE. 2023.

Reaction to George Floyd's murder: Surveys



"The emotional and mental health impact of the murder of George Floyd on the US population."
Eichstaedt et al. PNAS. 2021



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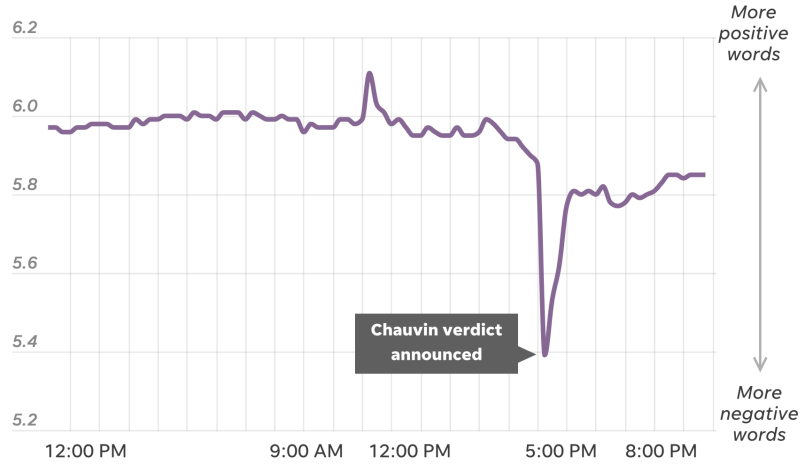
The words Americans used after Chauvin verdict reveal our political divide

USA TODAY analyzed the volume and tone of talk by Congress, social media, news outlets and readers as the man who killed George Floyd was convicted.

Aleszu Bajak, Javier Zarracina and Dan Keemahill, USA TODAY

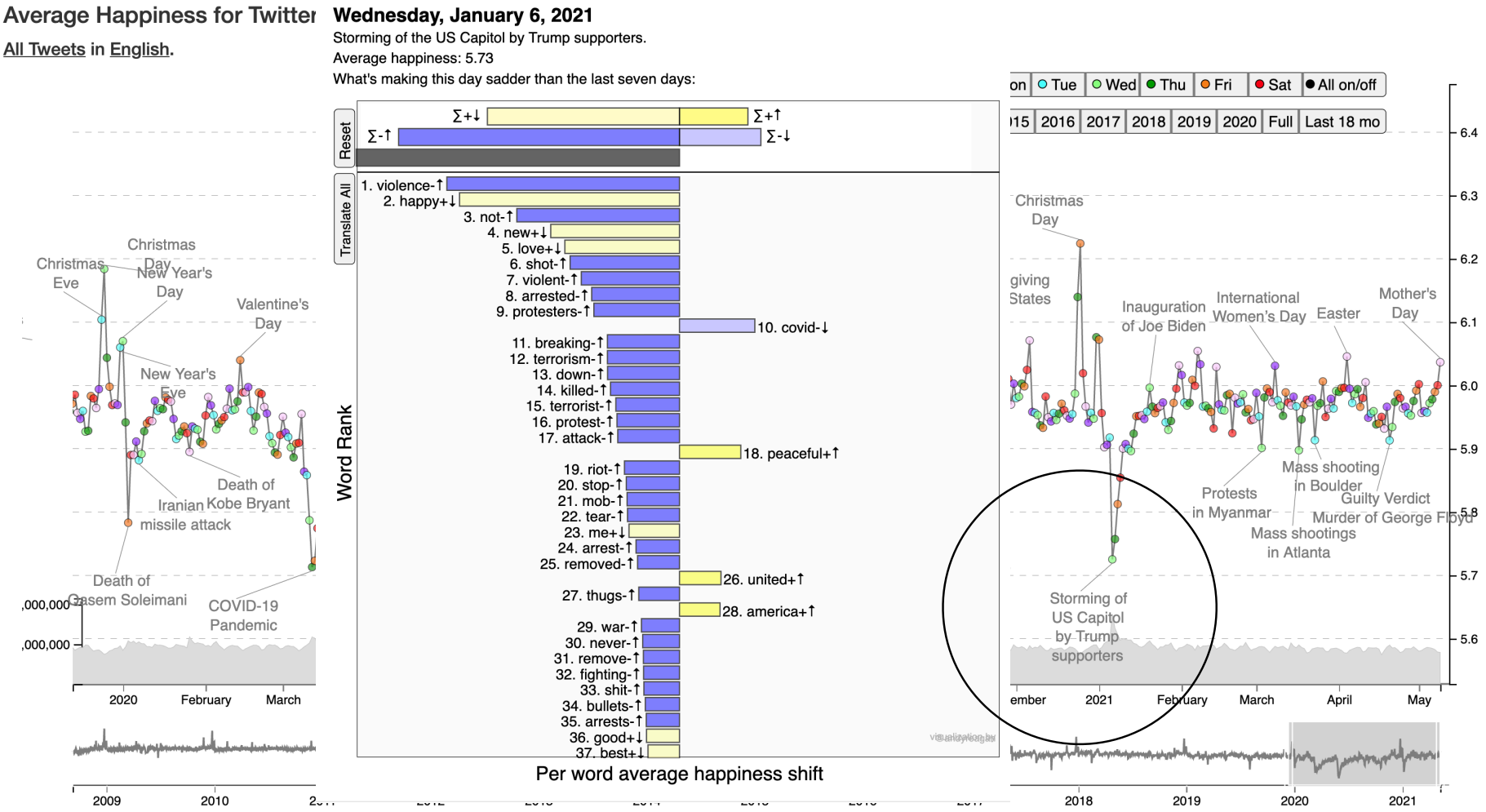
Published 6:01 AM EDT Apr. 27, 2021 I **Updated 8:49 AM EDT Apr. 28, 2021**

Twitter sentiment on April 20, 2021



SOURCE University of Vermont's Computational Story Lab.

Capitol Insurrection



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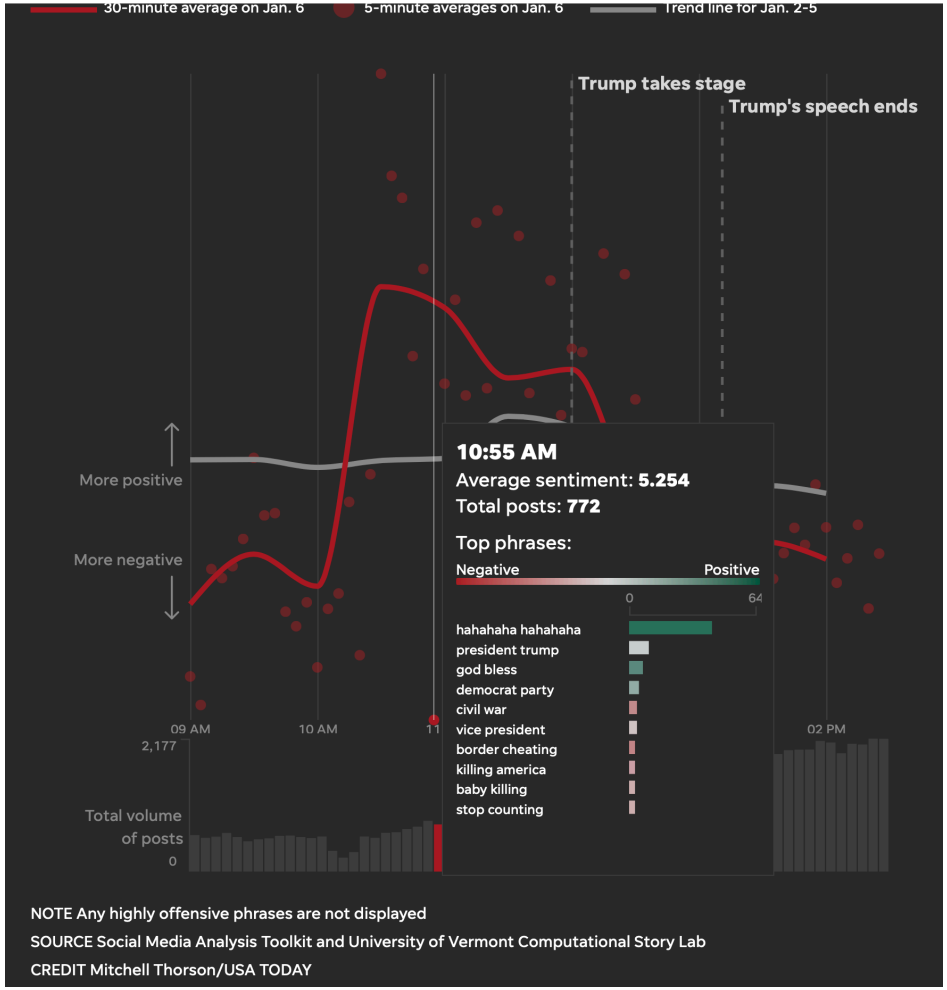
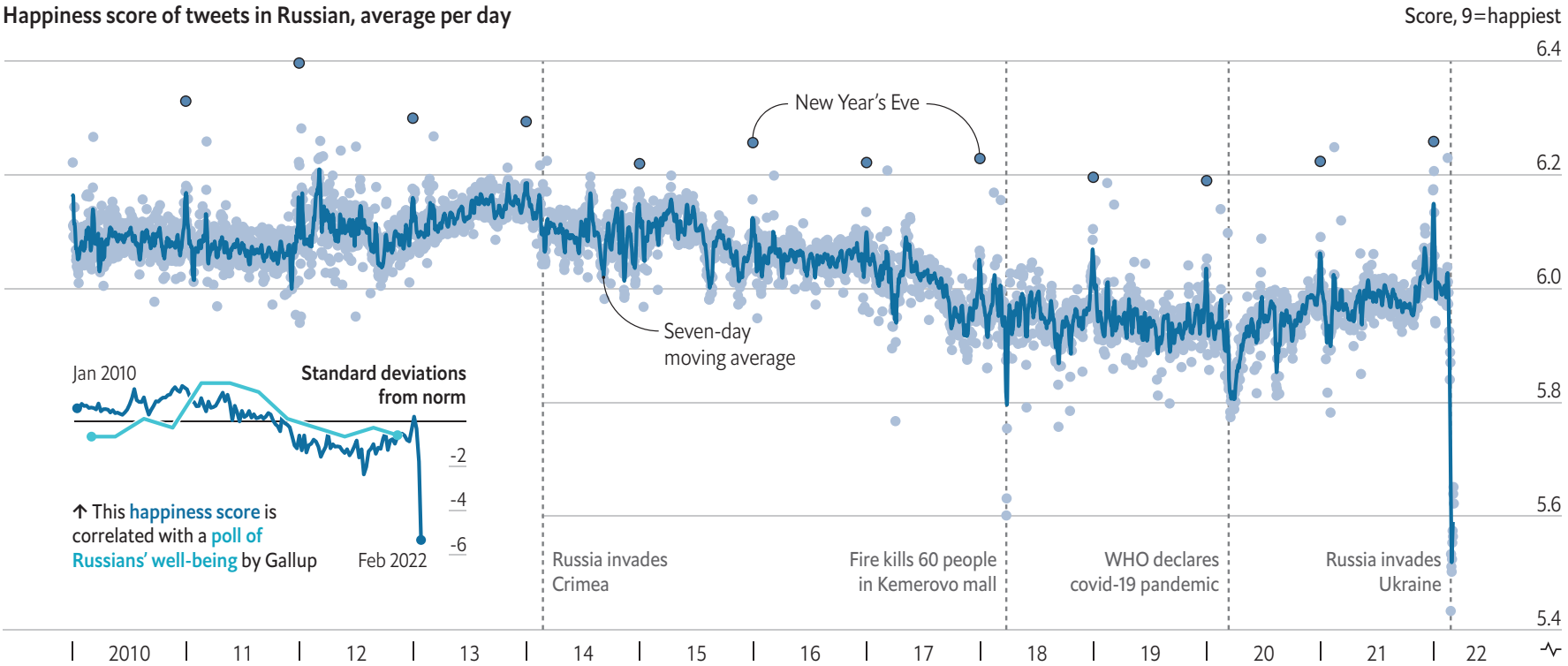


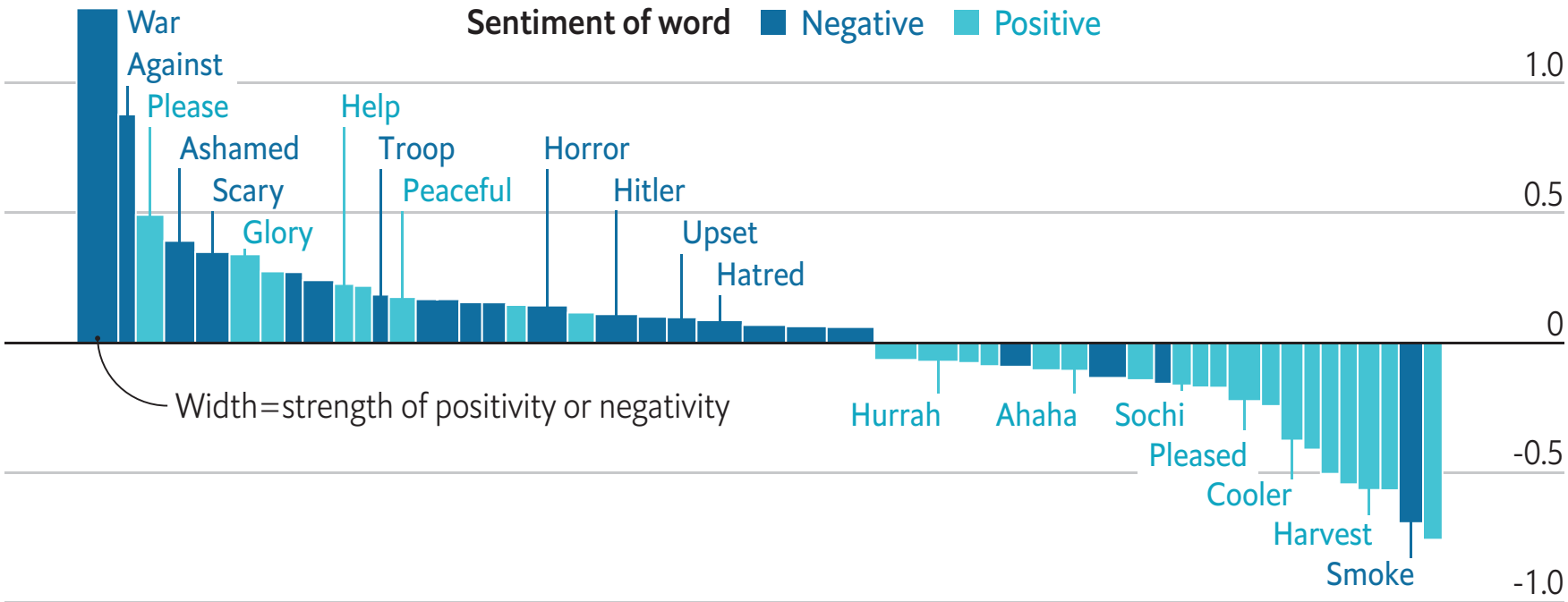
Graphic detail Russian public opinion

→ Sentiment on Russian-language social media soured when Russia invaded Ukraine



Difference in frequency of words in Russian-language posts on Twitter, %

Between day Russian troops entered Crimea in 2014 and start of current war in Ukraine, top 50 words*



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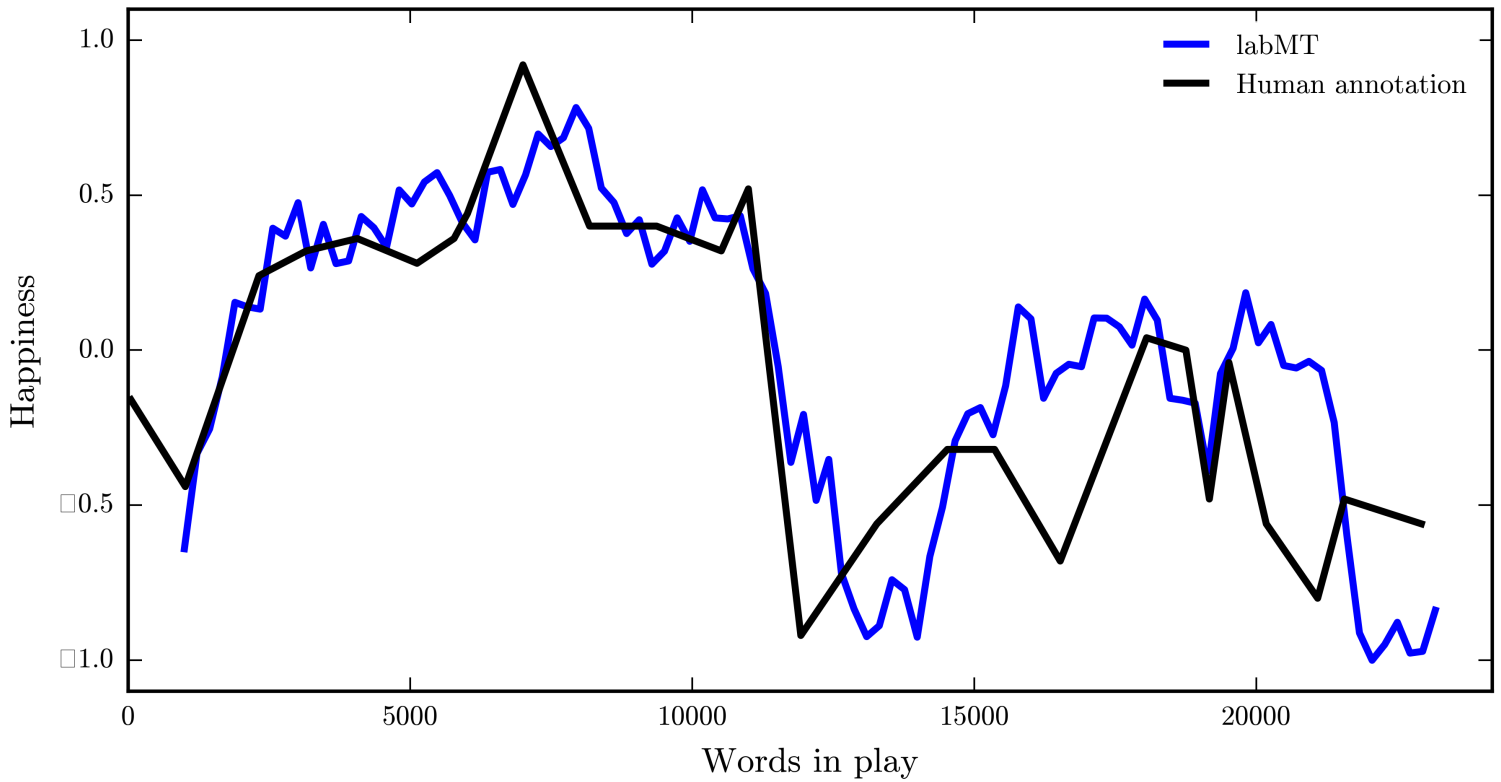
Romeo & Juliet



Jockers, Reagan

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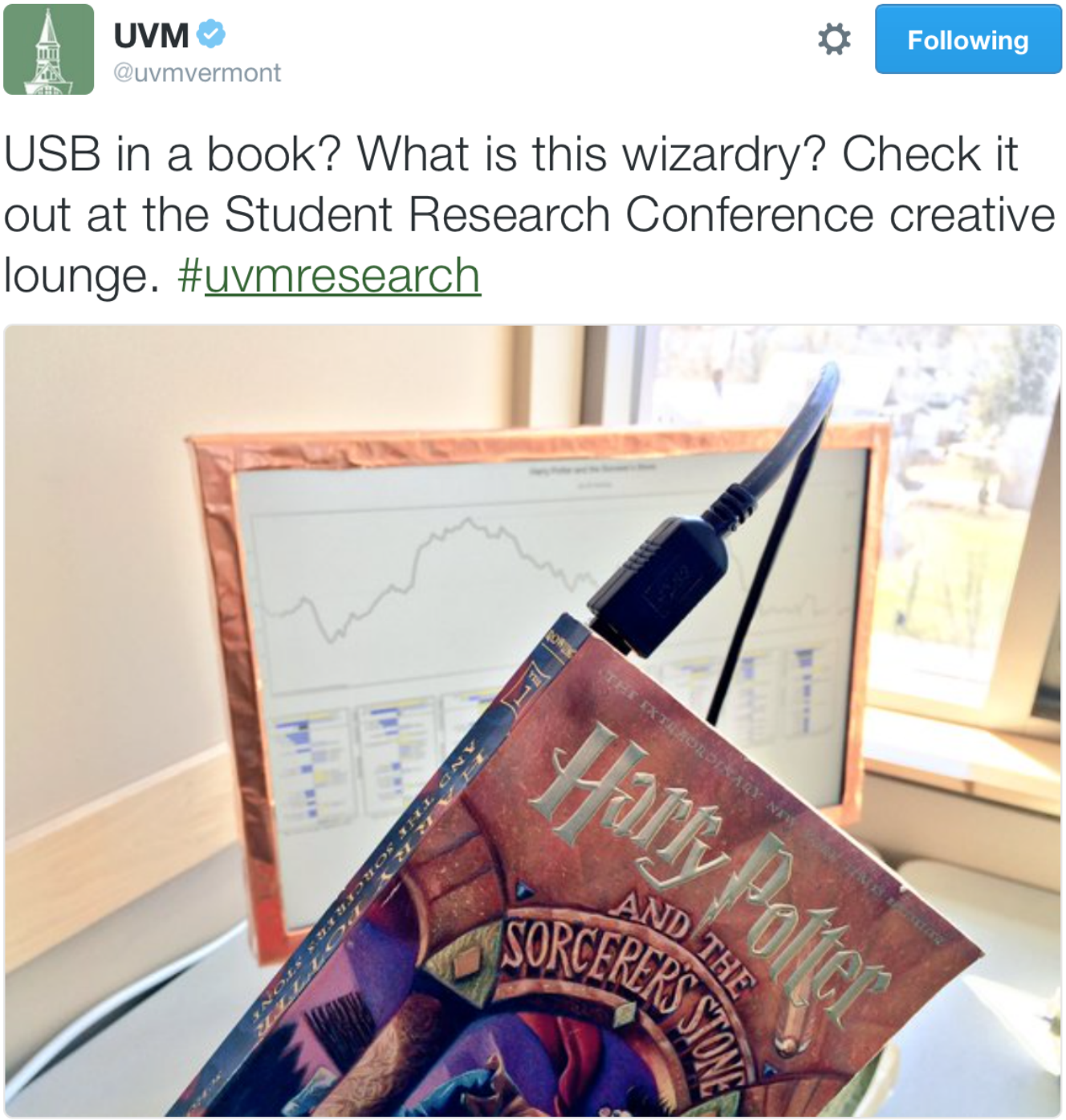

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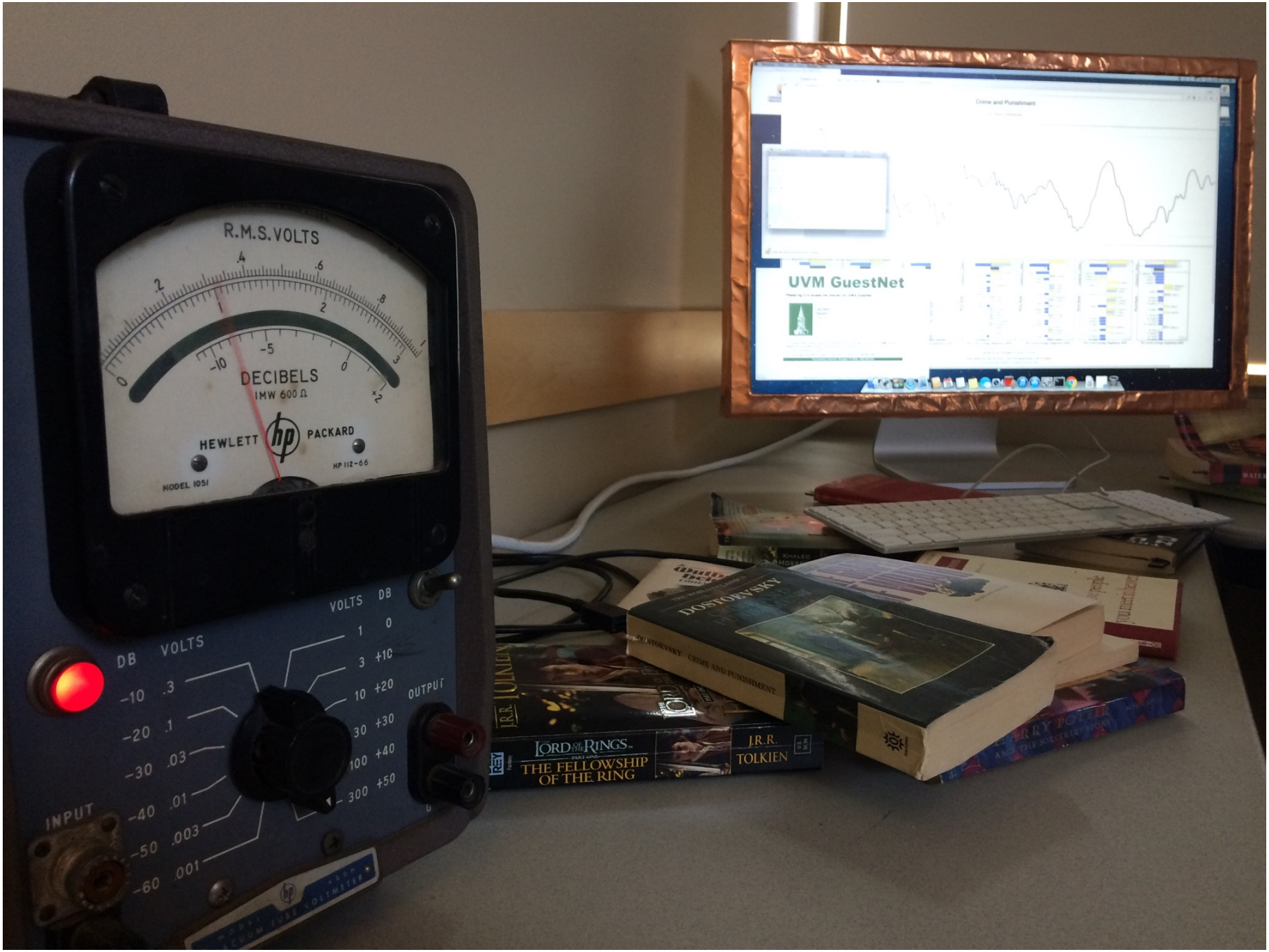
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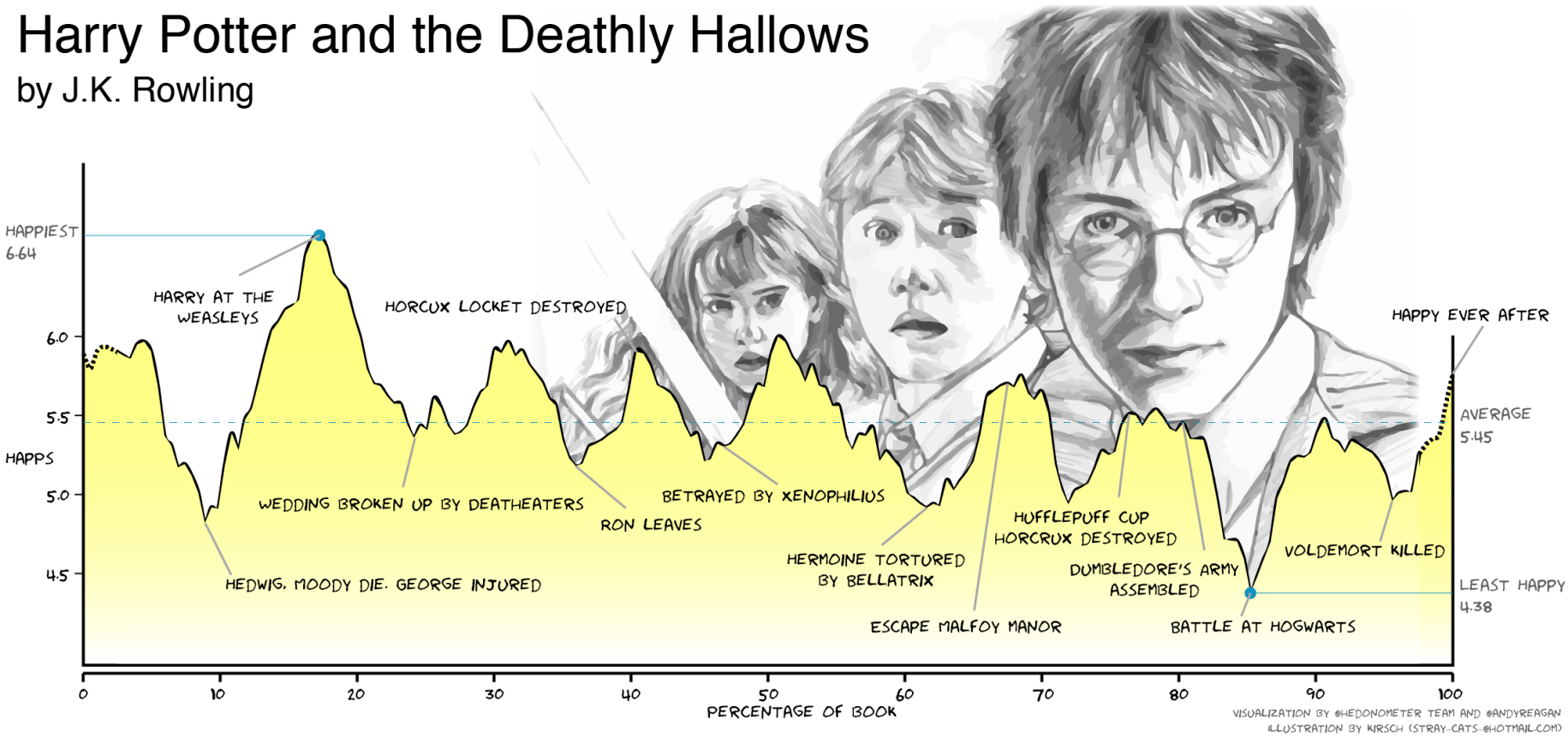
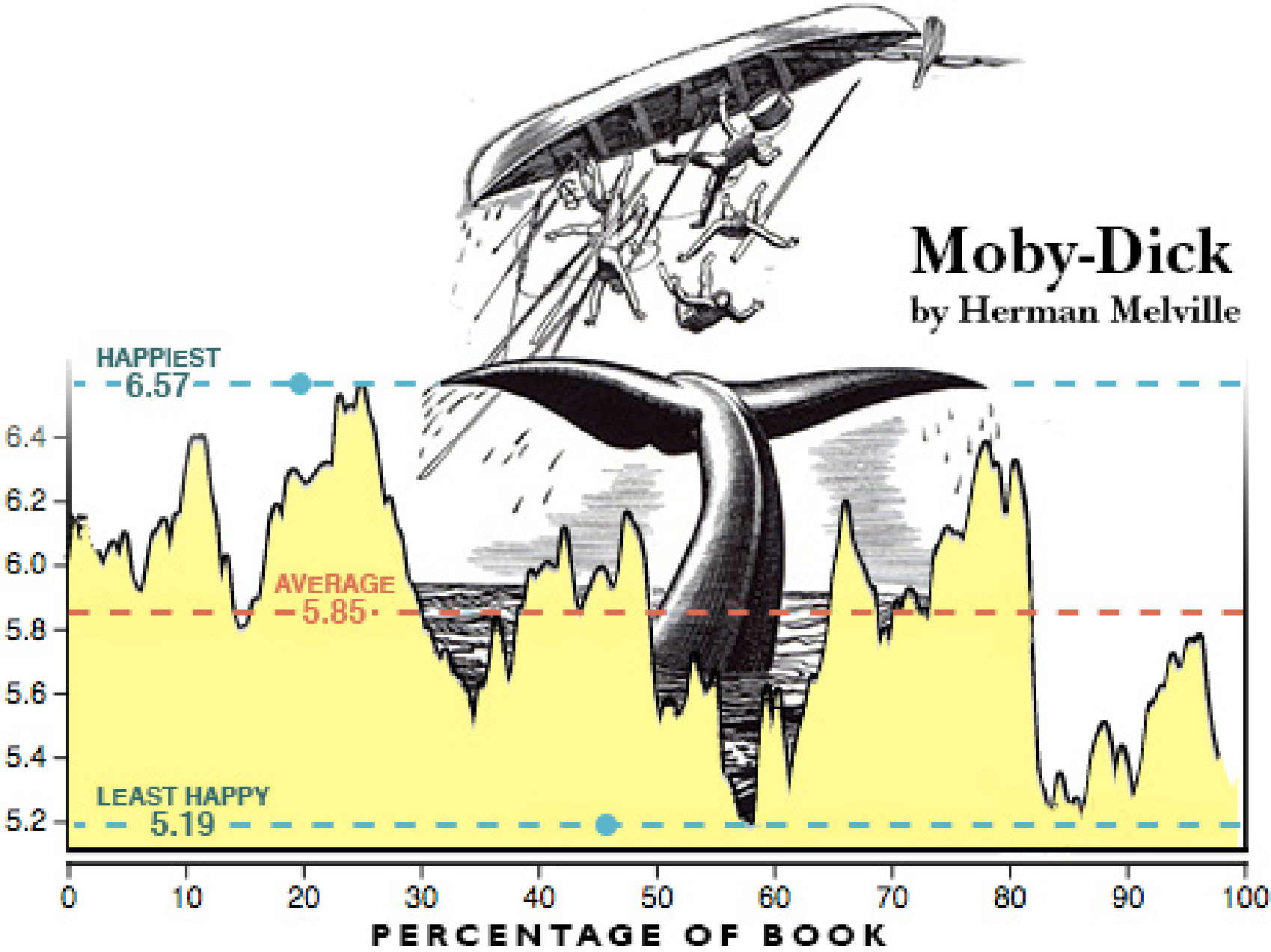
DECIBELS
1MW 600 Ω
HEWLETT PACKARD
MODEL 1051
HP 112-66
VOLTS DB
DB VOLTS
INPUT
OUTPUT
UVM GuestNet
DOSTOEVSKY
CRIME AND PUNISHMENT
LORD OF THE RINGS
THE FELLOWSHIP OF THE RING
J.R.R. TOLKIEN

Harry Potter and the Deathly Hallows

by J.K. Rowling

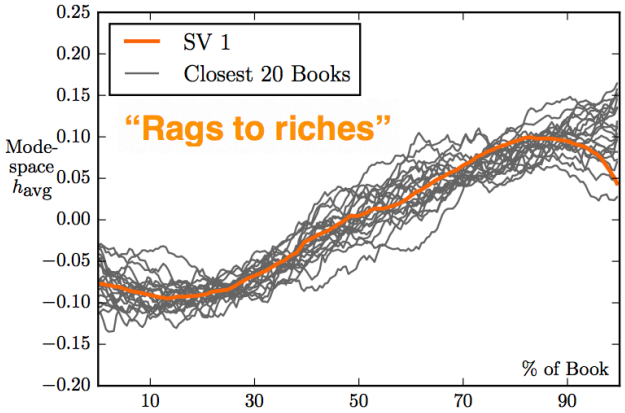


Reagan et al "The emotional arcs of stories are dominated by six basic shapes" EPJ Data Science 2016



Moby-Dick illustration by Rockwell Kent, 1930

http://whyfiles.org/2015/in-10-languages-happy-words-beat-sad-ones/



Top Stories:

1: Alice's Adventures Under Ground : Bein... (19002, 333)
http://hedonometer.org/books/v3/19002/
2: Dreams (1439, 169)
http://hedonometer.org/books/v3/1439/
3: The Human Comedy: Introductions and A... (1968, 175)
http://hedonometer.org/books/v3/1968/
4: The Ballad of Reading Gaol (301, 227)
http://hedonometer.org/books/v3/301/
5: The History Of The Decline And Fall O... (25717, 1697)
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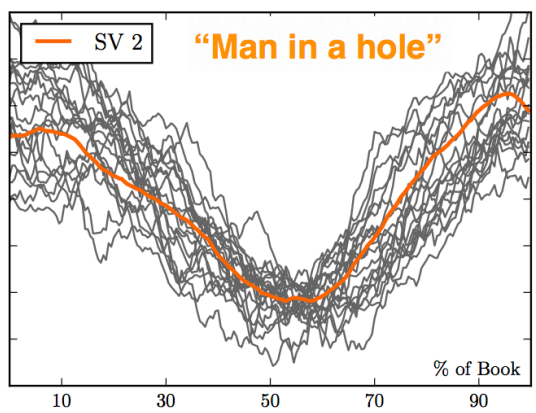

Top Stories:

1: Typhoon (1142, 219)
http://hedonometer.org/books/v3/1142/
2: Teddy Bears (51199, 944)
http://hedonometer.org/books/v3/51199/
3: The Autobiography of St. Ignatius (24534, 201)
http://hedonometer.org/books/v3/24534/
4: The Magic of Oz (419, 186)
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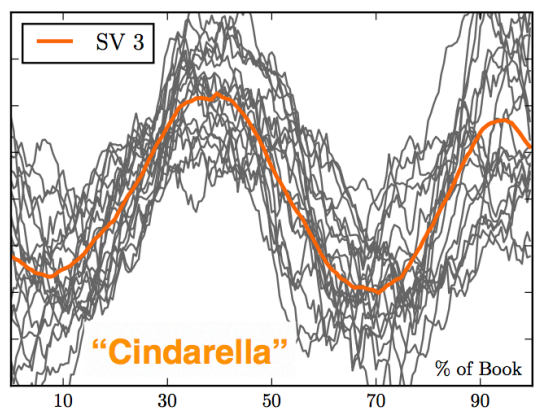
5: Fundamental Principles of the Metaphy... (5682, 1148)
http://hedonometer.org/books/v3/5682/



Top Stories:

1: The Consolation of Philosophy (14328, 1188)
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2: The Scarecrow of Oz (957, 162)
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3: A Christmas Carol (24022, 188)
http://hedonometer.org/books/v3/24022/
4: Sophist (1735, 162)
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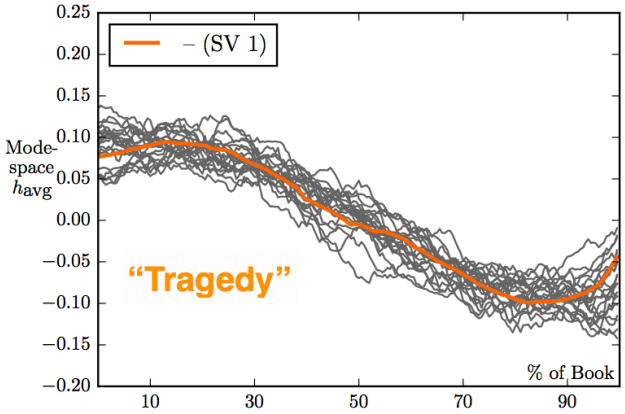
5: A Christmas Carol in Prose; Being a G... (46, 4602)
http://hedonometer.org/books/v3/46/



Top Stories:

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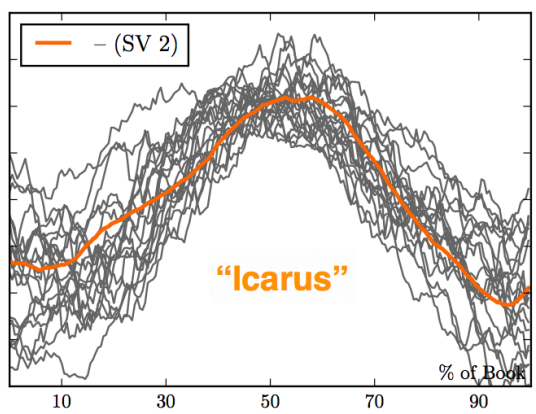
2: The House of the Vampire (17144, 188)
http://hedonometer.org/books/v3/17144/
3: Savrola: A Tale of the Revolution in L... (50906, 682)
http://hedonometer.org/books/v3/50906/
4: Romeo and Juliet (1777, 186)
http://hedonometer.org/books/v3/1777/
5: The Dance (by An Antiquary): Historic ... (17289, 222)
http://hedonometer.org/books/v3/17289/



Top Stories:

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2: Stories from Hans Andersen (17860, 262)
http://hedonometer.org/books/v3/17860/
3: How to Read Human Nature: Its Inner S... (41501, 278)
http://hedonometer.org/books/v3/41501/
4: The Rome Express (11451, 162)
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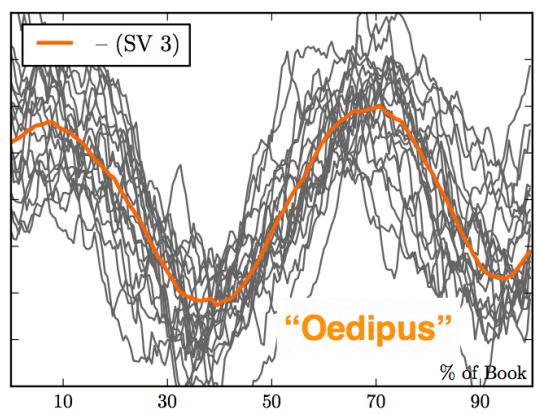
5: Chambers's Journal of Popular Literat... (51100, 312)
http://hedonometer.org/books/v3/51100/



Top Stories:

1: The Wonder Book of Bible Stories (16042, 183)
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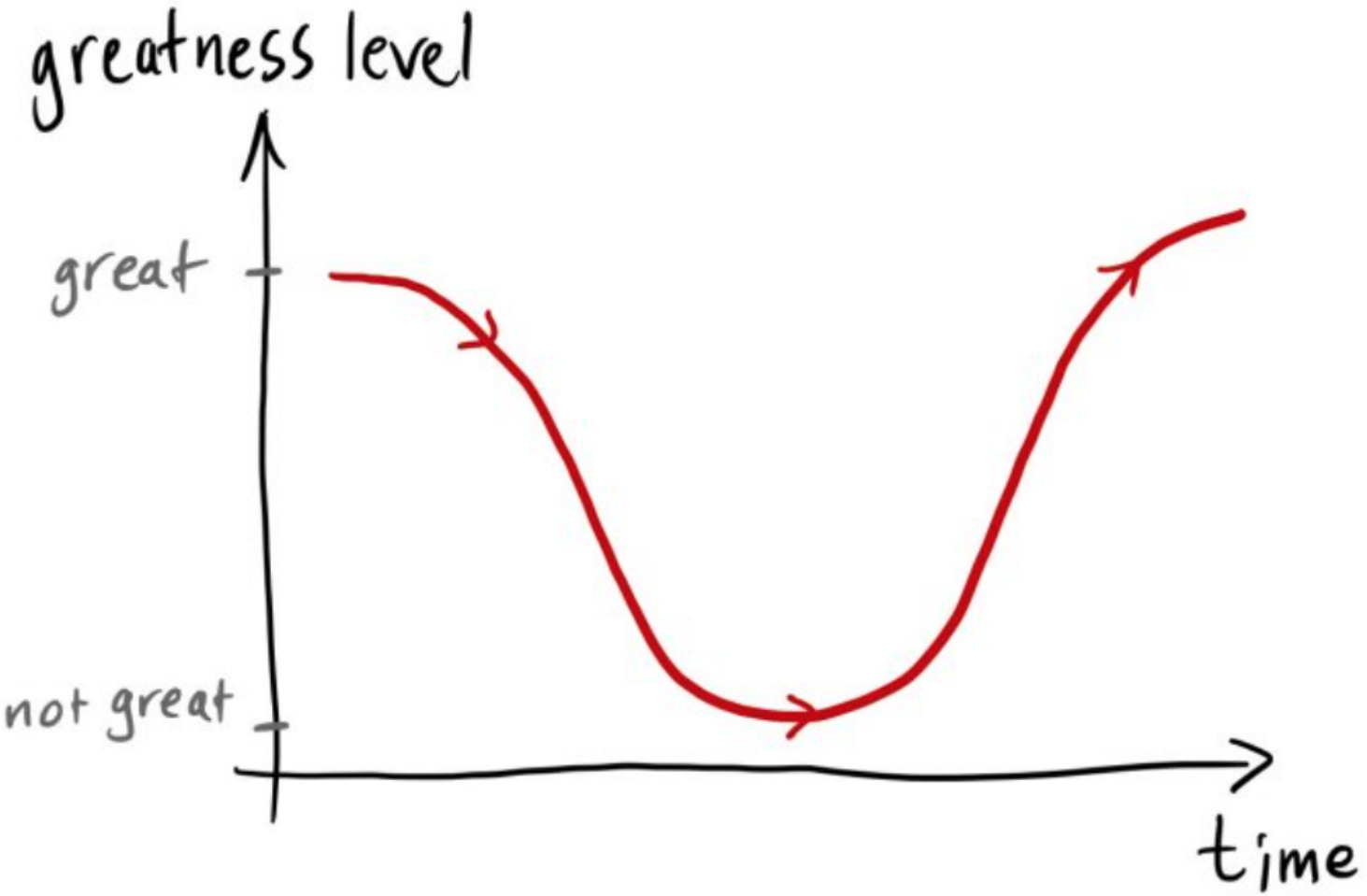
2: The Serpent River (50923, 306)
http://hedonometer.org/books/v3/50923/
3: A Hero of Our Time (913, 337)
http://hedonometer.org/books/v3/913/
4: On the Nature of Things (785, 857)
http://hedonometer.org/books/v3/785/
5: The Cosmic Computer (20727, 221)
http://hedonometer.org/books/v3/20727/

Reagan et al "The emotional arcs of stories are dominated by six basic shapes" EPJ Data Science 2016



Peter Dodds, 2017.

Happiness & Society
StoryWrangler
Hedonometer
Social Movements
Science of Stories
Mental Health & Nature
Sleep & Well-being
Thanks

Happiness & Society
StoryWrangler
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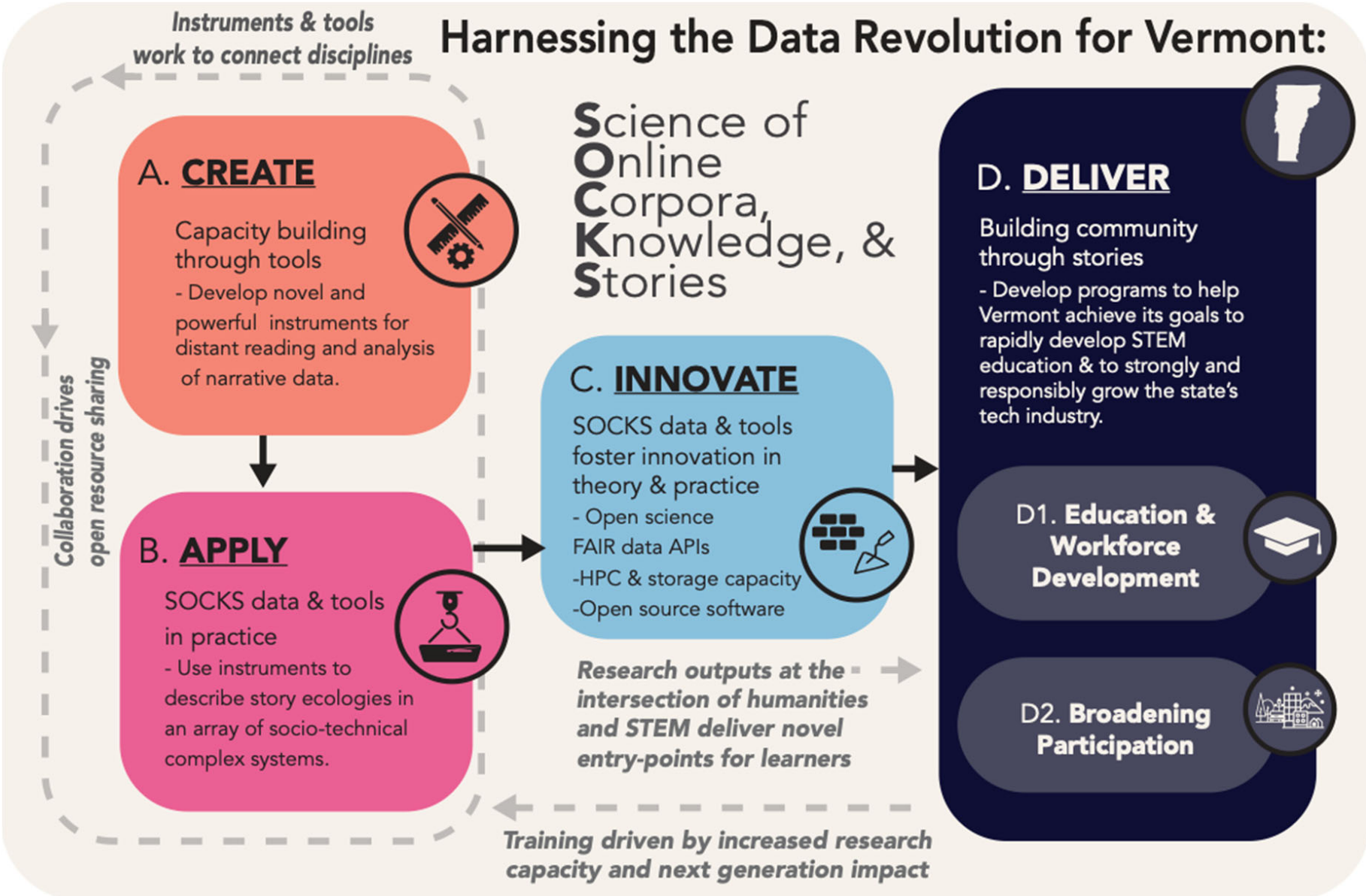
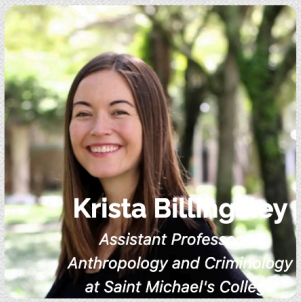
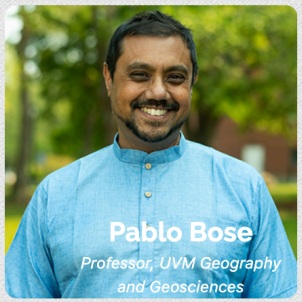
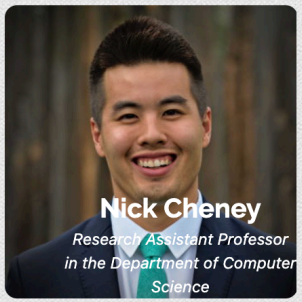
National Science Foundation

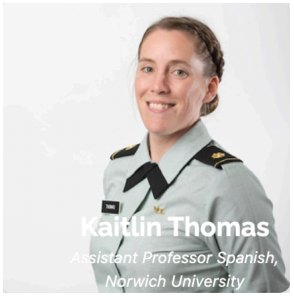


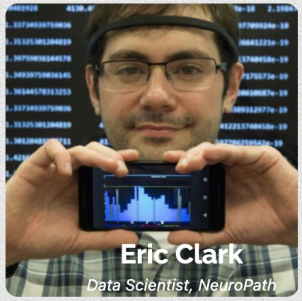
SOCKS: Social Science Applications

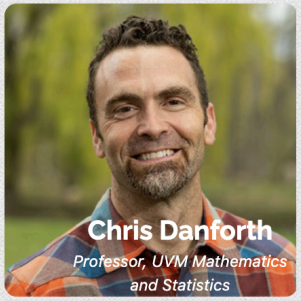


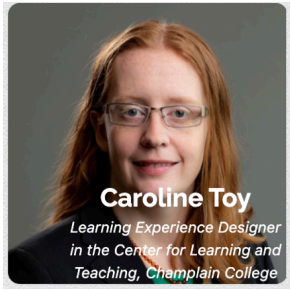


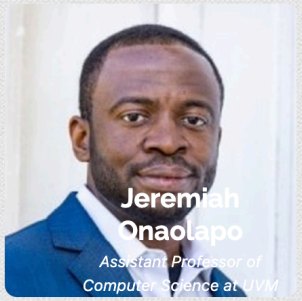


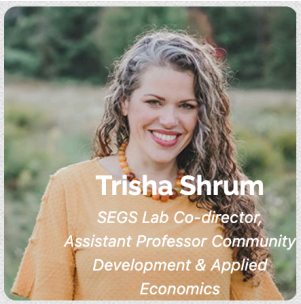




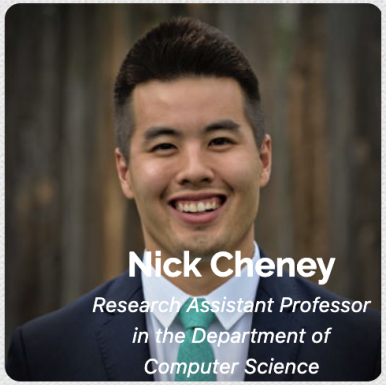


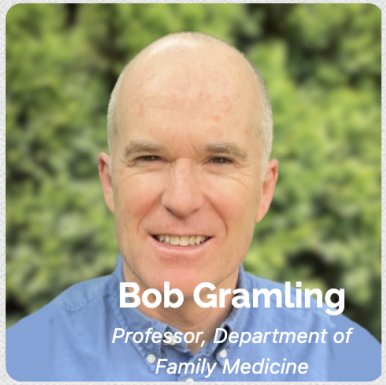


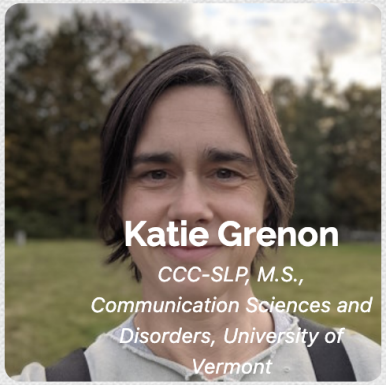


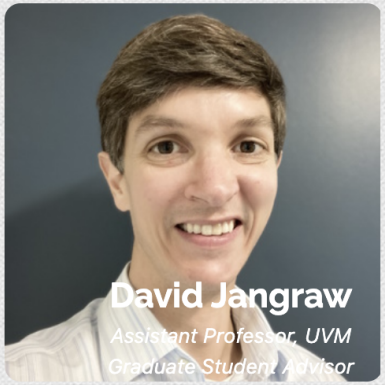


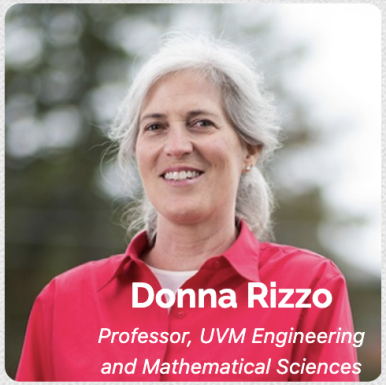
SOCKS: Health Applications



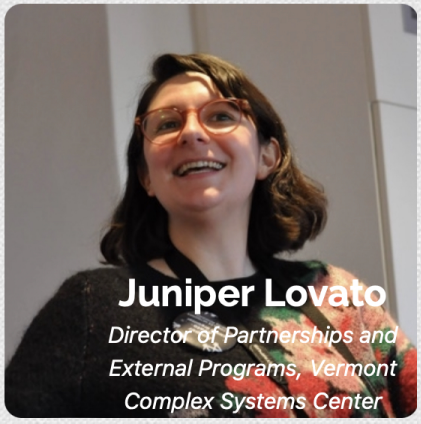


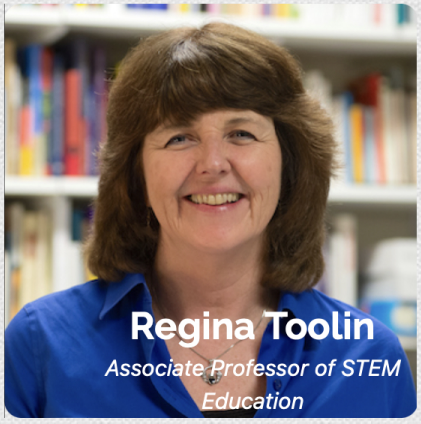


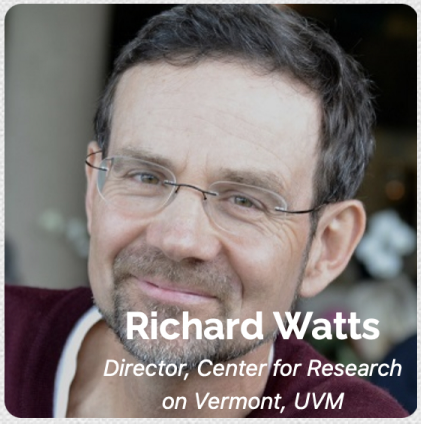




SOCKS: Education, Workforce Development







Outline

Happiness & Society
- StoryWrangler
- Hedonometer
- Social Movements
- Science of Stories
- Mental Health & Nature
- Sleep & Well-being
- Thanks

Happiness & Society
StoryWrangler
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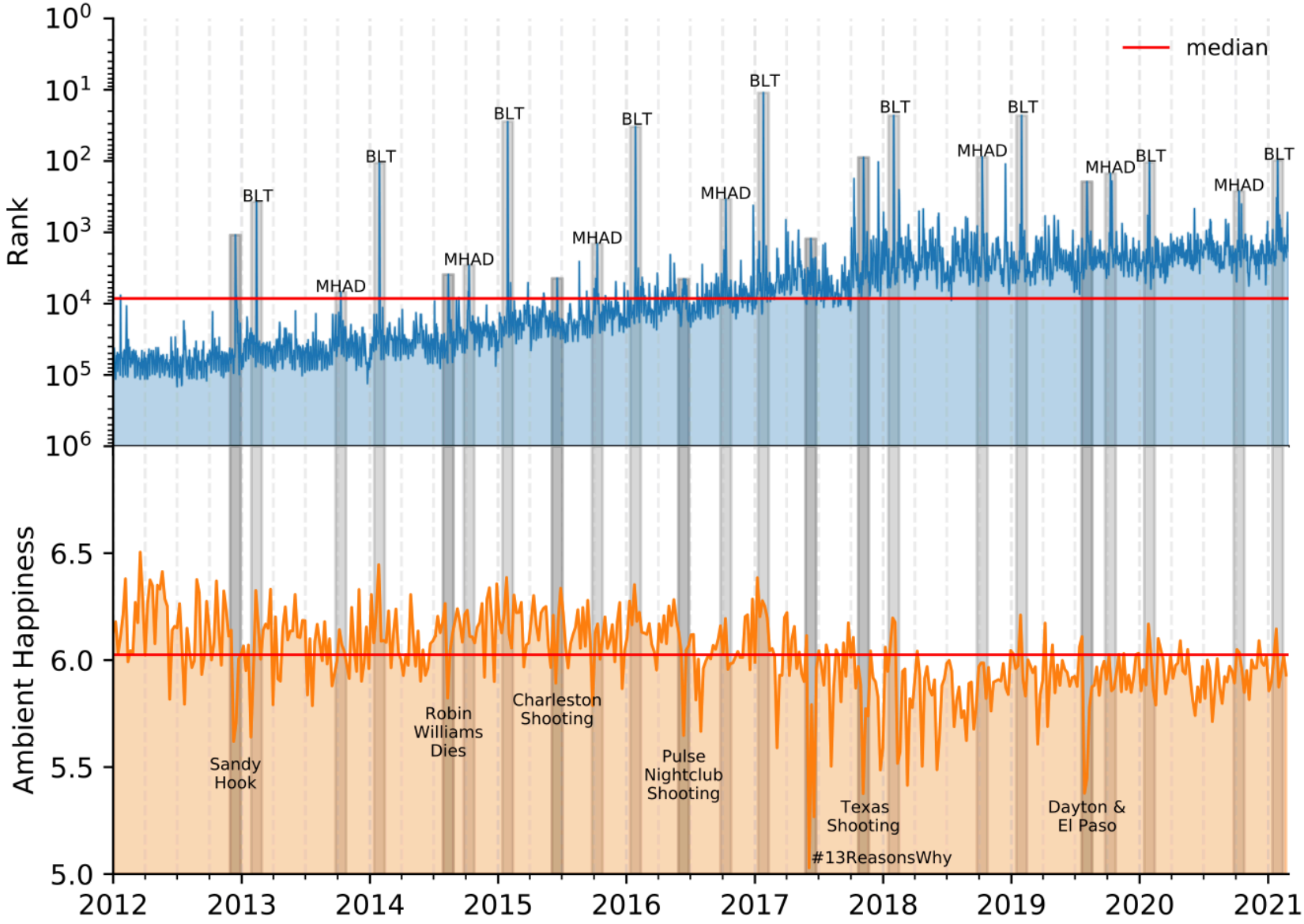
Sleep & Well-being
Thanks

Mental Health



Stupinski et al., "Quantifying Changes in the Language Used Around Mental Health on Twitter over 10 Years: Observational Study" Journal of Medical Internet Research. 2022.

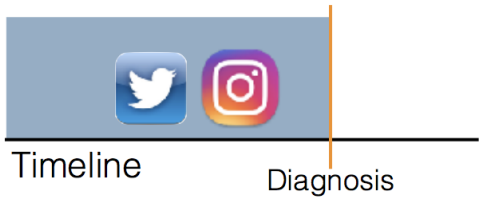
Research Questions

1. Any difference?

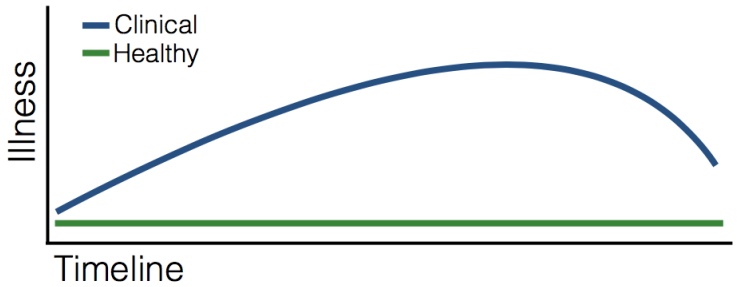
Clinical Population

Healthy Population

2. Pre-diagnosis difference?



3. Illness timeline?



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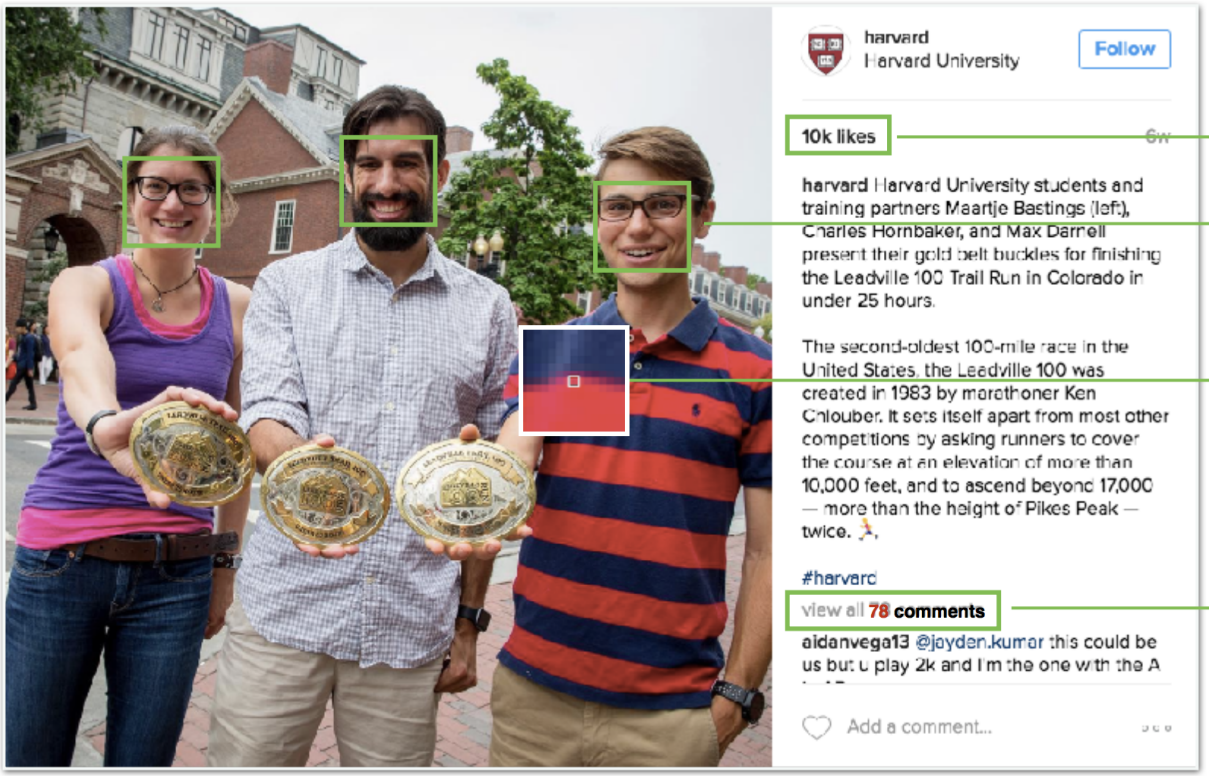
Thanks

Feature extraction/engineering



Barrick et al (2002); Bruce & Hoff (1994); Carruthers et al (2010); DSM-IV (2000)

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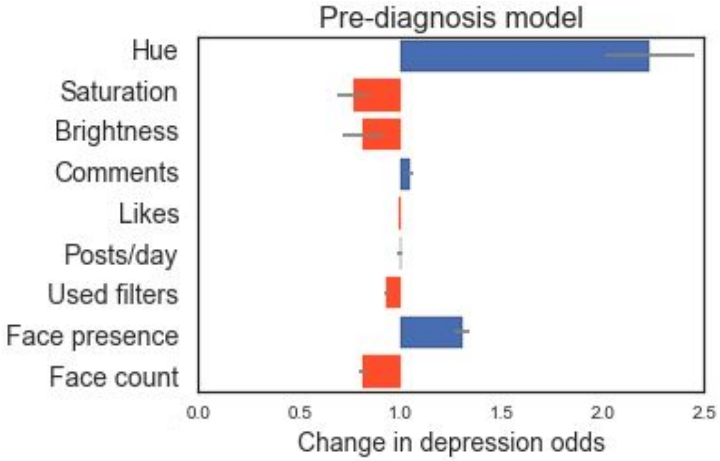
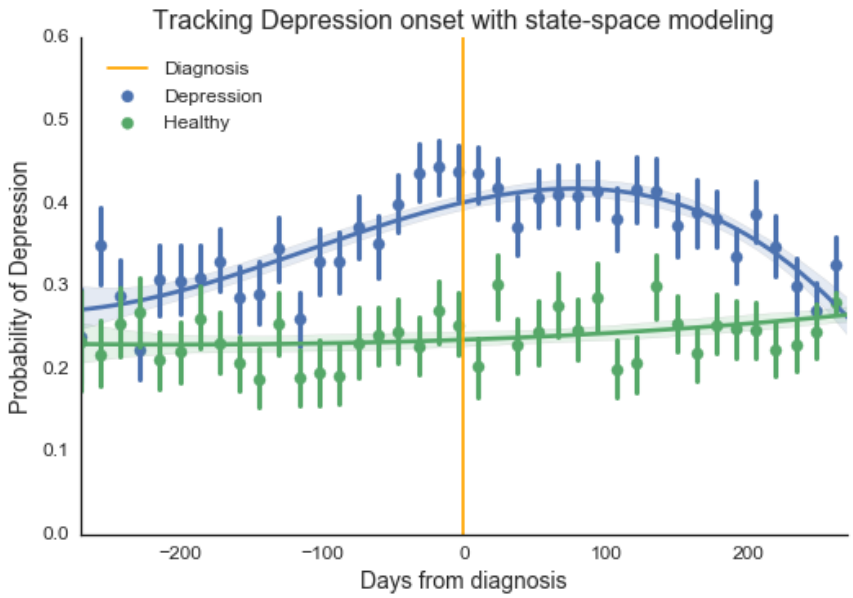
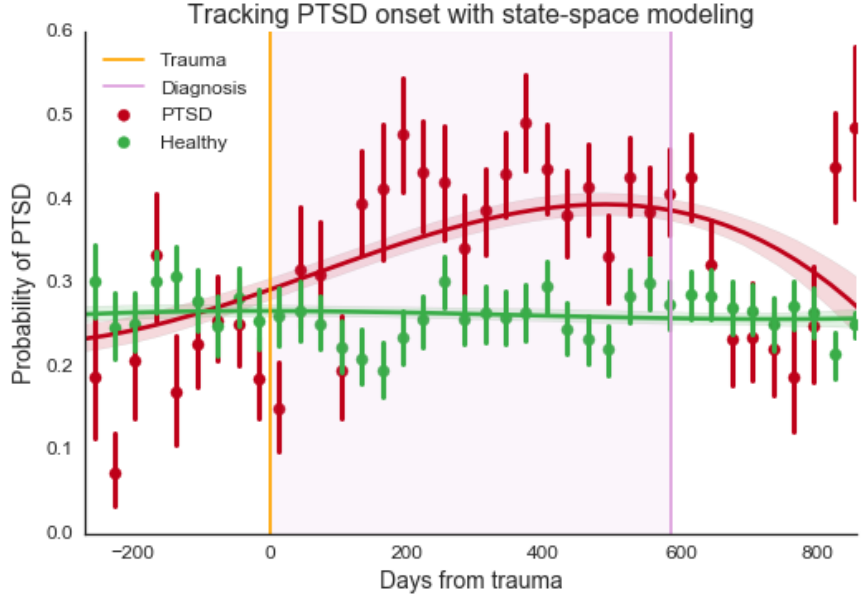


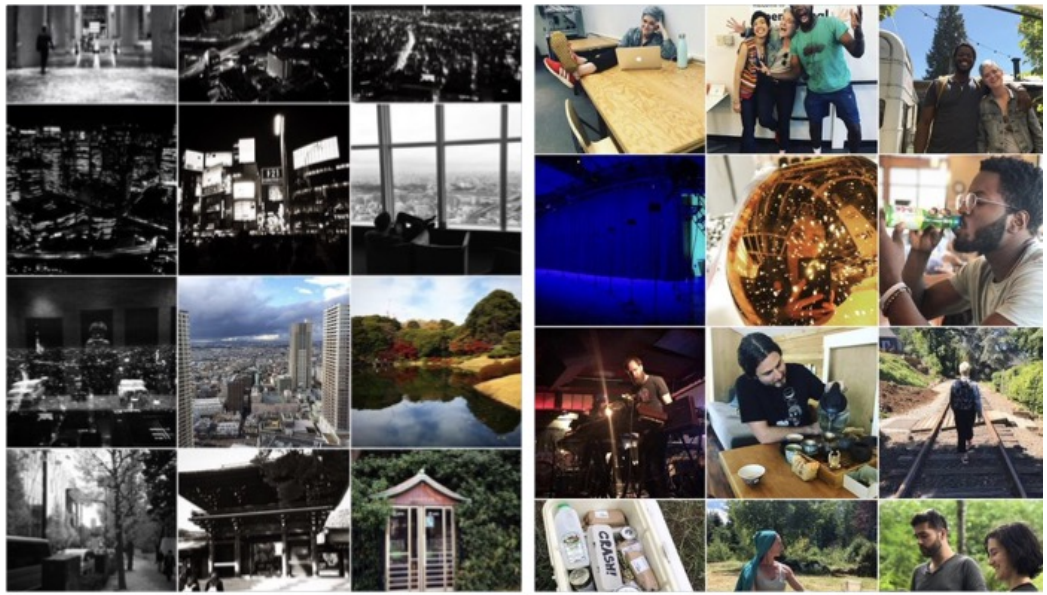




Reece & Danforth, "Instagram photos reveal predictive markers of depression." EPJ Data Science 2017
Reece et al. "Forecasting the onset & course of mental illness with Twitter data." Scientific Reports 2017

Amber Case
@caseorganic

Instagram photos reveal predictive markers of depression: epjdatascience.springeropen.com/articles/10.11... My feed at height of my depression vs. now. #depression



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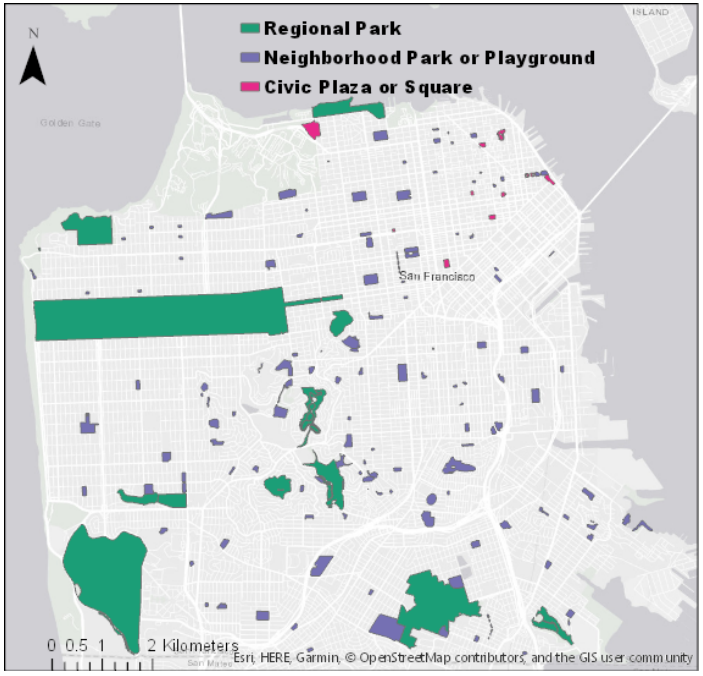
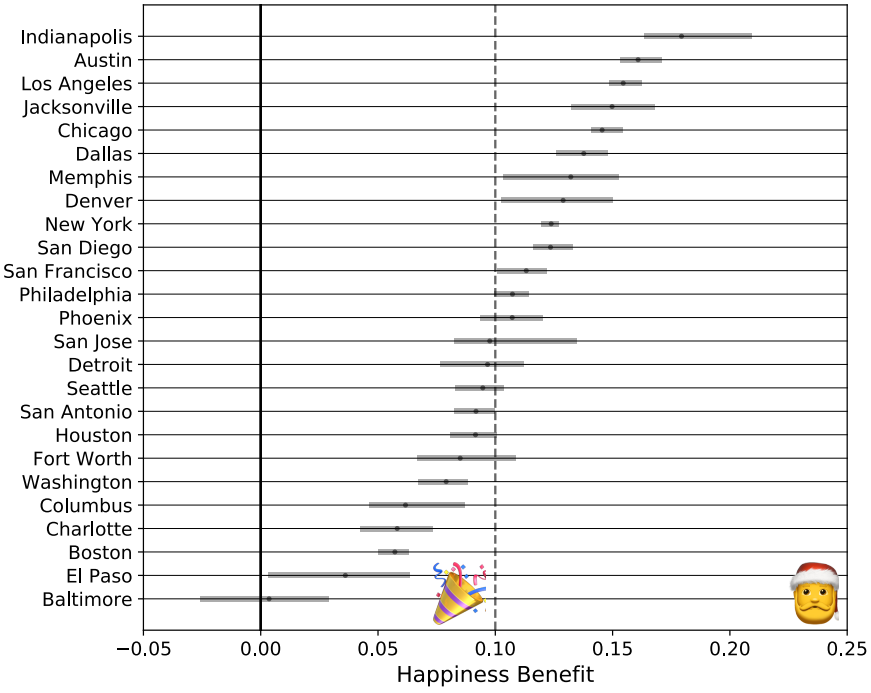
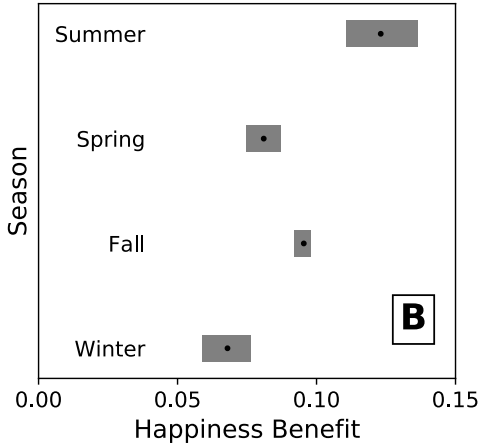
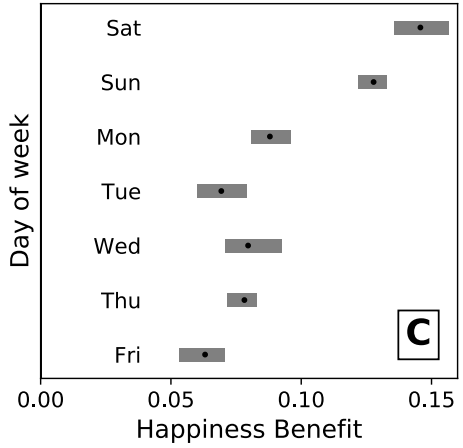
Estimating the happiness benefits of nature



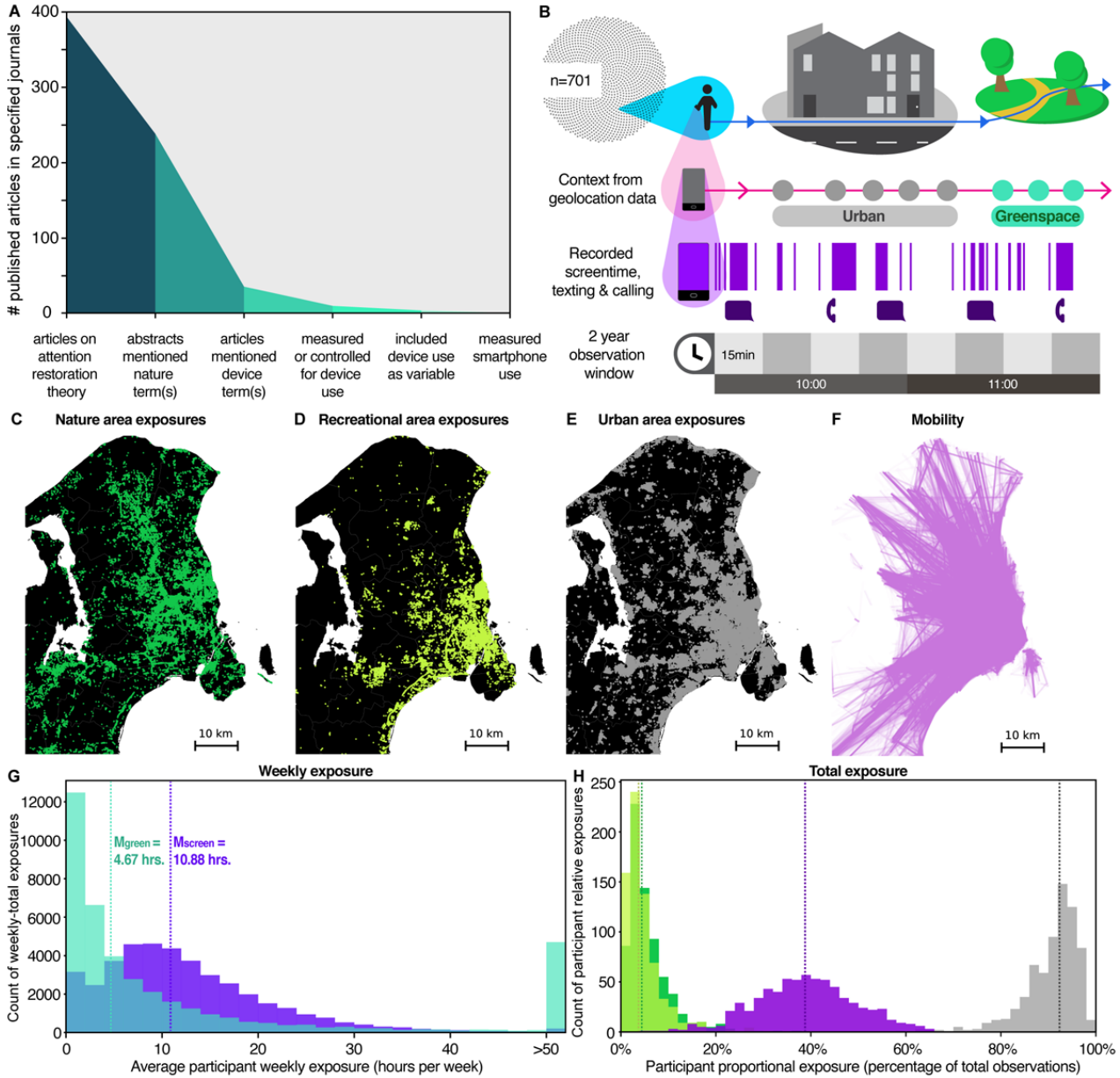






Schwartz et al., "Exposure to urban parks improves affect and reduces negativity on Twitter." 2019.
Schwartz et al., "Gauging the happiness benefit of US urban parks through Twitter." PLOS ONE. 2022.

Estimating the happiness benefits of nature



Minor et. al., “Nature Exposure is Associated With Reduced Smartphone Use". Environment & Nature. 2023.

Outline

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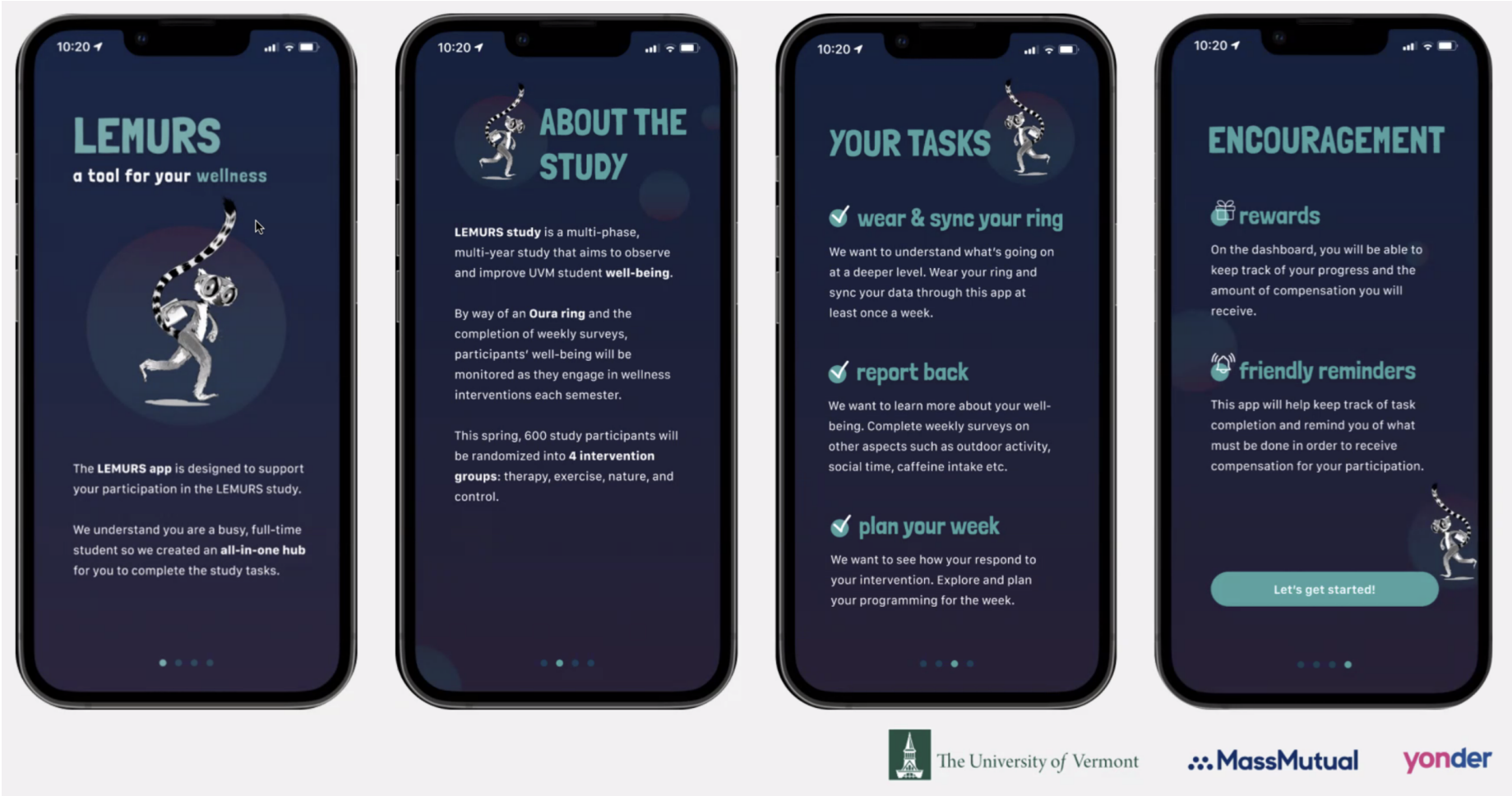
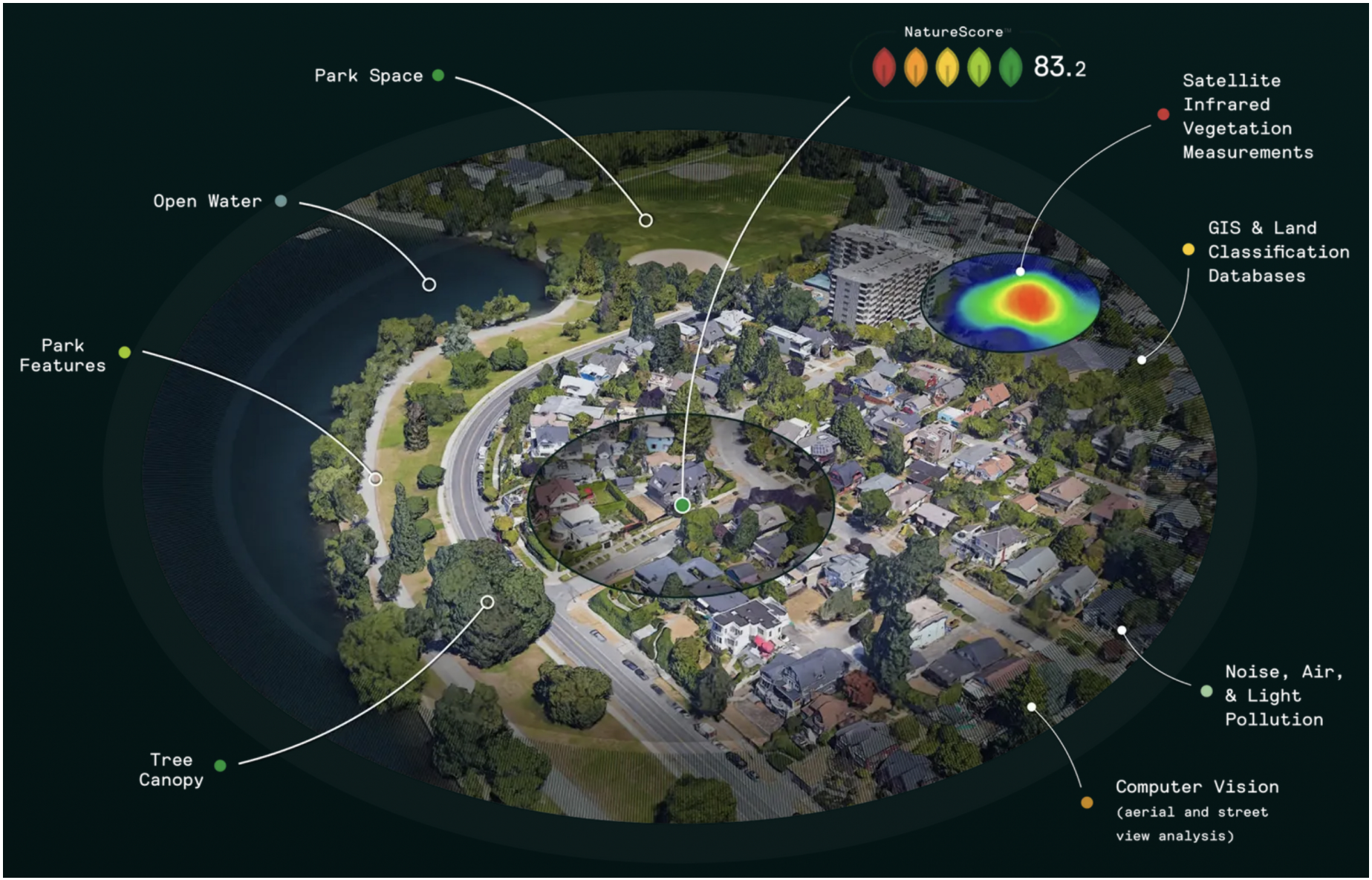
LEMURS

LIVED EXPERIENCES MEASURED USING RINGS STUDY

LEMURS App


10:20
LEMURS
a tool for your wellness
The LEMURS app is designed to support your participation in the LEMURS study.
We understand you are a busy, full-time student so we created an all-in-one hub for you to complete the study tasks.
10:20
ABOUT THE STUDY
LEMURS study is a multi-phase, multi-year study that aims to observe and improve UVM student well-being.
By way of an Oura ring and the completion of weekly surveys, participants' well-being will be monitored as they engage in wellness interventions each semester.
This spring, 600 study participants will be randomized into 4 intervention groups: therapy, exercise, nature, and control.
10:20
YOUR TASKS
wear & sync your ring
We want to understand what's going on at a deeper level. Wear your ring and sync your data through this app at least once a week.
report back
We want to learn more about your well-being. Complete weekly surveys on other aspects such as outdoor activity, social time, caffeine intake etc.
plan your week
We want to see how your respond to your intervention. Explore and plan your programming for the week.
10:20
ENCOURAGEMENT
rewards
On the dashboard, you will be able to keep track of your progress and the amount of compensation you will receive.
friendly reminders
This app will help keep track of task completion and remind you of what must be done in order to receive compensation for your participation.
Let's get started!
The University of Vermont
MassMutual
yonder

NatureDose App



Mood Lifters Has 3 Key Weekly Components

Mood Lifters℠

1. Check in

Before each meeting begins, we will ask you to fill in brief questionnaire so we can track your improvements over time. We will also review points earned over the prior week, discuss any barriers you may have experienced, and answer any questions you may have.

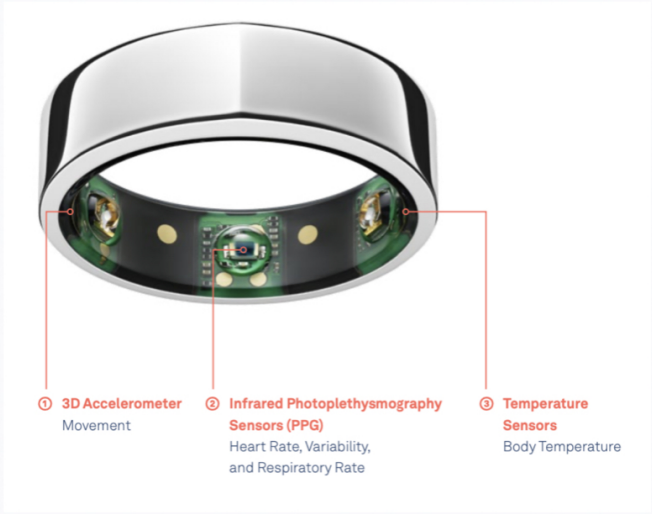
2. Meetings

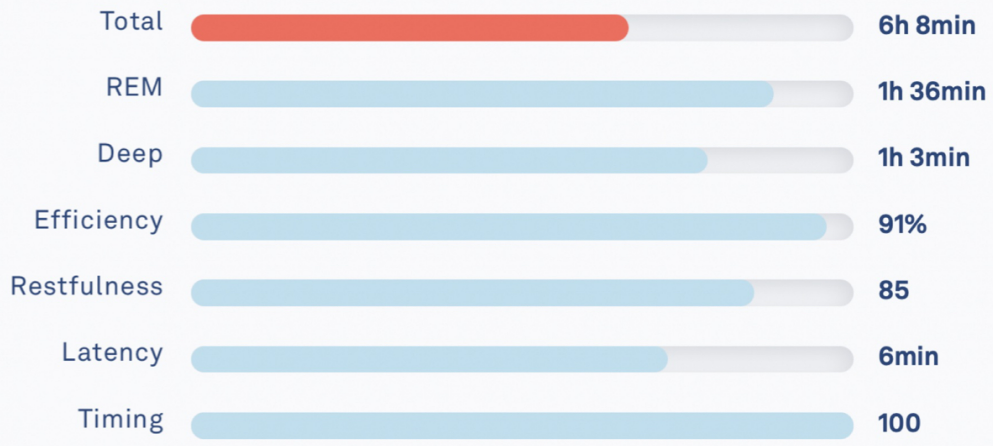
We introduce a new topic each week in one of 6 categories (sleep, body, thoughts, behaviors, emotions or relationships). We discuss the research behind each topic and explore strategies for incorporating that research into your daily life. Example topics include: sleep strategies, the importance of exercise, improving relationships, controlling your emotions, changing your negative thoughts and increasing joy and contentment.

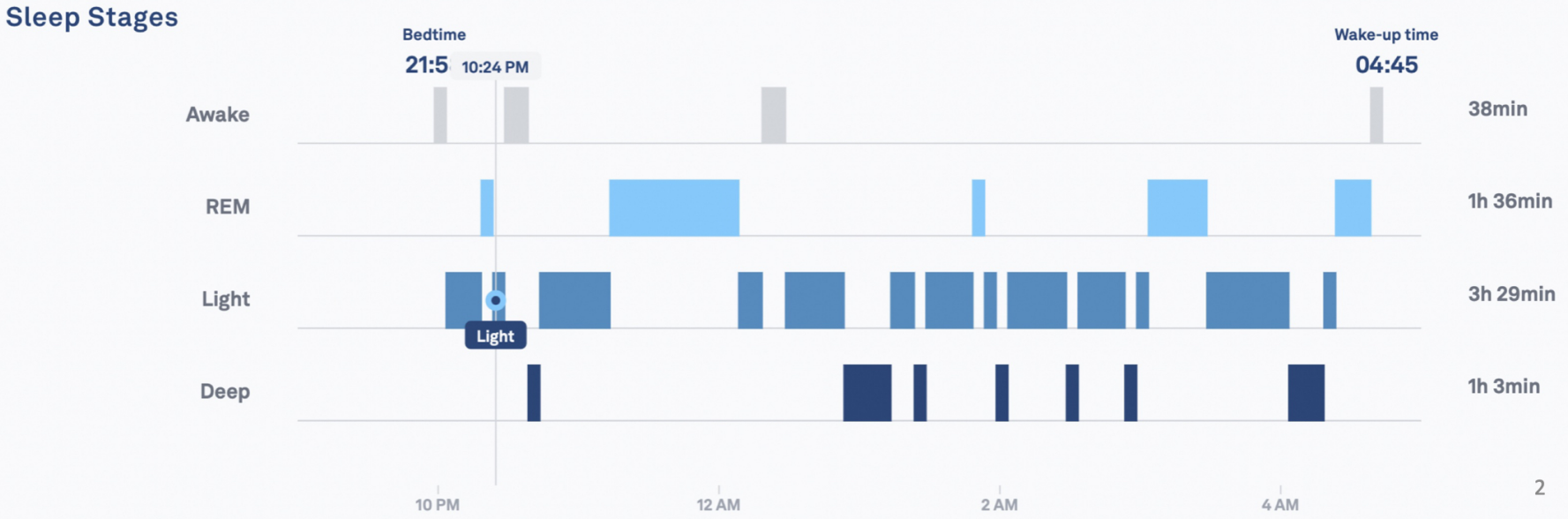
3. Points

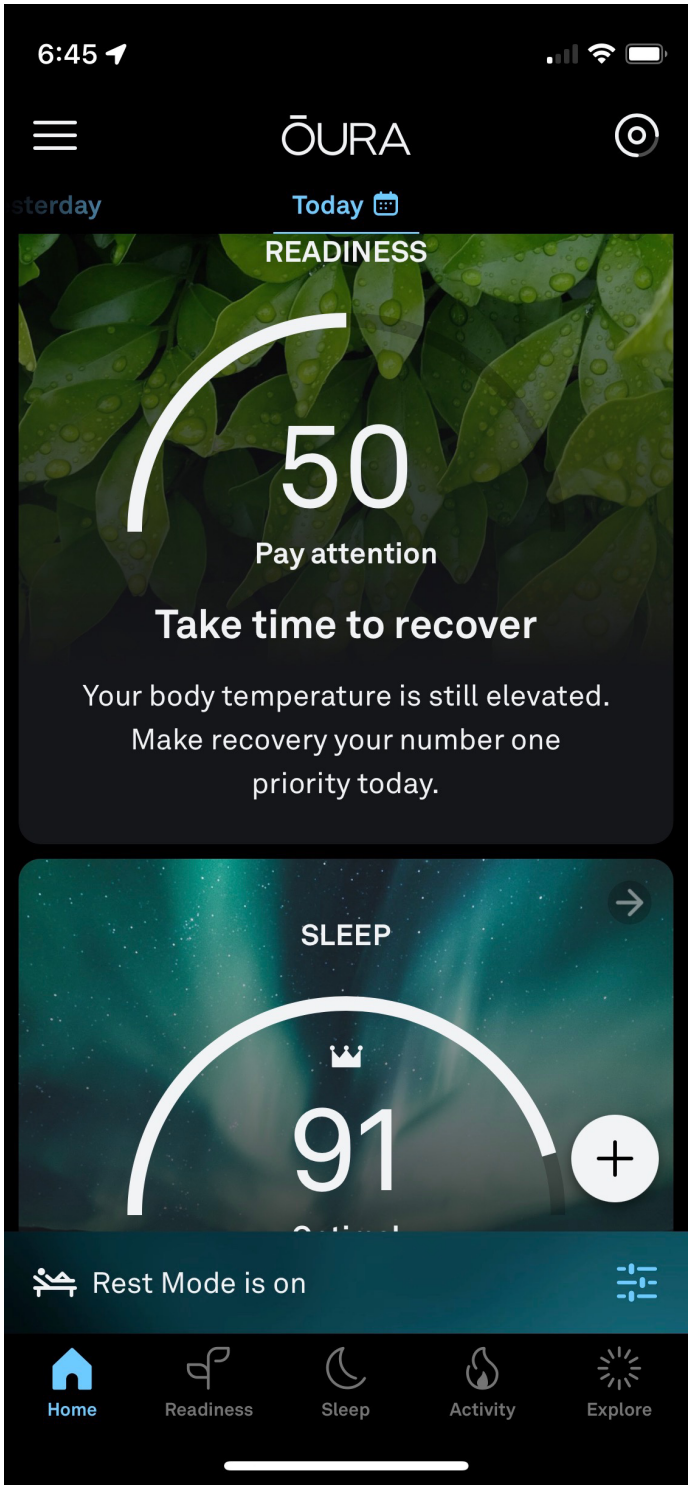
Points are earned by participating in activities related to the topic of each meeting. Each activity is assigned points. The ultimate goal is for you to turn the strategies you learn in the Mood Lifters meetings into healthy habits. As with any new skill, participants will need to practice these new strategies in order to master them. Our data strongly suggests that successfully adopting these habits will lead to a happier and healthier life.

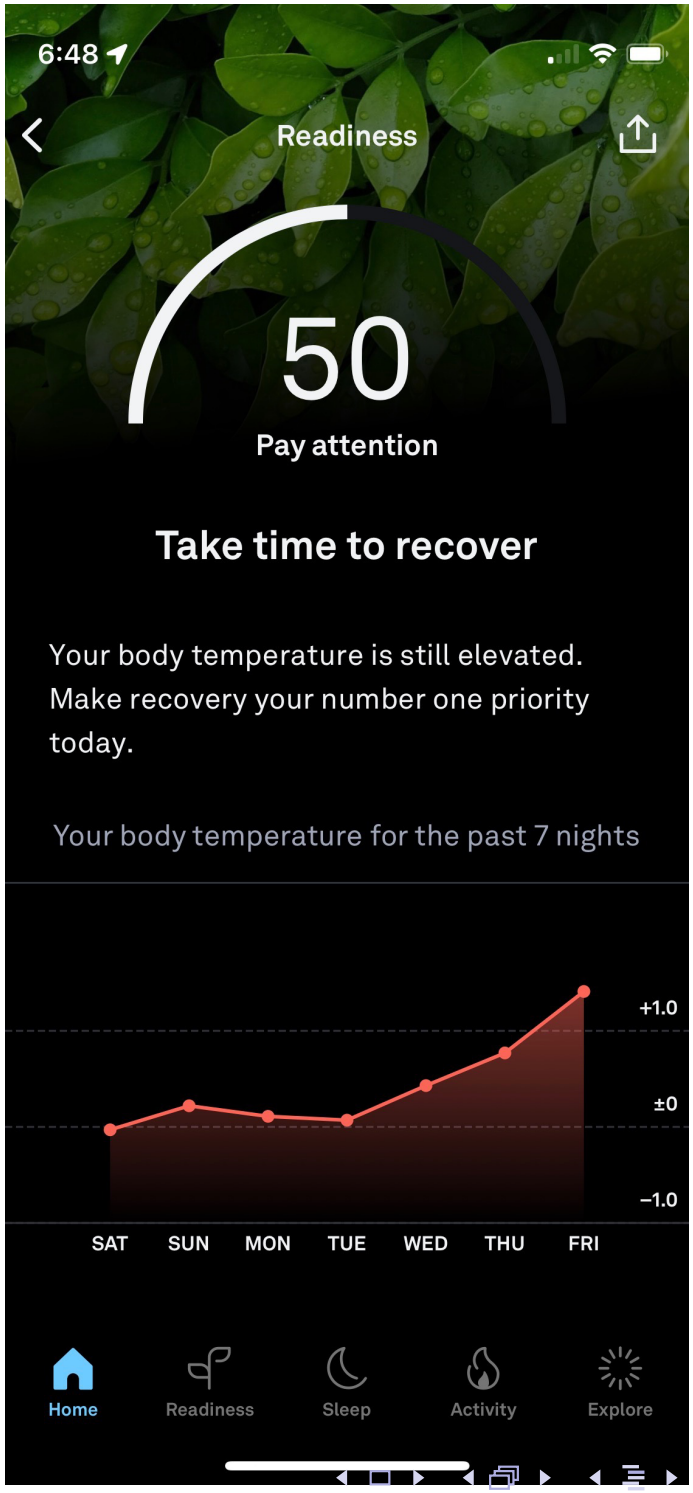
Oura: heart rate, heart rate variablity, sleep stages, breathing, temp, activity, readiness



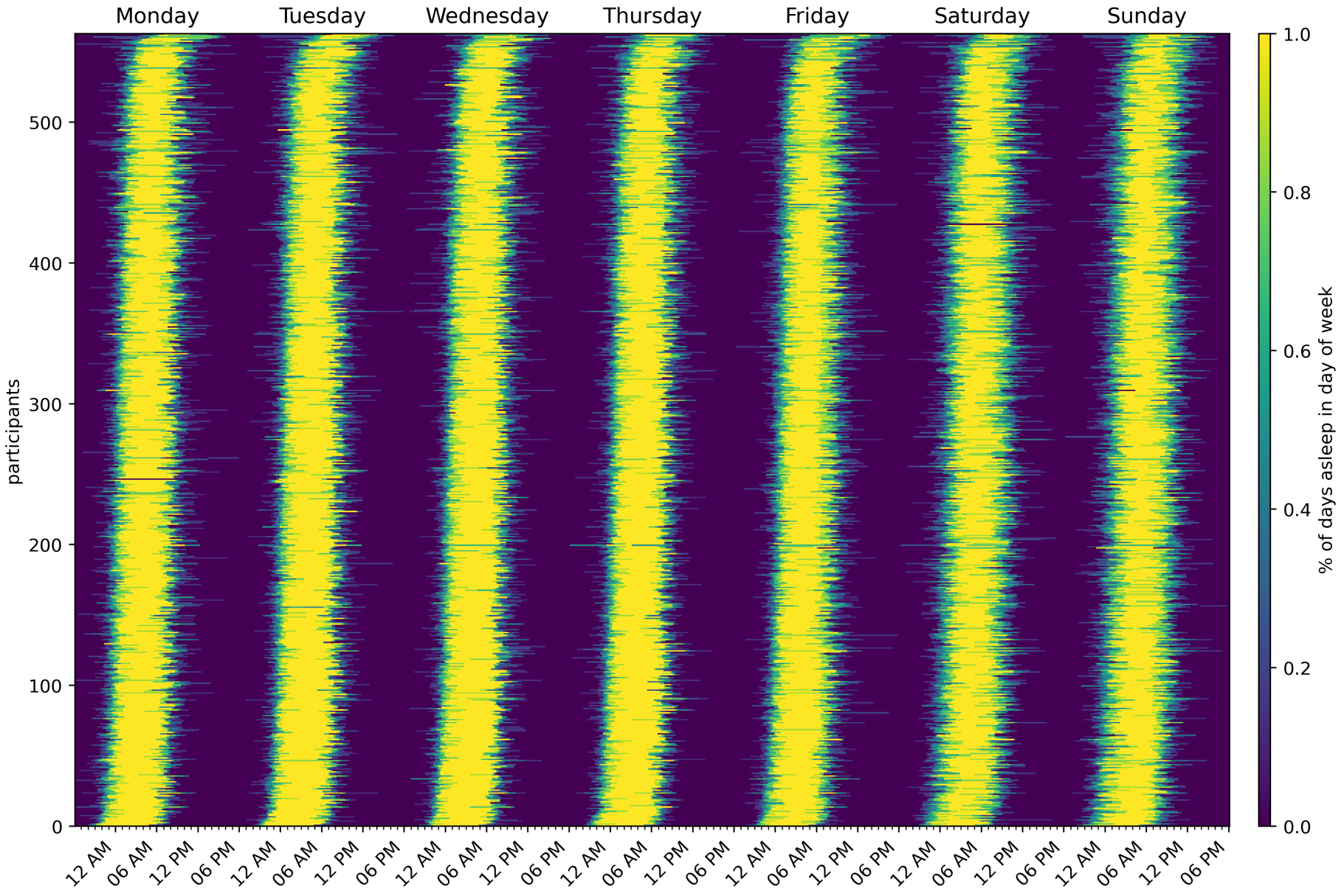





6:45
ŌURA
sterday
Today
READINESS
50
Pay attention
Take time to recover
Your body temperature is still elevated. Make recovery your number one priority today.
SLEEP
91
Rest Mode is on
Home
Readiness
Sleep
Activity
Explore


6:48
Readiness
50
Pay attention
Take time to recover
Your body temperature is still elevated. Make recovery your number one priority today.
Your body temperature for the past 7 nights
+1.0
±0
−1.0
SAT
SUN
MON
TUE
WED
THU
FRI
Home
Readiness
Sleep
Activity
Explore

Oura: Sleep hygiene in UVM first-years



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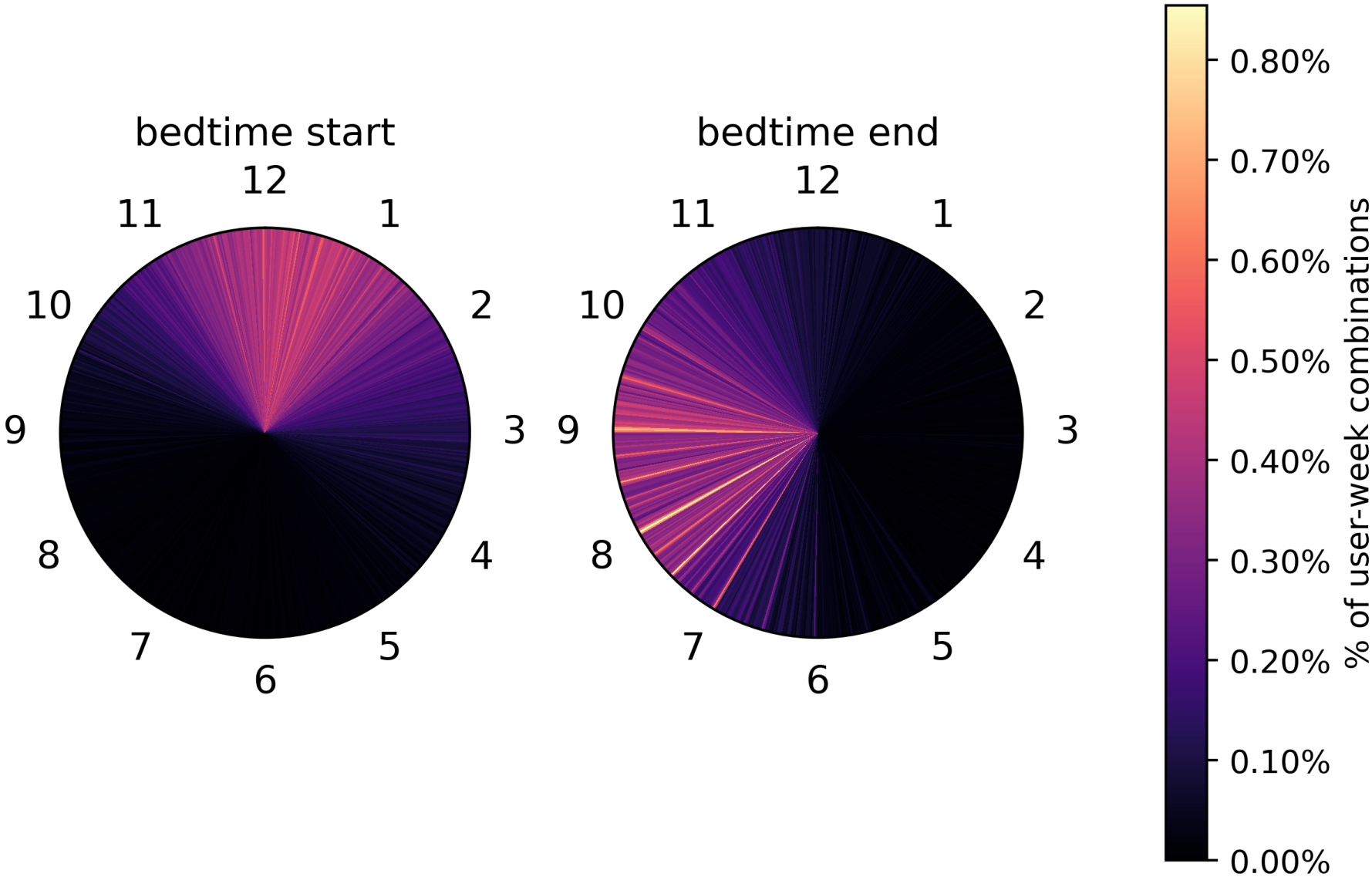
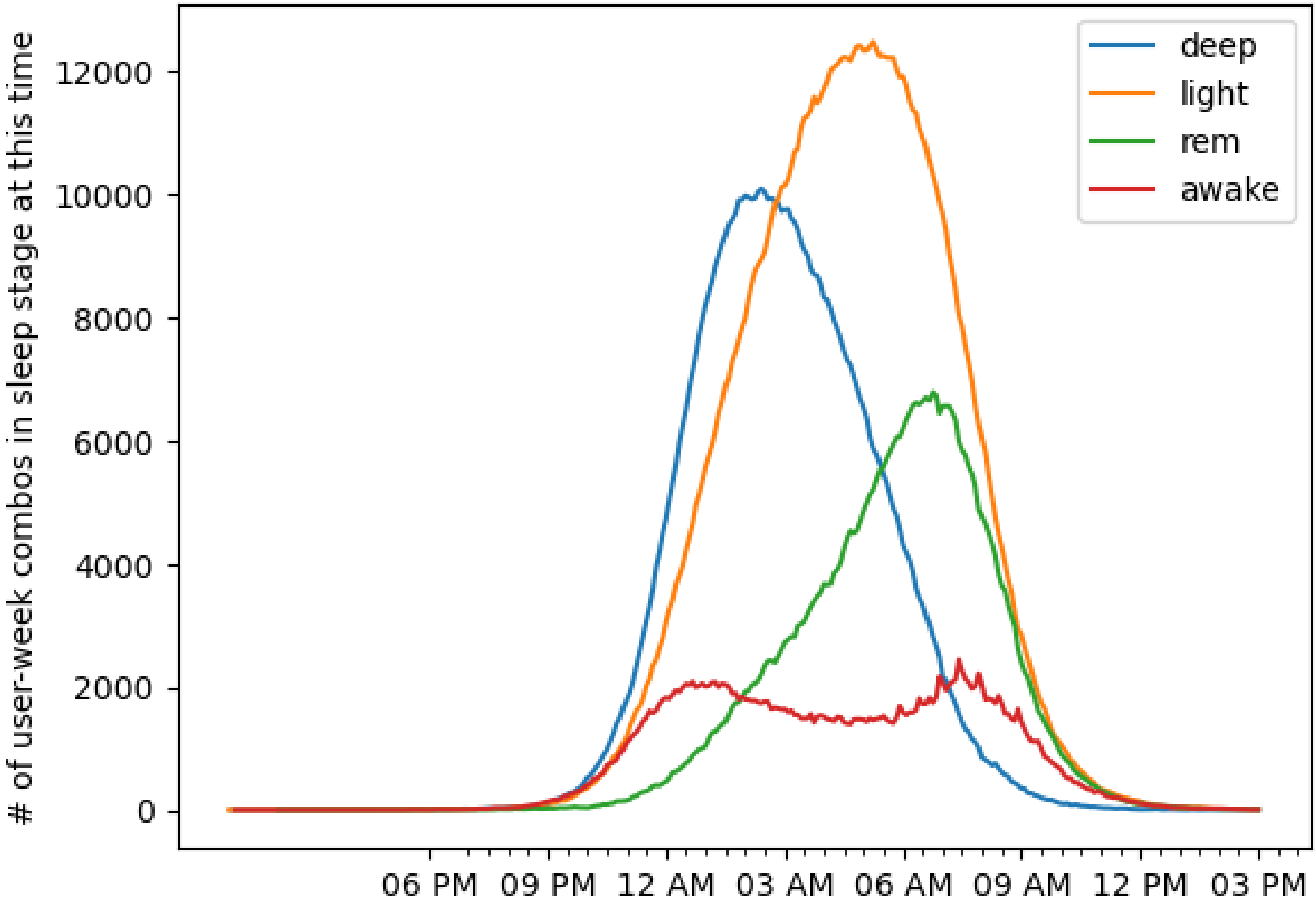


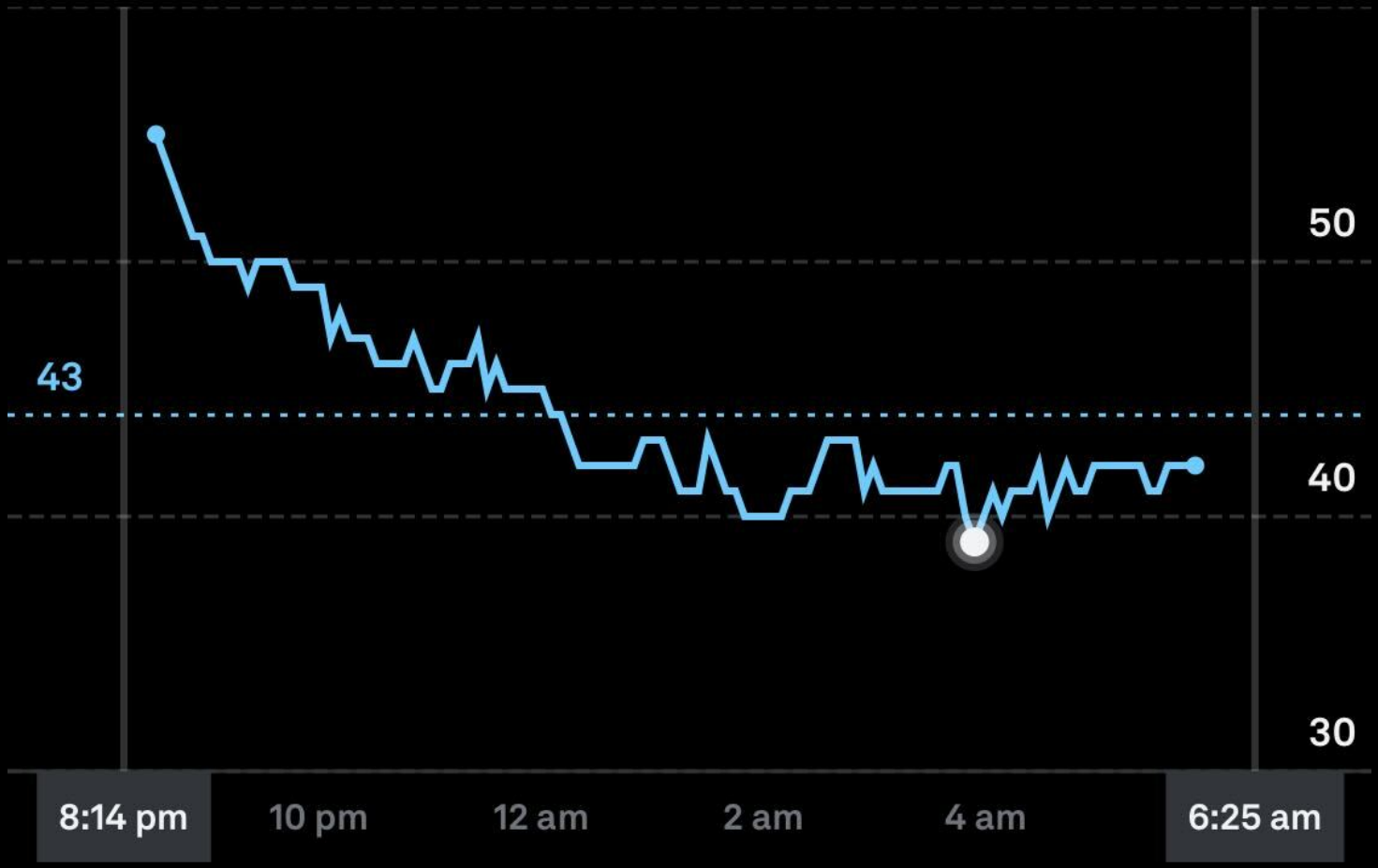
Oura: Stages of Sleep in UVM first-years



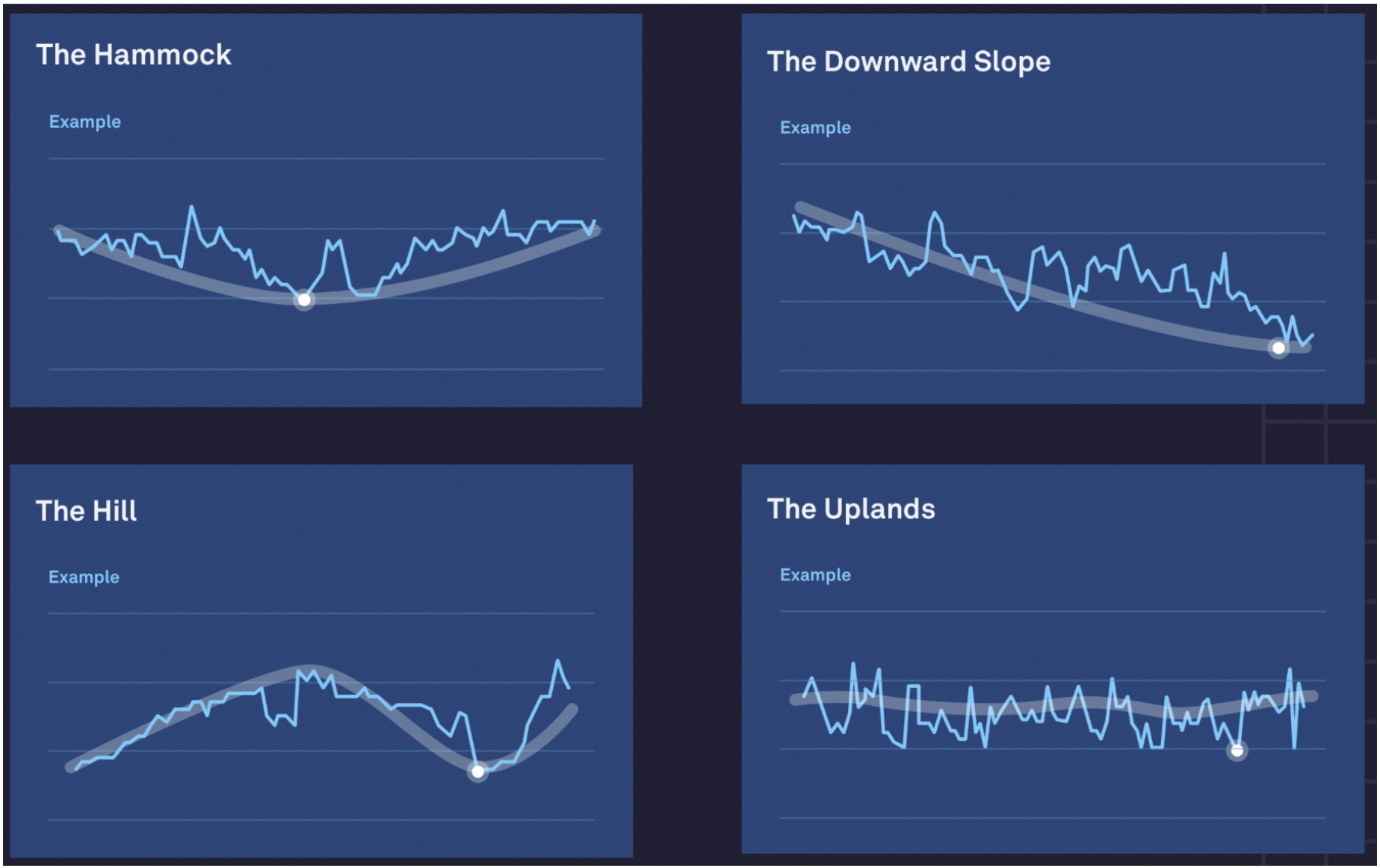
Lowest heart rate

39 bpm

Average 43 bpm



Oura: Shapes of Sleep worldwide



https://ouraring.com/blog/sleeping-heart-rate/

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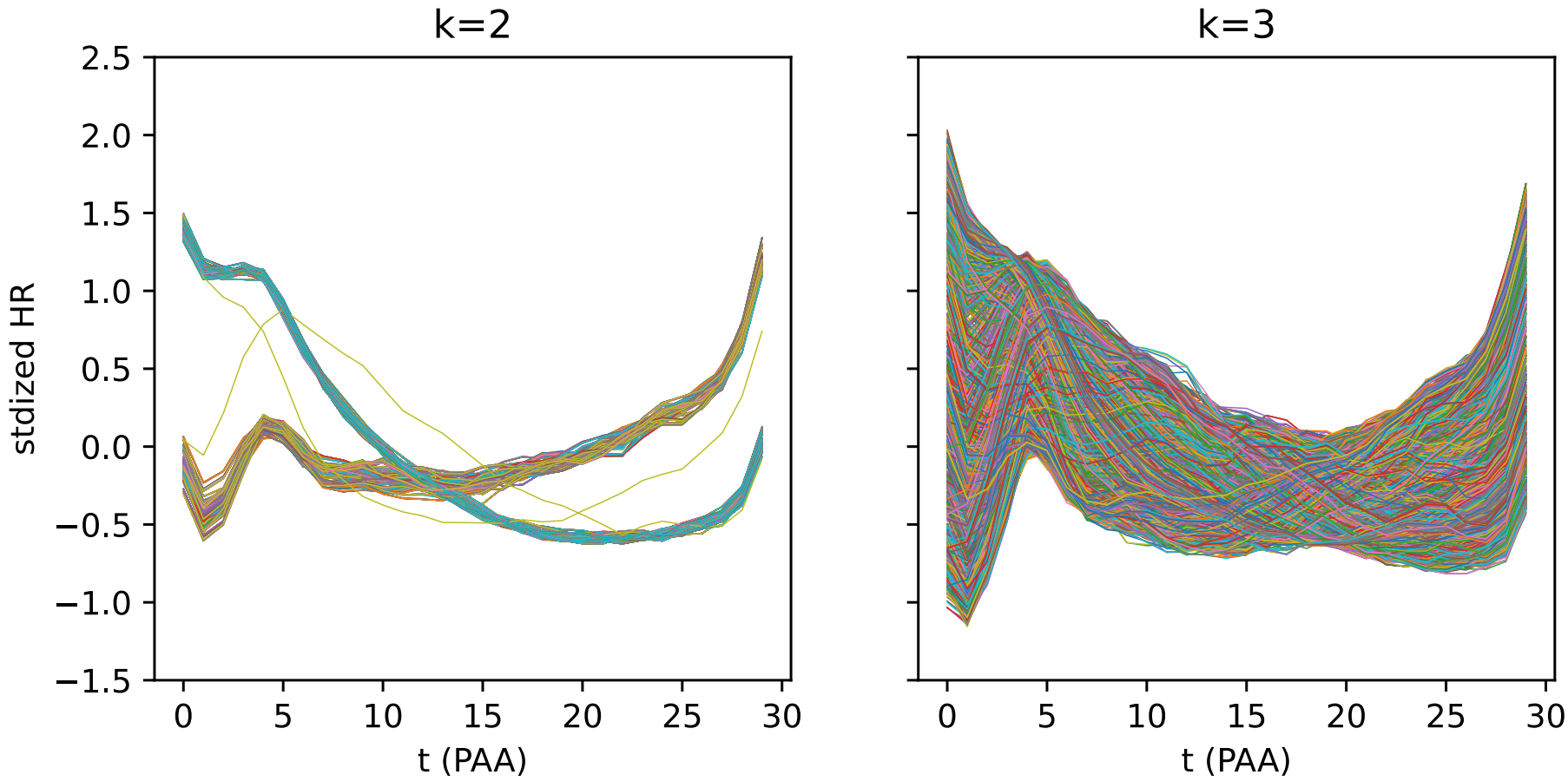
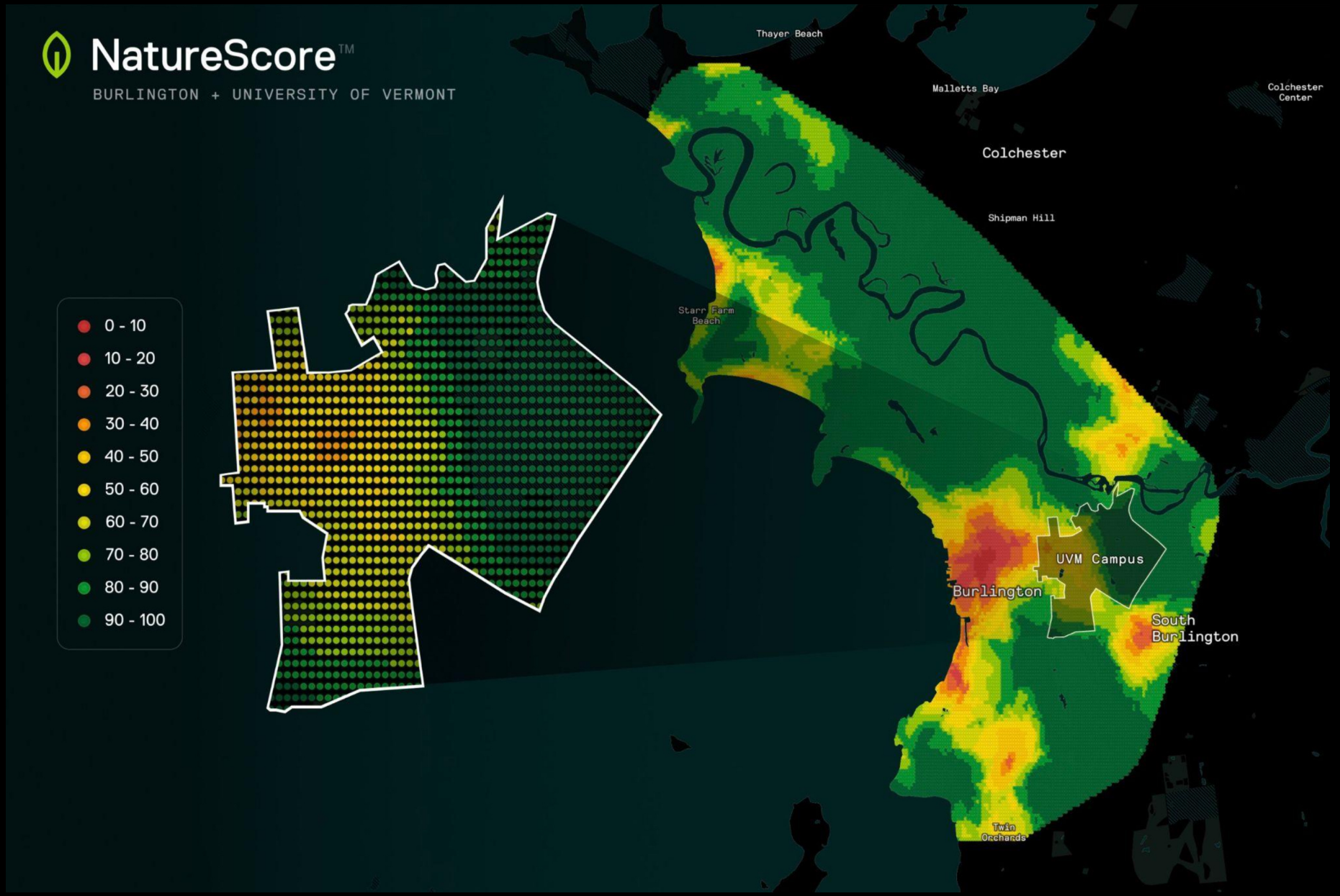


Fudolig et. al., “The two fundamental shapes of sleep heart rate dynamics and their connection to mental health.” In Review. 2023.


NatureScore™
BURLINGTON + UNIVERSITY OF VERMONT
0 - 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
90 - 100
Thayer Beach
Malletts Bay
Colchester Center
Colchester
Shipman Hill
Starr Farm Beach
UVM Campus
Burlington
South Burlington
Twin Orchards

LEMURS: Preliminary Findings

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LEMURS: Preliminary Findings

- More than half of LEMURS participants met the criteria for generalized anxiety disorder (GAD) at least once during their fall semester.

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- Mood, sleep, & physiological health benefits: walk w/friend! *The most scalable & accessible intervention.*

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Future

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Future

- Recruit new cohort each year, platform for wellness

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- Incentive experiment in Spring 2024

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- Goal: personalized health recommendations (think: umbrella)

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Summary

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Summary

- Data Science $\rightarrow$ Social Good!

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Summary

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- StoryWrangler `http://storywrangling.org`

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- Science of Online Corpora, Knowledge, & Stories (SOCKS)

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The Lived Experiences Measured Using Rings Study (LEMURS)

Yoshi

Taylor

Ryan

Peter

Mikaela

Melissa

Matt

Mariah

Marc

Laura

Kathryn

Juniper

Julia

Jordan

Johanna

Isabelle

Ellen

Chris

Juniper Lovato

Will Thompson

Parisa Suchdev

Mikaela Fudolig

Laura Bloomfield

Mariah Boudreau

Julia Zimmerman

Michael Arnold

Yoshi Bird

Carter Ward

Isabel Smith

Calla Beauregard

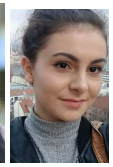
Ashley Fehr

Julia Kim

Jordan Llorin

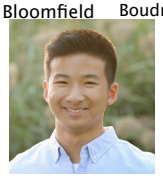
Jane Adams Northeastern

John Ring MassMutual


Kelly Gothard Reddit

Anne Marie Stupinski Talkspace

Vanessa Myhaver NASA JPL


Henry Wu Harvard

Colin Van Oort MITRE

Thayer Alshaabi Postdoc, Berkeley

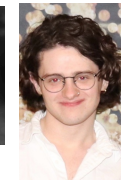
Lindsay Ross Apple

Ethan Davis Lewis & Clark

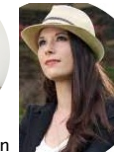
Aaron Schwartz Stryd

Danne Elbers, VA

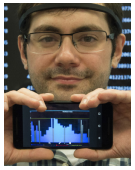
Kathryn Cramer


Murphy Peisel

Kathryn Stanton


Rachel Dotey

Abby Ross Northfield Mount Hermon School


Eric Clark, UVM Research Scientist

Ryan Gallagher Alethea

Tyler Gray IDA

Ben Kotzen Mass General

Brendan Whitney Faraday

Andy Reagan Data Scientist MassMutual

Sarah Howerter Packetized Energy

Andy Metcalf Optimal Solutions

Ben Emery Sandia

Sophie Hodson Algorex Health

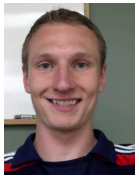
David Dewhurst Charles River Analytics

Todd DeLuca Cancer Center UVM

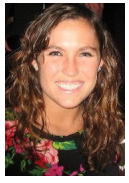
Kelsey Linnell LL Bean

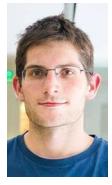
Max Green tomorrow.io

Nick Allgaier Psychiatry UVM Faculty


Dilan Kiley Data Scientist Zillow

Tom McAndrew Lehigh Faculty


Emily Cody Data Scientist Adobe


Morgan Frank Pitt Faculty

Cathy Bliss SUNY Empire St Faculty

Mark Ibrahim Data Scientist Meta AI

Ross Lieb-Lappen Vermont Tech Faculty

Eitan Pechenick Maine School of Science & Math Faculty

Sven McCall Strava

Henry Mitchell UVM Medical School

Laura Jennings River and Mercantile

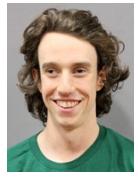
Josh Minot MassMutual

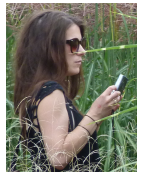
Delaney Woods

Lewis Mitchell Adelaide Faculty

Jake Williams Drexel Faculty

Isabel Kloumann Cornell PhD Facebook Data Scientist

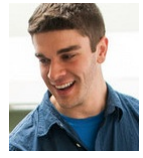

Fletcher Hazlehurst Rock Gym Pro


Sharon Alajajian Research Scientist Univ of Pennsylvania

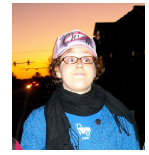
Kameron Harris Western Washington Faculty

Paul Lessard Colorado PhD Student

Suma Desu Apple Data Scientist


Mike Foley Northeastern PhD student

Darcy Glenn Climate Science UC London, MS student


Lindsay Van Lier VCHIP

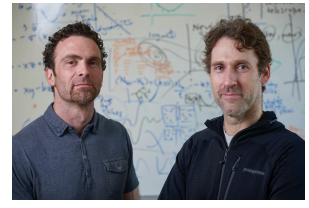
Sandhya Gopchandani iManage

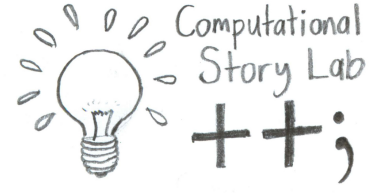
Megan Ardren Northwestern Mutual

Amelia Tarren

Melissa Parr

Andi Elledge


Chris Danforth Peter Dodds



Funding: NSF, MITRE, AMD, MassMutual

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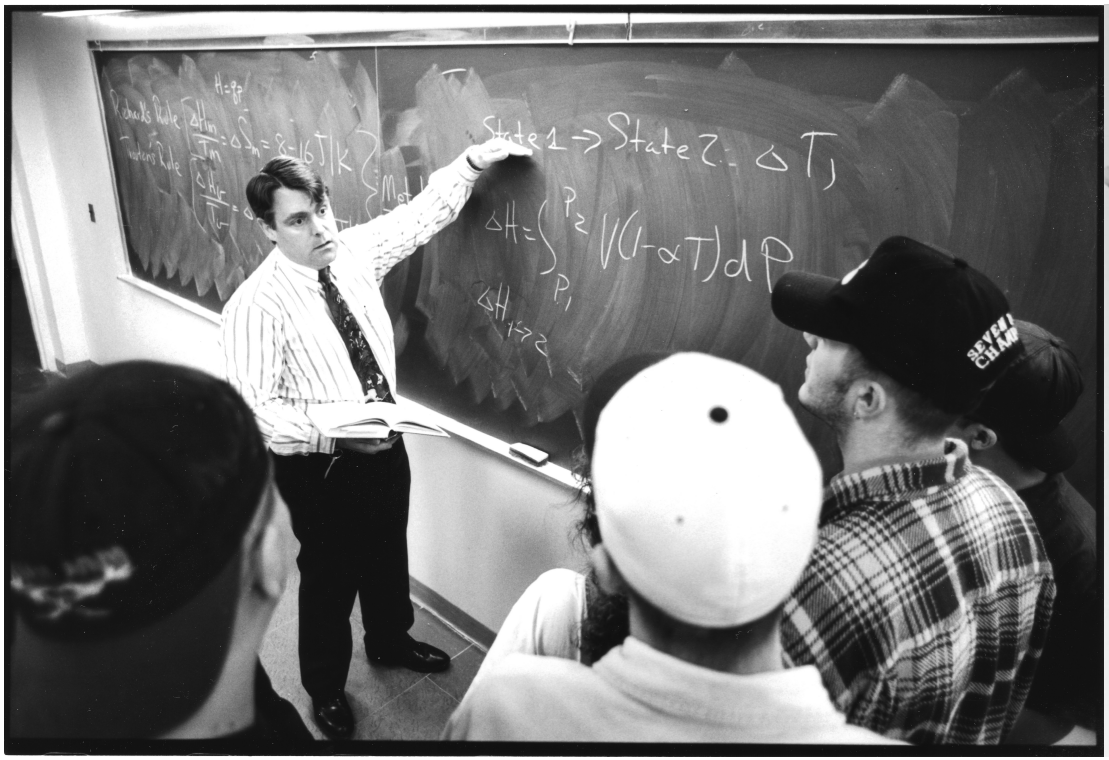
- Jarlath O'Neil-Dunne, Miles Colaprete, Clarence Davis, Paul Yoon, Matt Anderson, Justin Smith
- Eugenia Kalnay, James Yorke, Domenico Grasso


State 1 -> State 2: ΔT
ΔH = ∫ V(1-αT)dP

Poppy & Rose