

Learning through Collective Intelligence



Scott Klemmer

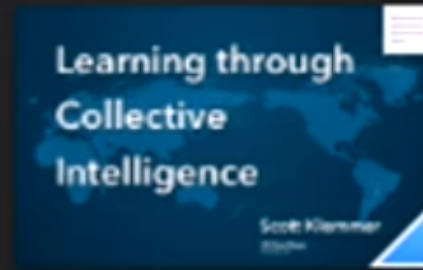
UC San Diego
The Design Lab



Harvard Graduate School of Architecture



1



2



3



4



5



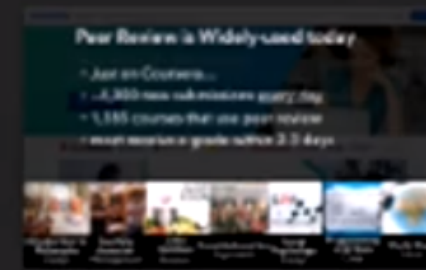
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7



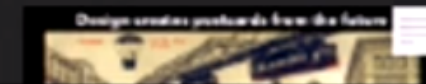
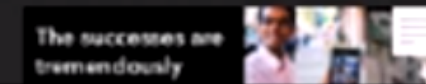
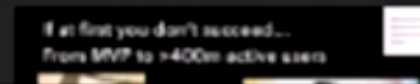
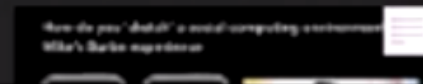
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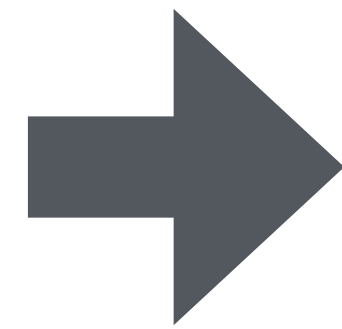
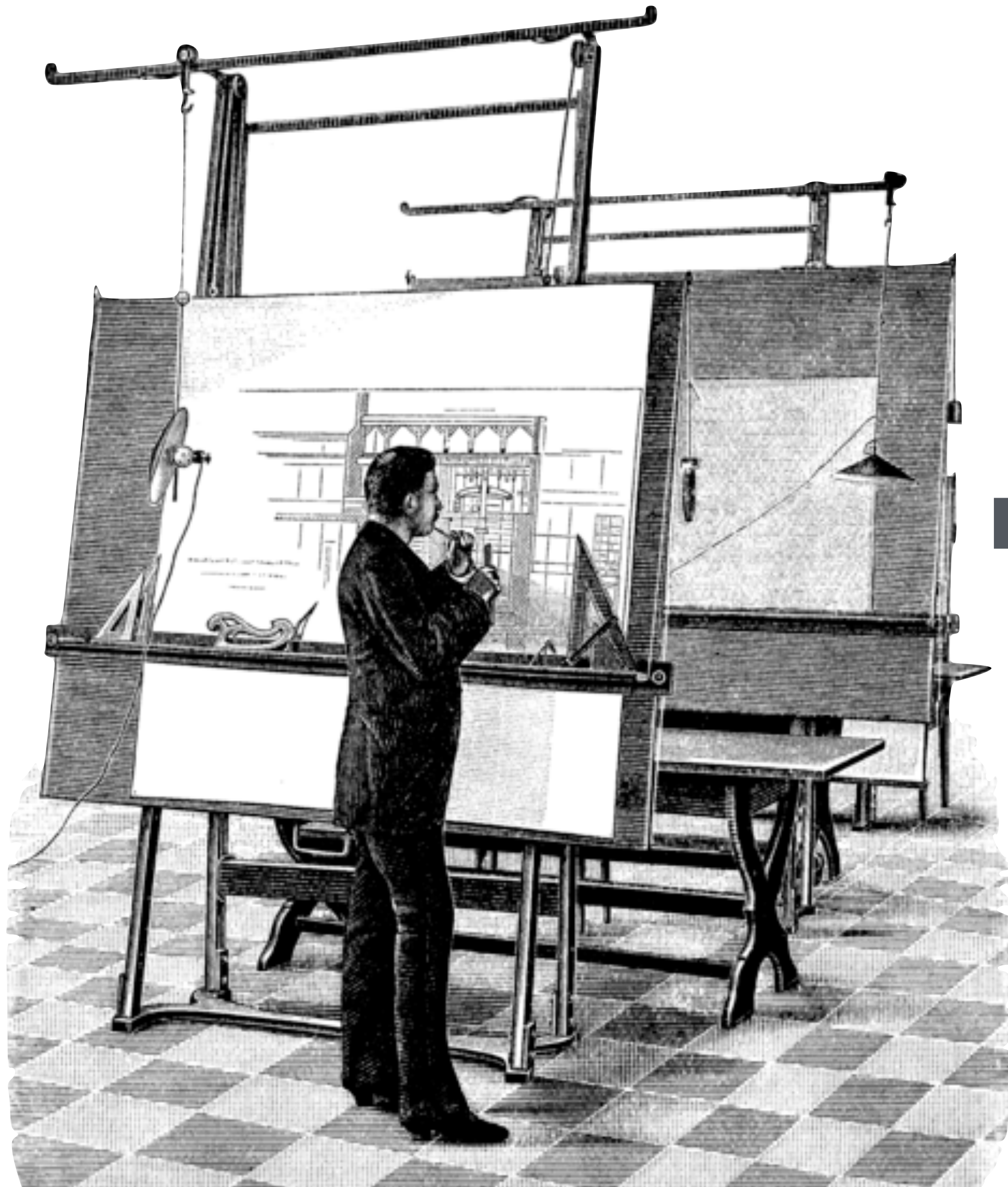


10



Design studios are really special learning places. Here are pictures I took in an architecture and a product design studio. You see barbie dolls, umbrellas, all sorts of half-baked ideas. The physical layout, the culture, and the practices mean that you learn both profound and really mundane things. You're the **first to see** a peer's brand-new exciting idea, and you get to see all the twists and turns. You also learn really mundane but useful things like who's got a soldering iron and can show you how to use it. In a studio **class**, when 17 people get a design brief, they interpret it in 17 different ways. You get to see all 17 when students come together for critique, and how they turned out. What worked, what didn't, what you never even thought to

How Might We...



Scaling open-ended work is challenging

3+4 = 7,
16 oz in 1 lb,
Calculate the speed of a car
Towers of Hanoi,
Writing a for loop in Python

Strength of a design,
Measuring quality of a
literary work,
Increasing accessibility,
Decreasing wage
inequality



Open-Endedness

Scaling open-ended work is challenging

Canonical Wisdom of Crowds

*Galton's guess the weight of an ox,
Are these two product images the same*

...

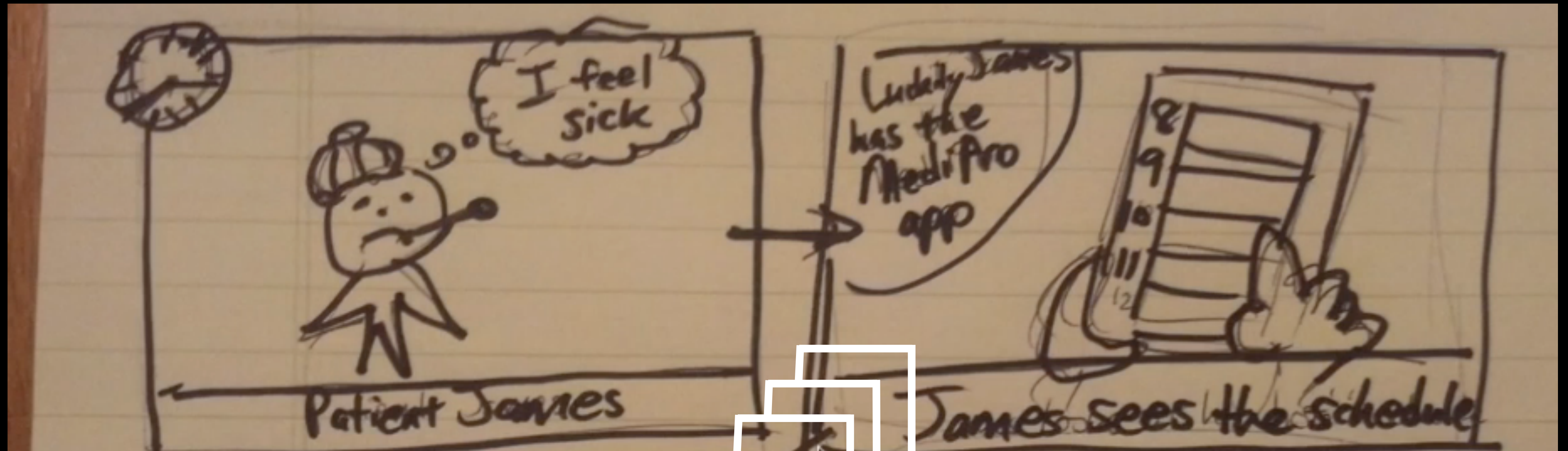


Objective Truth

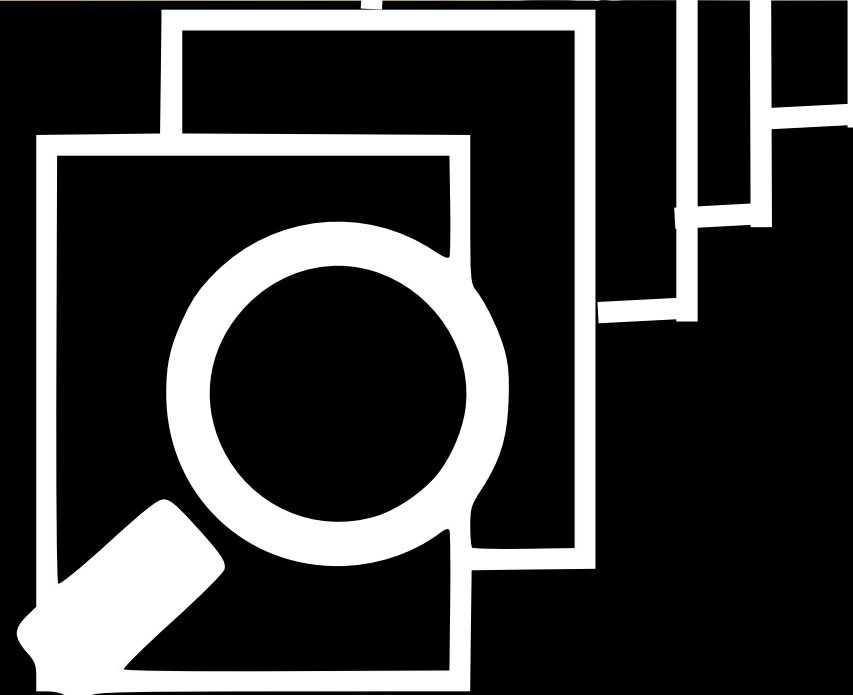
Contextual Truth

Open-Endedness

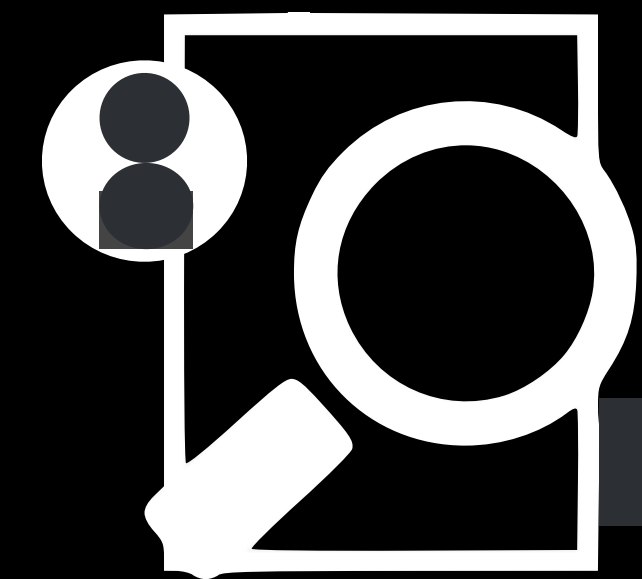
Scaling feedback on open-ended work



1) Train: calibrate

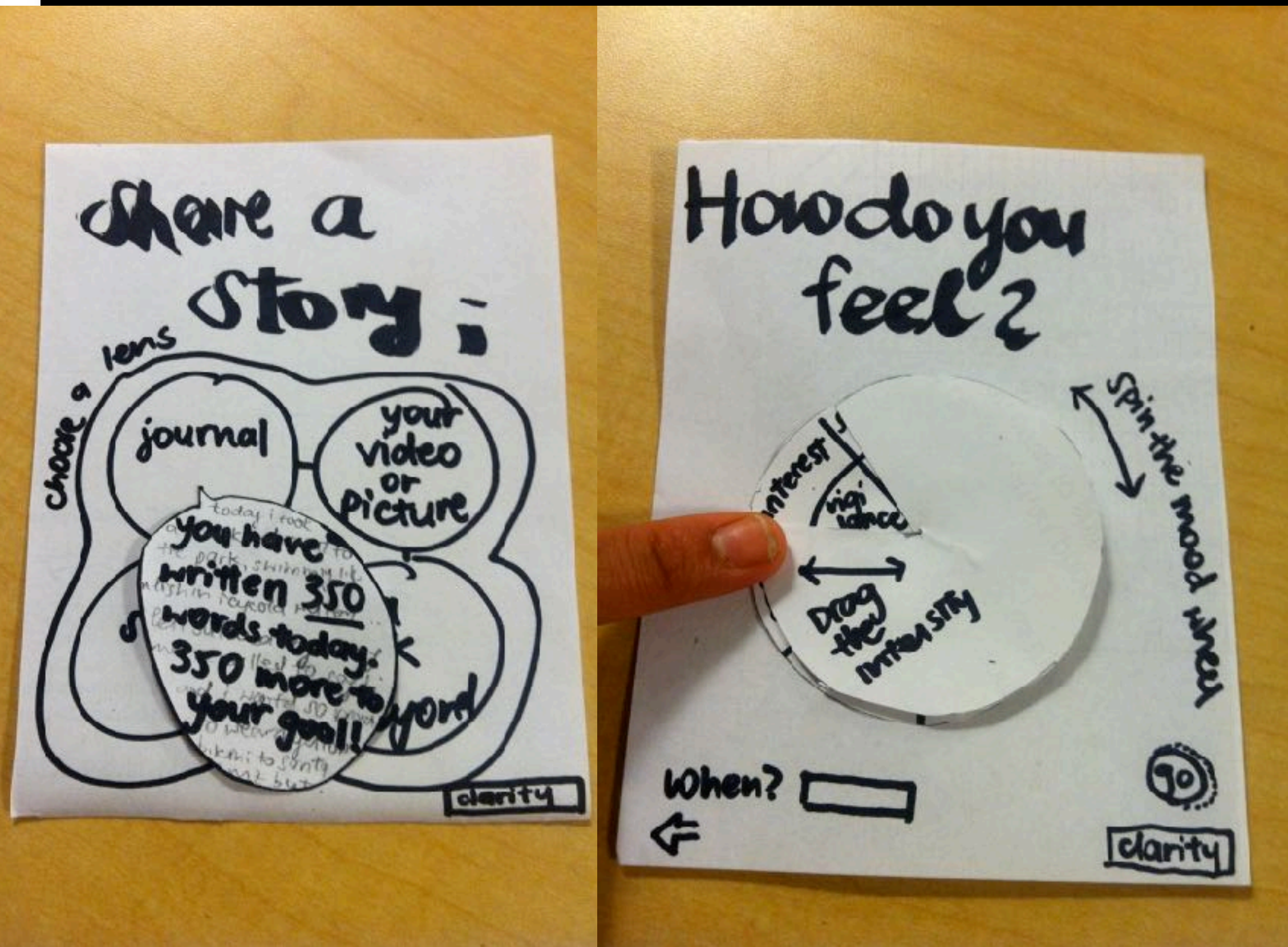
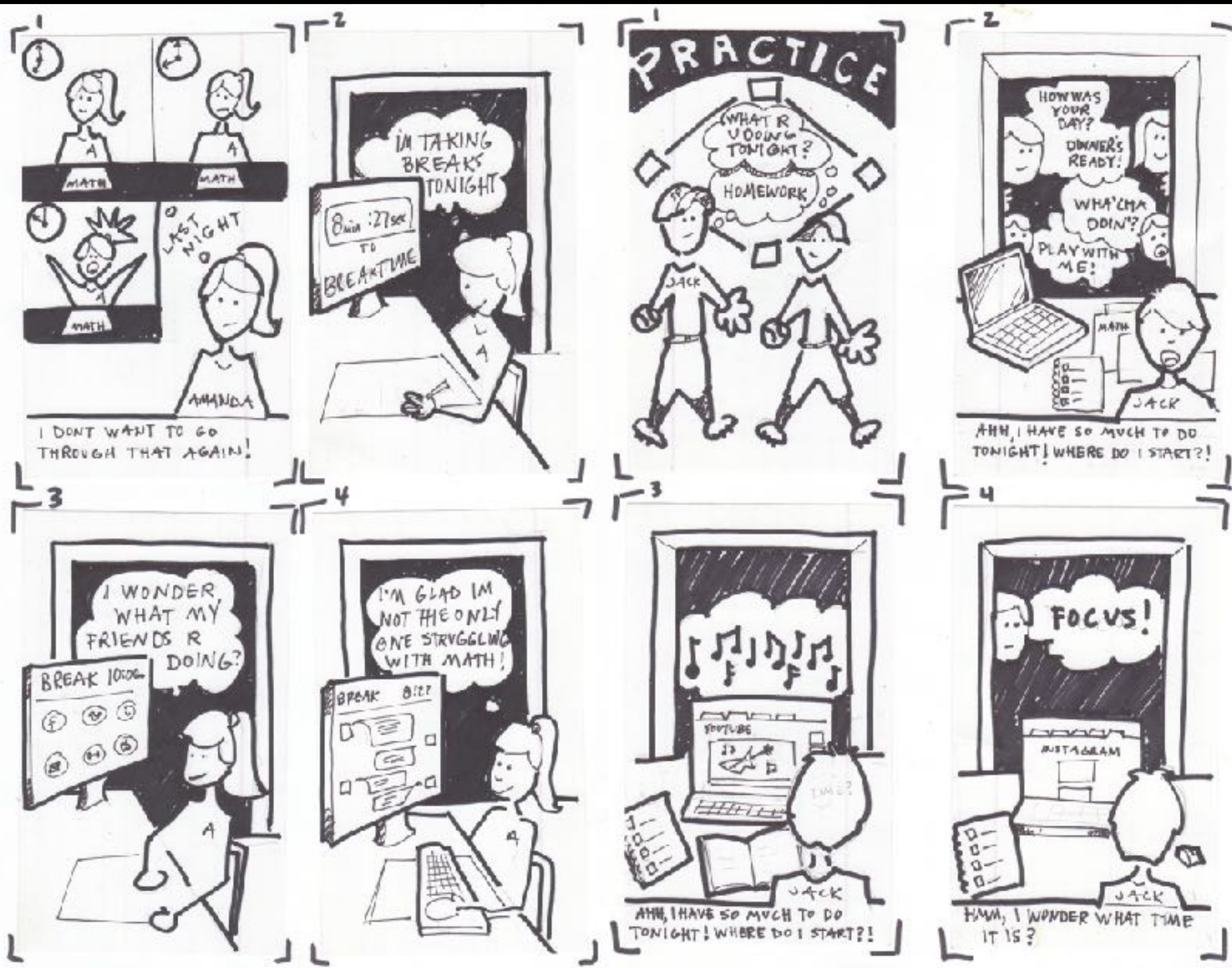


2) Assess: Peers



3) Reflect
(Assess: Self)

Student Prototypes



<http://hci-class.org>

Peer Review is Widely-used today

Take the world's best courses,
online.

- Just on Coursera...

- ~4,000 new submissions every day

- 1,385 courses that use peer review

- most receive a grade within 2-3 days



See All



Introduction to
Philosophy
Essays



Teaching
character
Management



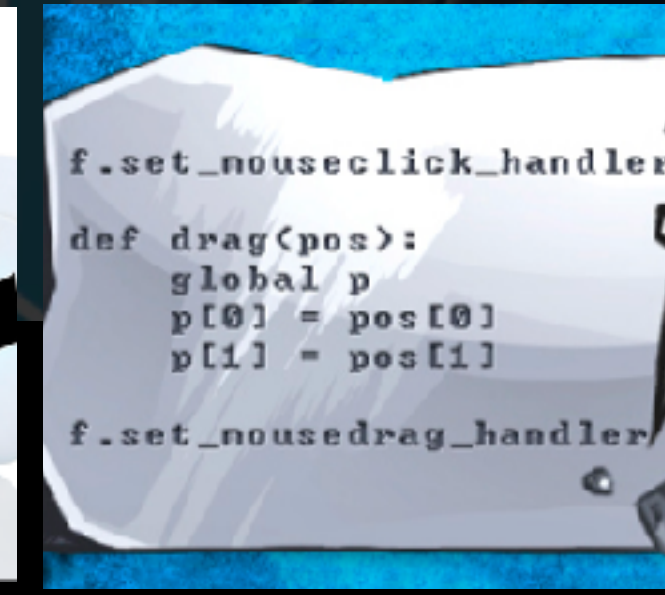
Child
Nutrition
Recipes



Constitutional law
Arguments



Social
Psychology
Essays



Programming
in Python
Code



World Music
Music

Engaging Diverse Perspectives



“Magical lights” from Norway



“Treasure Cage” from Canada
Introduction to Art

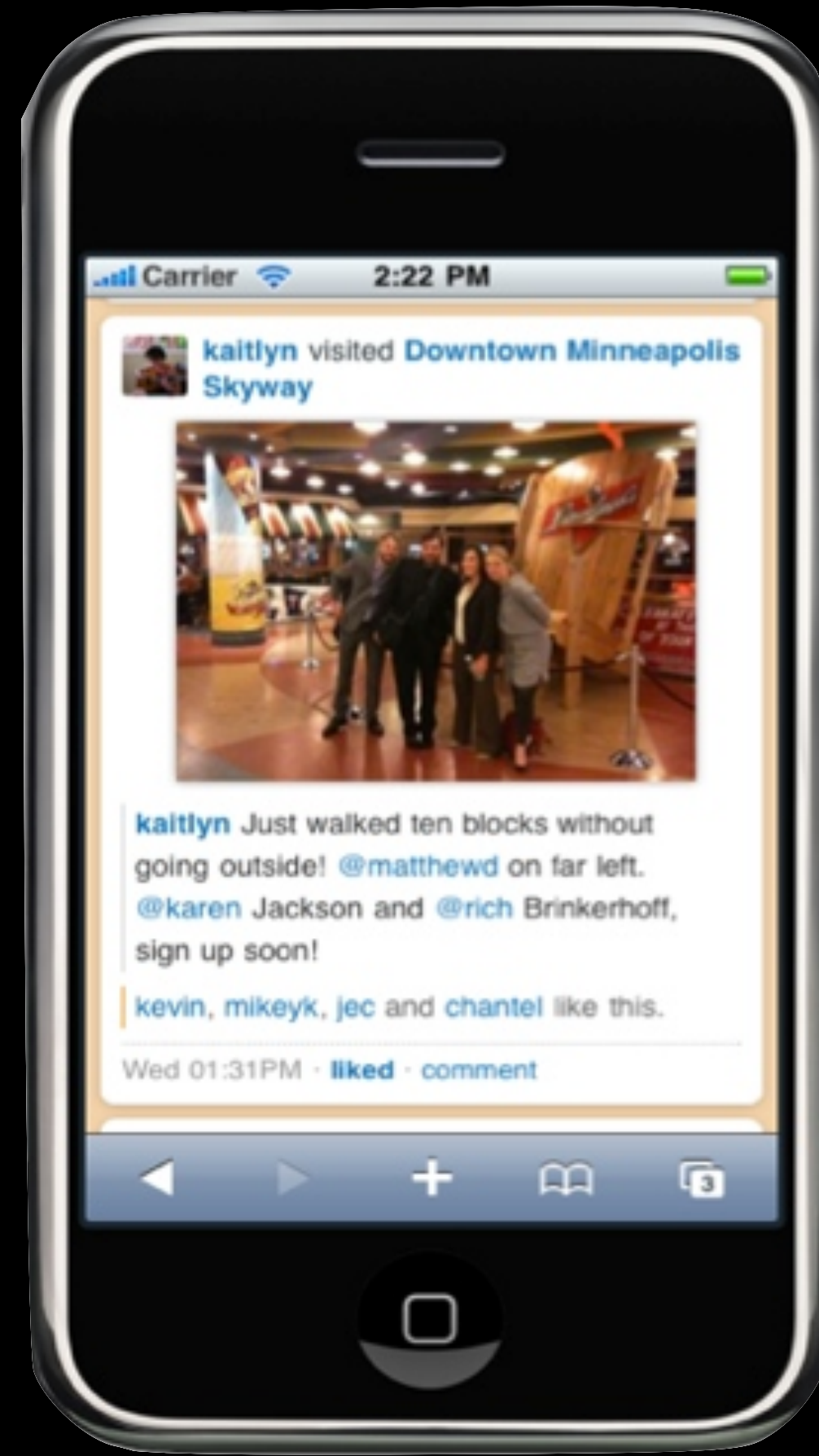
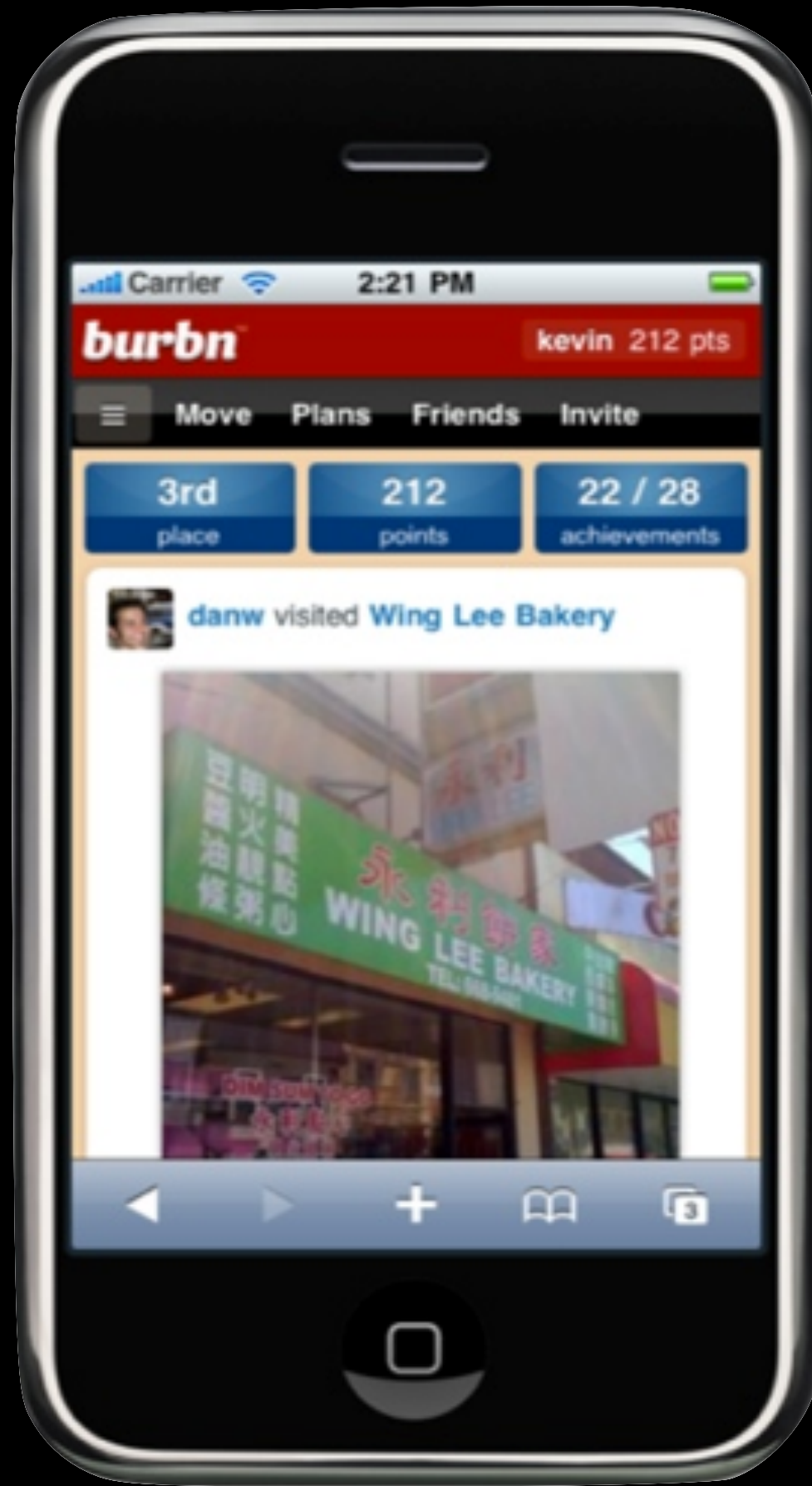
PROBLEM-FINDING

as well as

PROBLEM SOLVING

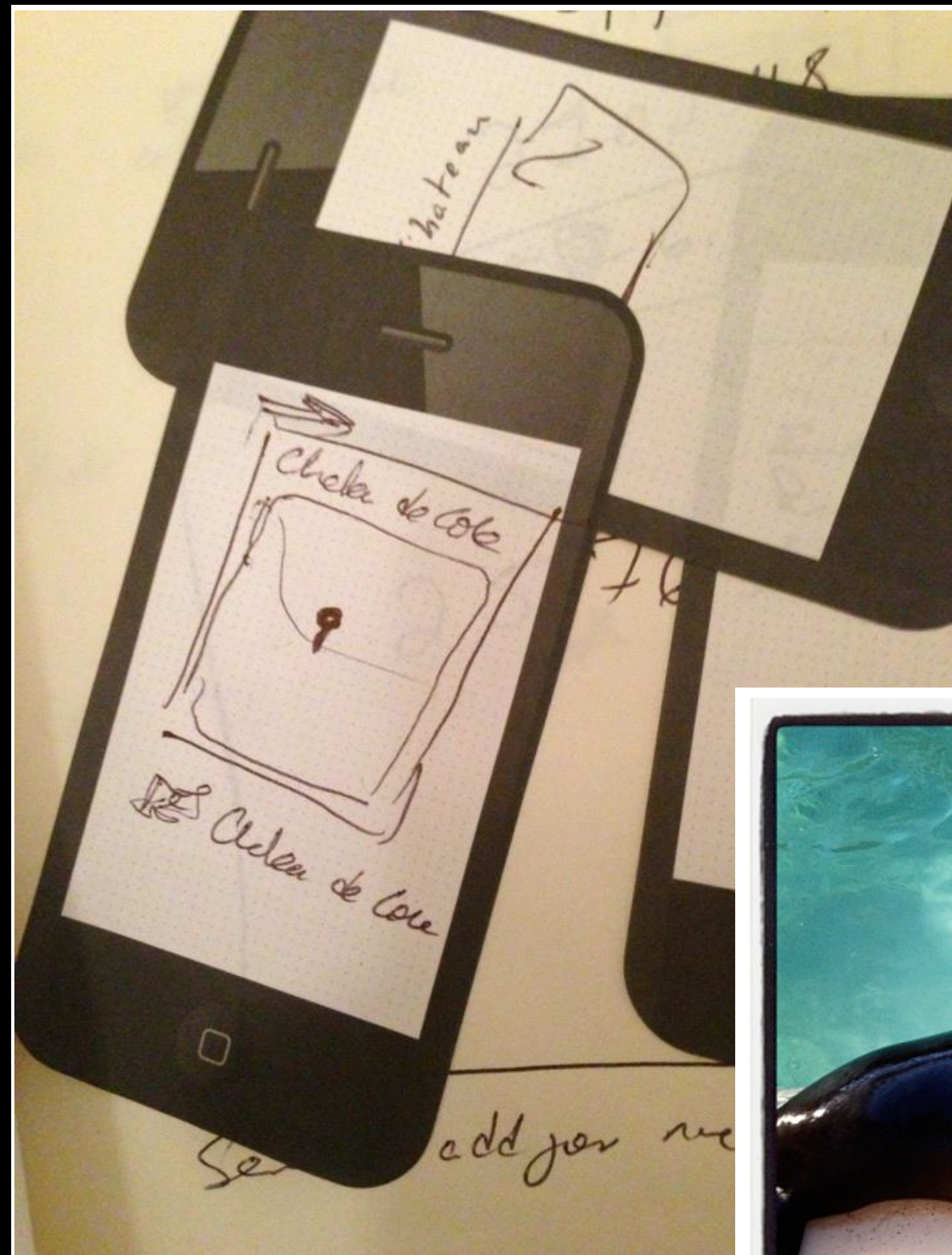
"A negotiation around the valuation criteria" –Jeff Nickerson

How do you 'sketch' a social computing environment? Mike's Burbn experience



If at first you don't succeed...

From MVP to >400m active users



The successes are tremendously exciting



Design creates postcards from the future



from the Lab...



...to the Wild



~40 randomized experiments, median n=520

ASSESSMENT

- Grading feedback
- Interactive scoring checklist
- Verify faster than assess
- Machine-corection of biases
- Automated short answer assessment
- Detailed explanation of bias model

ENGAGEMENT

- Checklists
- Show activity by friends
- Ask intent to complete
- Growth-mindset messages
- Personalized message
- “360 degree” review
- Aggregate peer suggestions

TOOL ADOPTION

- Pro-social reasons
- Instructor Authority
- Saying “Thank you”

IMPROVING ACHIEVEMENT

- Fast feedback
- Early feedback
- Discussion
- Examples of work

DIVERSITY

- Bias against foreign submissions
- Linguistic biases
- Context biases
- Groups with geographic diversity
- Gender balanced discussions

DISCUSSION STRUCTURE

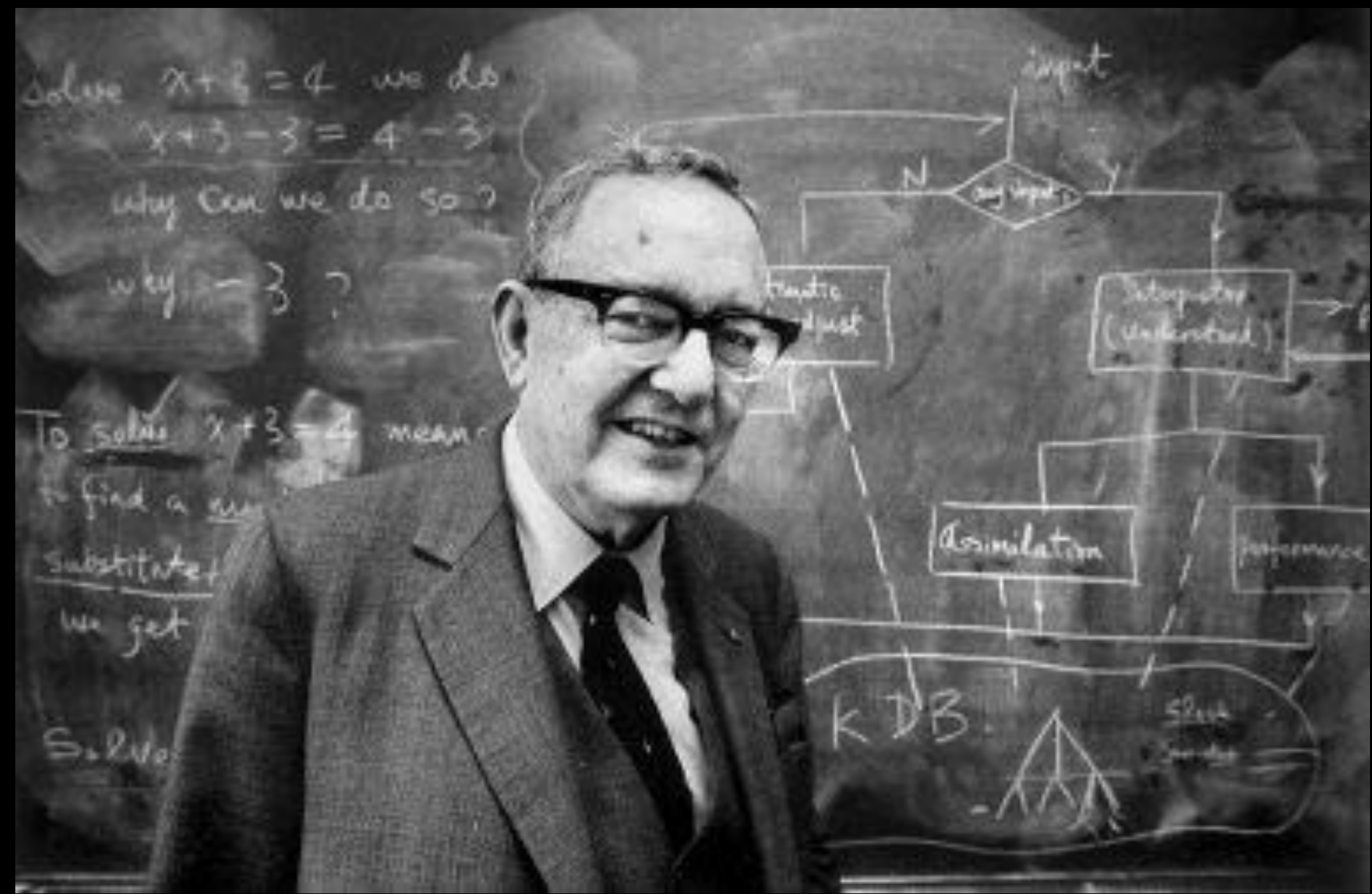
- Persistent vs ad-hoc groups
- Moderators
- Moderation tips
- Enforced scripts



Chinmay Kulkarni
*Best Dissertation,
Stanford CS, 2015*

“Everyone designs who
devises courses of action
aimed at changing existing
situations into preferred ones.”

– *Herb Simon*



Prototyping in real life

James Landay the prototype furniture **Johan Lundin** Cooking and raising children is constant prototyping of methods
Like · Reply · 13 hrs



Almost everything I do that I haven't done before involves prototyping. Just a few examples: (1) took me three revisions to make a Lego stand for my mobile phone. (2) Driving home from a local high school during rush hour required multiple trials to figure out which alternative route to use under various conditions. (3) Cooking a brand of pasta I haven't cooked before took several trial before I got it the way I liked it. (4) Writing a web post: always takes me more drafts than I plan for.

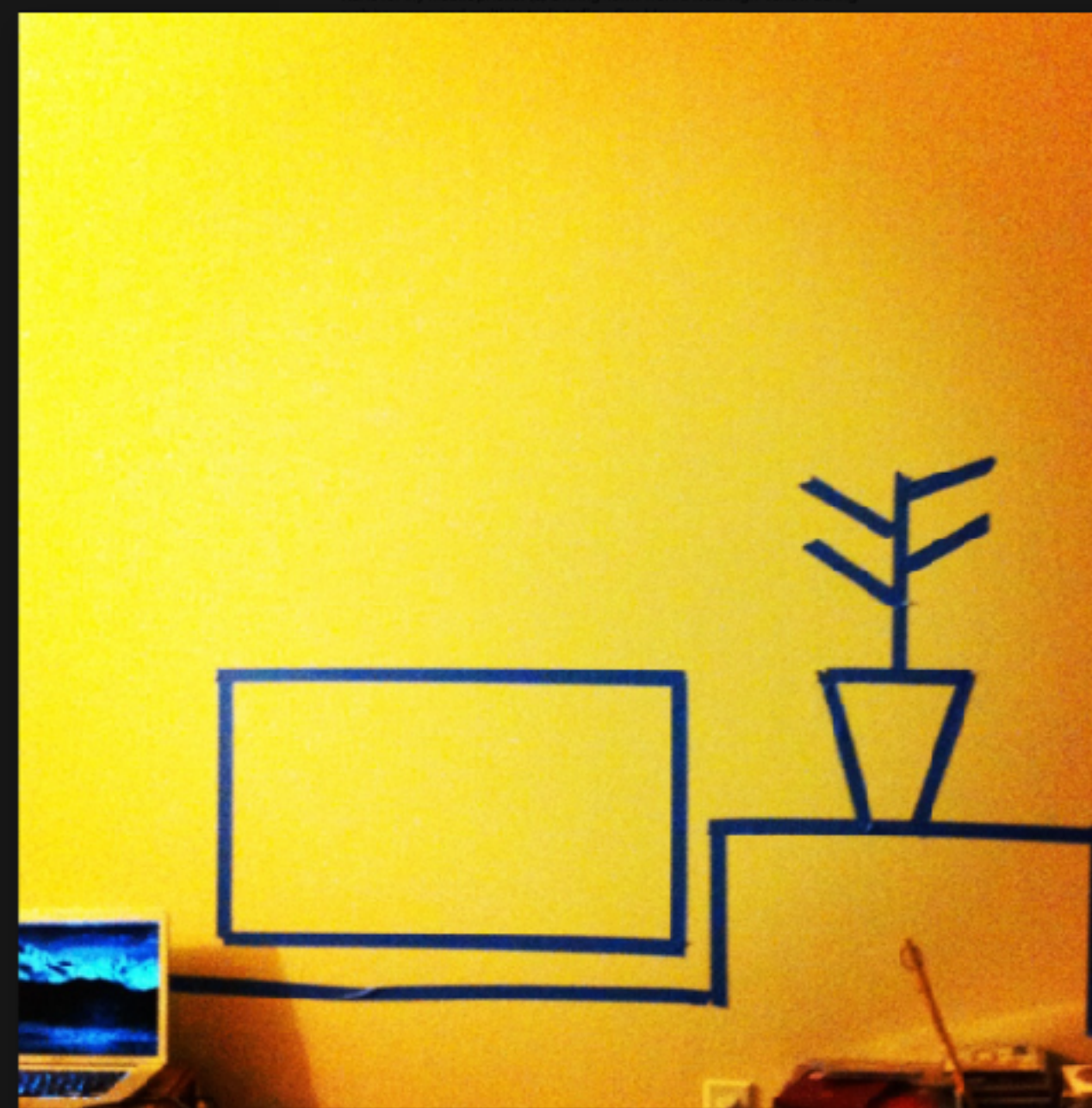
Like · Comment

You like this:

Write a comment...

People You May Know See All

Sivan Zhai (赵思研)
2 mutual friends
Add Friend



Marie Crimetele
16 hrs

prototyping entertainment center with painter's tape in our old apartment. plant included for full effect. this was the winning constellation! happy to send full size (1142x1142) if FB empowers, just let me know.

Like · Comment

You **Alexandria To**, **Truc Nguyen** and **Eenot Hudson** like this

Write a comment...

Suggested Pages See All

What We Drink: a collection of cocktail recipes
Daniel and 14 other friends like this
Like



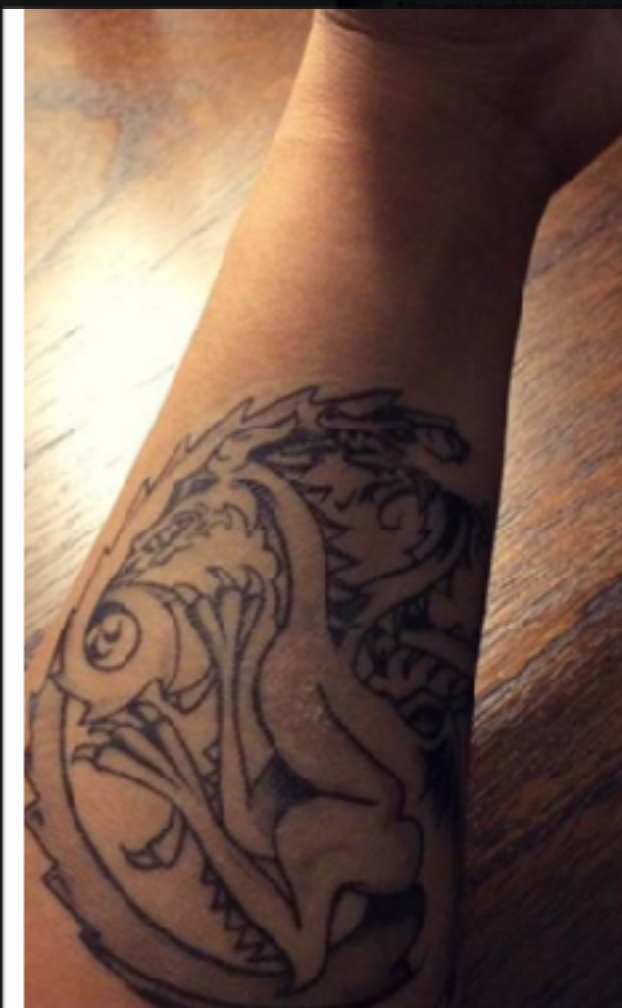
When I remodeled my kitchen, before I started teardown and building I wanted to make sure my design would work. So hearkening to my model airplane days, I built a balsa wood model. It was absolutely necessary. My design involved a complicated roofline, and my drawings did not reveal the subtle interaction between wall height, roof pitch, and skylight positioning.

Like · Comment

Write a comment...

Suggested Pages See All

ACM ITS 2011
Edward and Hided like this
Like



I'm doing long term prototyping. I try a different custom temporary tattoo every other month with the goal of choosing a design and location in a few years for a real one.

Like · Comment

Write a comment...

Suggested Pages See All

Maryanna Rogers Contracting as a prototype for working at a company full time

Maryanna Rogers Prototyped living with my man for 3 months (in Berlin) before moving in together 😊

Joined Big Sisters to prototype parenthood.

Meenal Lele oh and I ikea hacked a standing desk. which taught me that i like sitting

We'll start by telling you that the sequence 2, 4, 8 obeys the rule:

2 4 8 **Obeys the rule**

Now it's your turn. Enter a number sequence in the boxes below, and we'll tell you whether it satisfies the rule or not. You can test as many sequences as you want.

Enter your first sequence here:

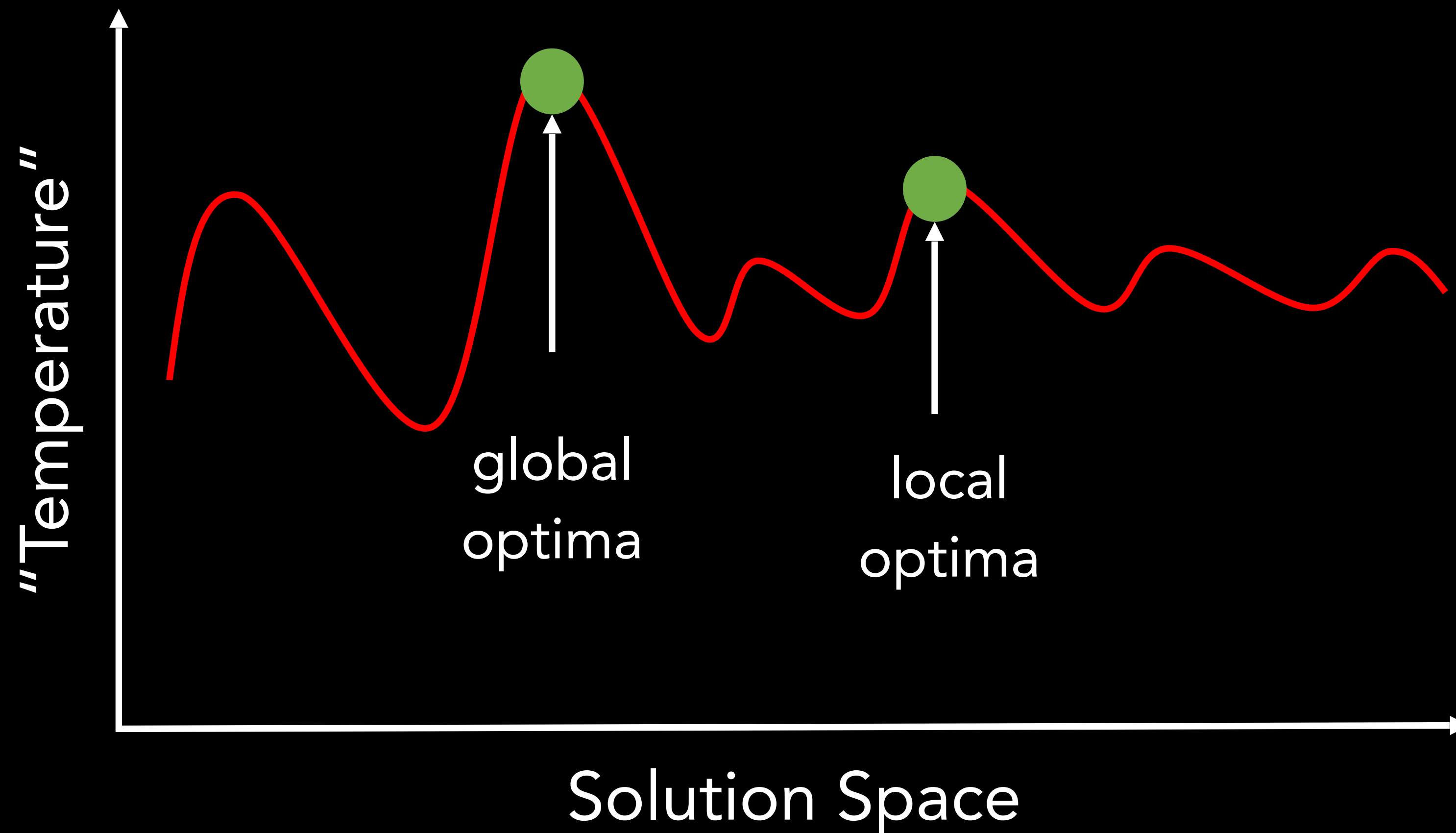
[I don't want to play; just tell me the answer](#)

Participants picked their concept early



“This is the only way to go... I don't see any other way.”

Creativity as simulated annealing: hot & cold thinking



[Kirkpatrick, Gelatt, & Vecchi, 1983; Lucas et al, 2014]

Doubt, Reflection, & Realignment as creativity resources

Research Article

The Wisdom of Many in One Mind

Improving Individual Judgments With Dialectical Bootstrapping

Stefan M. Herzog and Ralph Hertwig

University of Basel

ABSTRACT—*The “wisdom of crowds” in making judgments about the future or other unknown events is well established. The average quantitative estimate of a group of individuals is consistently more accurate than the typical estimate, and is sometimes even the best estimate. Although individuals’ estimates may be riddled with errors, averaging them boosts accuracy because both systematic and random errors tend to cancel out across individuals. We propose exploiting the power of averaging to improve estimates generated by a single person by using an*

sufficient to tap into the power of averaging (e.g., Hogarth, 1978; Johnson, Budescu, & Wallsten, 2001). This phenomenon is known as the *wisdom of crowds* (Surowiecki, 2004).

Thus, the simple prescription for making good forecasts and accurate estimates is as follows: Gather a few predictions or estimates from sources that are likely to differ in their e
issue to which we return shortly) and average them (Armstrong, 2001). Sometimes, however, an individual cannot exploit the wisdom of the crowd—for instance, because other people are not available, there is no time for consultation, or rules prohibit

Creative thinking is increasingly important in education

Will Robots Take Our Children's Jobs?

He said the most vulnerable jobs in the robot economy are those involving predictable, repetitive tasks, however much training they require. “A lot of knowledge-based jobs are really routine — sitting in front of a computer and cranking out the same application over and over, whether it is a report or some kind of quantitative analysis,” he said.

Professions that rely on creative thinking enjoy some protection (Mr. Ford's older son is a graduate student studying biomedical engineering). So do jobs emphasizing empathy and interpersonal communication (his younger son wants to be a psychologist).

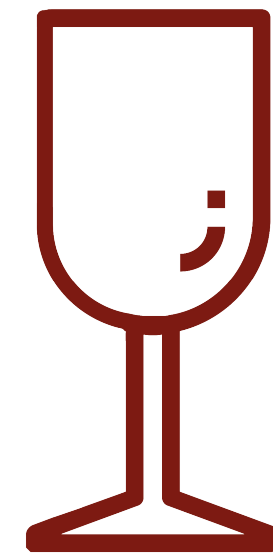
By Alex Williams

Dec. 11, 2017 [Leer en español](#)

Structured comparisons: learning by comparing closely aligned examples

EXPERT

"I'm getting notes of forest floor, pencil shavings, and lots of tannins"



NOVICE

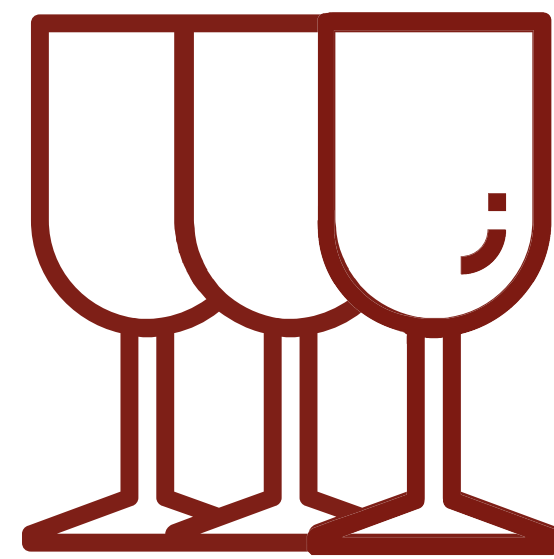
"It just tastes like red wine."

w/Julia Cambre & Chinmay Kulkarni

Structured comparison: learning by comparing closely aligned examples

EXPERT

"I'm getting notes of forest floor, pencil shavings, and lots of tannins"



NOVICE

"The wines differ in sweetness, and the first wine is a bit earthy"

comparison helps us notice
what only experts otherwise see

[Schwartz (*ABCs of How We Learn* '16)]

Juxtapeer: comparative peer review

Compare these two submissions

Note: You cannot edit your review after you submit it, so please consider your responses carefully.

Remember, your feedback should be:

- Specific
- Peer-oriented
- Eye-opening
- Supportive

Step 1: Design an ideal schoolbag for a college-going student

Do the pre-interview sketches give a good idea of the intended design?

Step 2: Interview two other college goers about their bag (not enrolled in this class)

Step 3: Think

Step 4: Redraw

Step 5: Reflect

Overall

Submit review

Flag an Issue

Step 1: Design an ideal schoolbag for a college-going student

1) Outside view

2) Inside View

3) Front pocket view

Labels in sketches include: Easy to hold, Wide straps for easier carrying, Do big pockets with extra pockets, When books, Umbrella, etc., School ID Card, keys, Tissues, Lip balm, Charge, etc., A Pocket in the front pocket for pens, chargers, pens, etc., Pocket for money, Credit cards, Laptop pocket, Fit headphones, Gym bags, glasses in the large pocket.

Step 2: Interview two other college goers about their bag (not enrolled in this class)

Interview Questions:

- Tell me about your schoolbag.
- What do you put in your school bag?
- If there is one thing you would like to change it, what would it be?

Interviewee 1:

A female 1st-year graduate student majoring in applied data science

Step 1: Design an ideal schoolbag for a college-going student

1) dimension should be bigger than a laptop (15")

2) should have a hook to hang it

3) should have a flat bottom that stands

4) sides should be expandable

5) inside of a flap: pen holders for easy reach

* design is the key!
it should be stylish. That's from my experience

Step 2: Interview two other college goers about their bag (not enrolled in this class)

Below is the summary of my two interviews.

Q. What's in your bag?

A. laptop, pencil case, notebook, binders, gym clothes, chargers.

Q. How do you carry smaller items (keys, lip balm, earphones, etc)

A. I put them in my pockets.

Q. Does all your clothes have pockets? What if what you don't have any in your clothes?

10
courses

5
schools

2,178
learners

104
countries

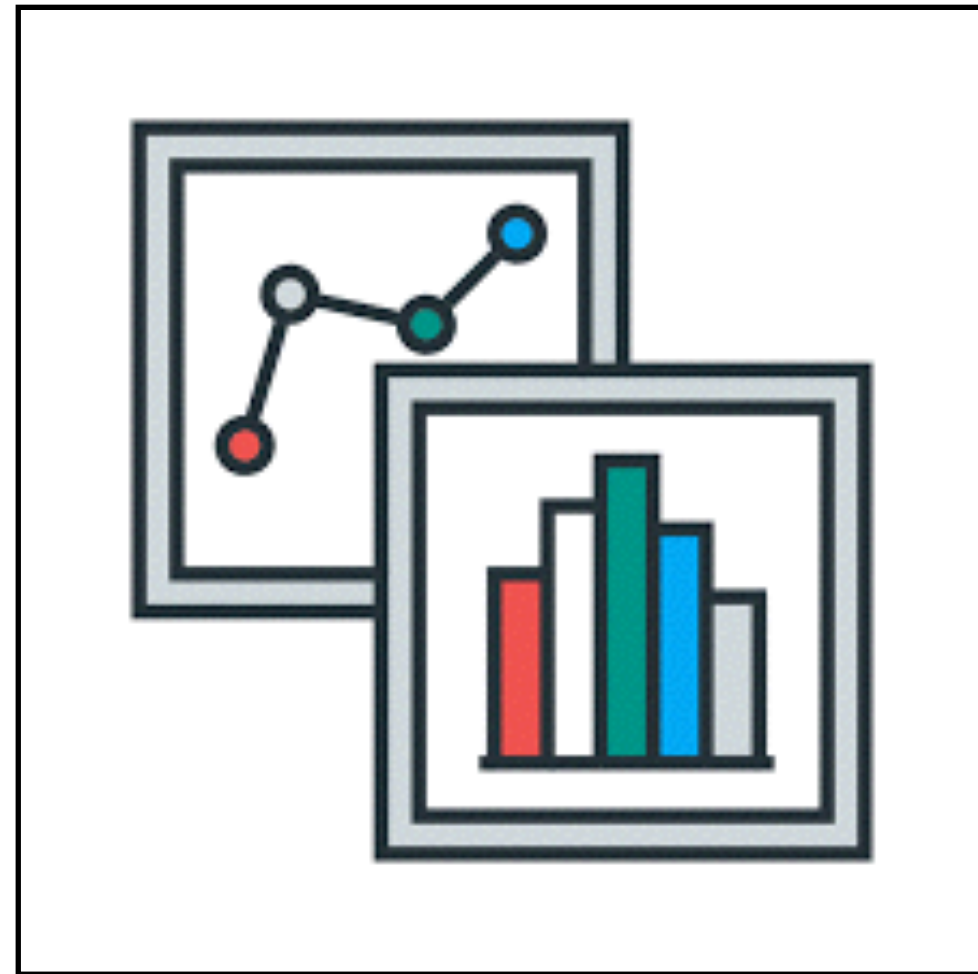
39.3%
from U.S.

Results: comparing peer work helped learners write feedback that was longer, more specific, deep, and likely to use expert terminology

↑	Specificity (+11.6%)	$\chi^2(1) = 9.32, p = 0.011$
↑	Use of expert terminology (+16.4%)	$\chi^2(1) = 13.3, p = 0.0013$
↑	Depth (+0.5 pt)	$Z = 3.10, p = 0.010$
n.s.	Supportive language	$\chi^2(1) = 4.20, p = 0.20$
n.s.	Suggest Action	$\chi^2(1) = 3.45, p = 0.32$
↑	Comment length (+9 words)	$t(596) = 3.34, p = 0.0036$
↑	Time (+1 min)	$t(489) = 3.37, p = 0.0033$
n.s.	Score	$t(403) = -2.03, p = 0.17$

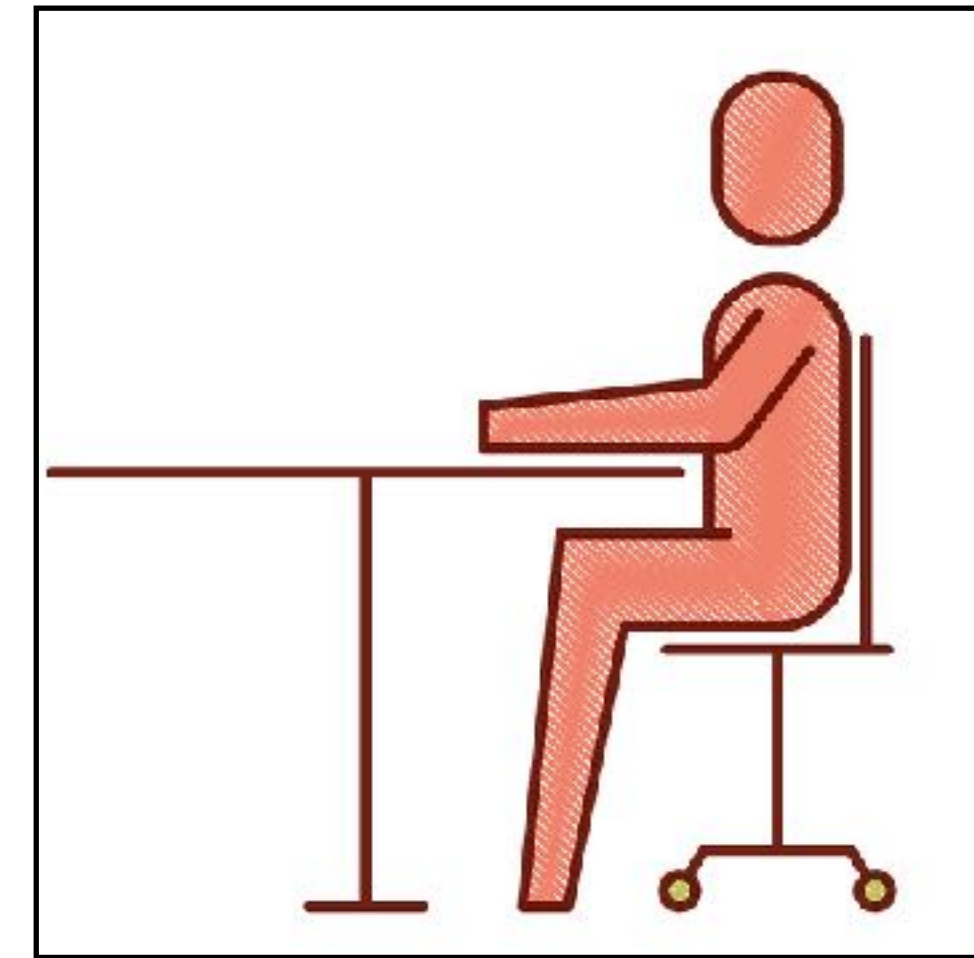
note: we report exact p-values after Bonferroni family-wise correction

Score



meaningful

Location



arbitrary



1 Ingroup
1 Outgroup



1 Ingroup
1 Outgroup

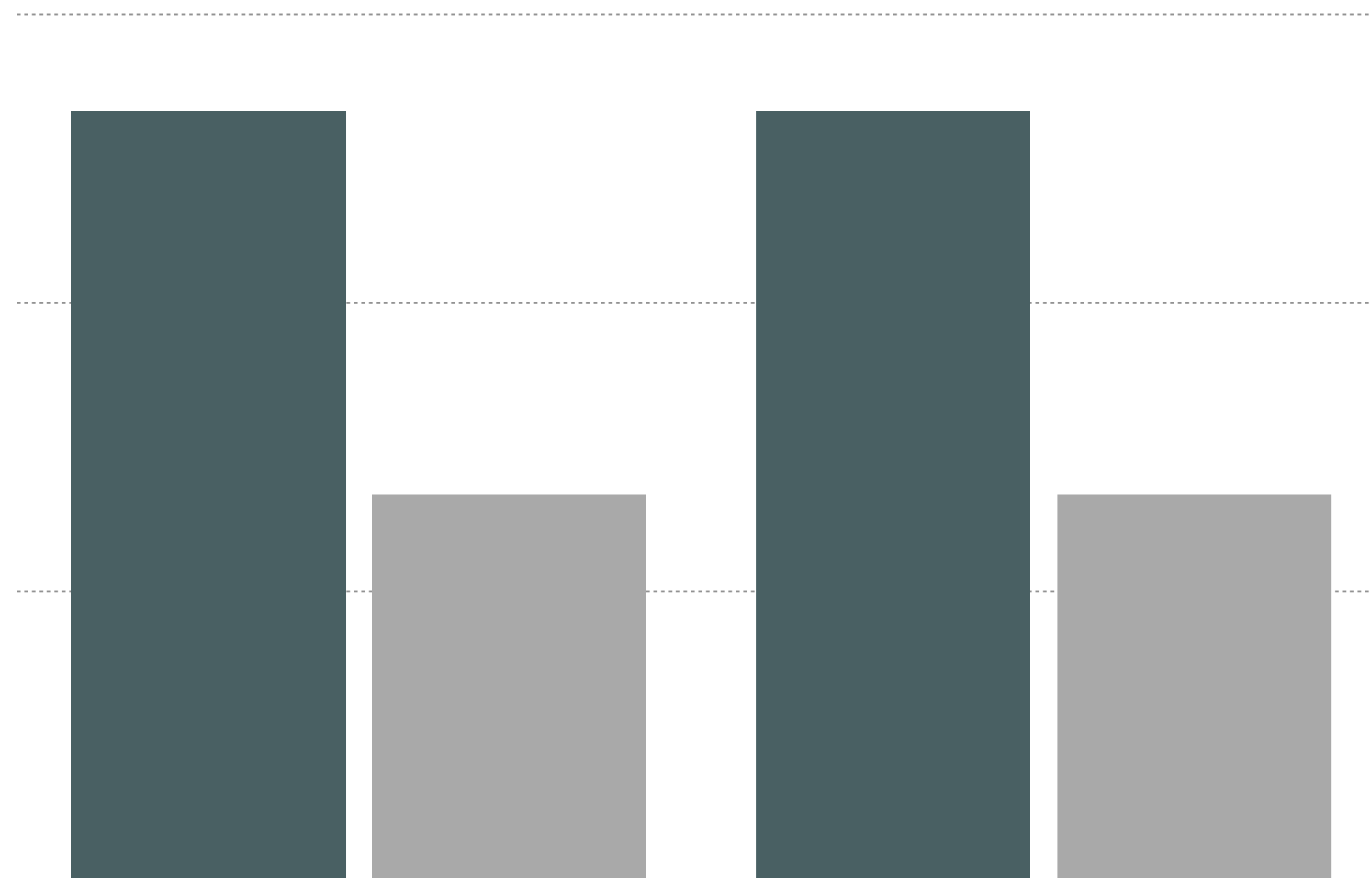
w/Celia Durkin & Federico Rossano (CSCW2018)

hypotheses

■ Ingroup ■ Outgroup

Time Spent

Character Count

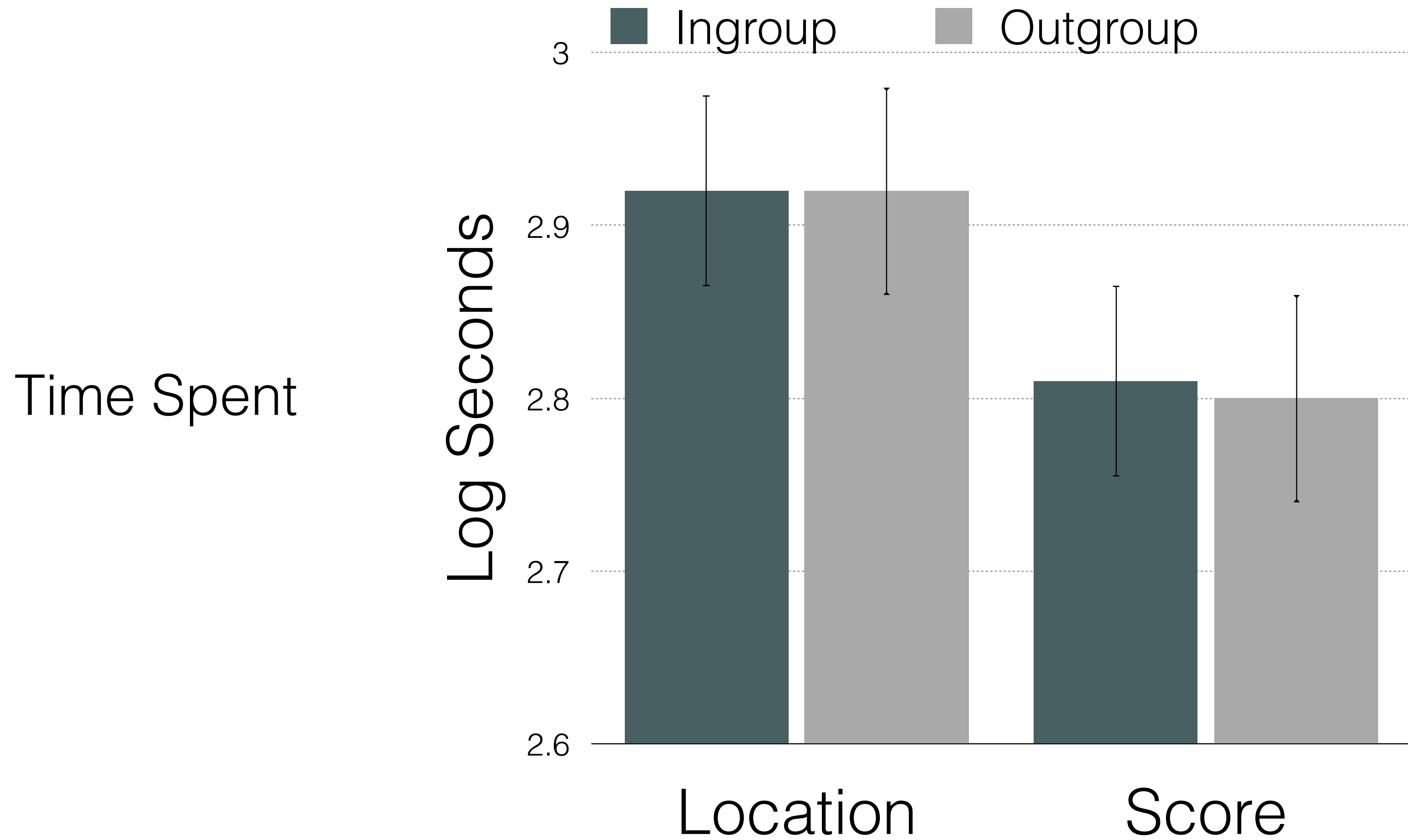


Location

Score

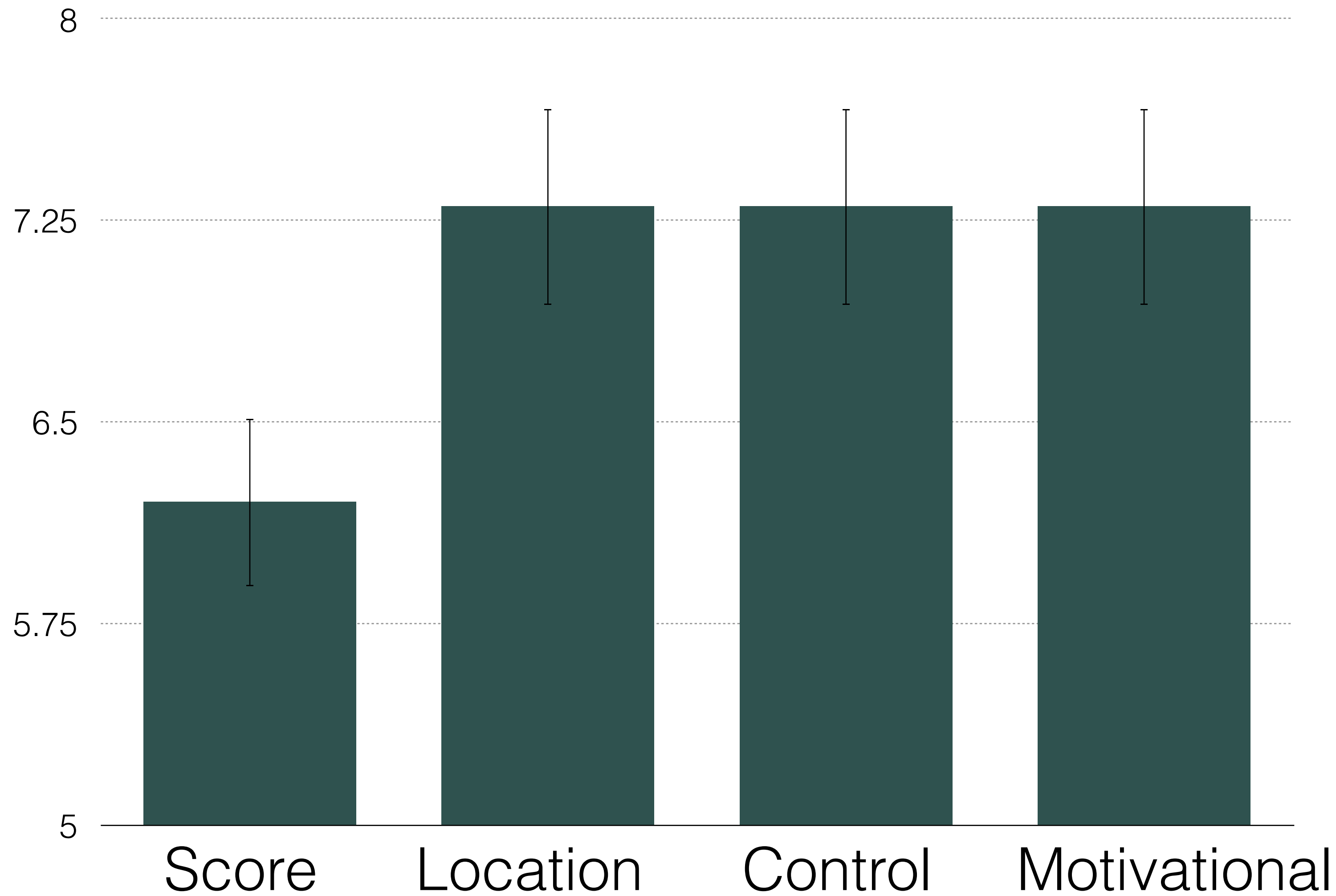
however, we saw neither of these.

Students spend less time when cued by Score



Students grouped by Score graded harsher

Mean Grade on Submission



Vision: Enable internet-scale personally-meaningful scientific work by building online learning systems



Gut Instinct
gutinstinct.ucsd.edu



Start with
an intuition



Design an
experiment



Receive feedback
on your experiment



Run your
experiment

Vineet Pandey, Tushar Koul, Chen Yang, Embriette Hyde, Rob Knight, Scott Klemmer

Scientists and people can learn from and help each other

Historical Perspectives

Self-Experimentation and Its Role in Medical Research

Allen B. Weisse, MD

Although experimentation involving human volunteers has attracted intense study, the matter of self-experimentation among medical researchers has received much less attention. Many questions have been answered only in part, or have been left unanswered. How common is this practice? Is it more common among certain nationalities? What have been the predominant medical fields in which self-experimentation has occurred? How dangerous an act has this proved to be? What have been the trends over time? What is the future likely to bring?

From the available literature, I identified and analyzed 465 documented instances of this practice, performed over the course of the past 2 centuries. Most instances occurred in the United States. The peak of self-experimentation occurred in the first half of the 20th century. Eight deaths were recorded. A number of the investigators enjoyed successful careers, including the receipt of Nobel Prizes. Although self-experimentation by physicians and other biological scientists appears to be in decline, the courage of those involved and the benefits to society cannot be denied. (*Tex Heart Inst J* 2012;39(1):51-4)

Cell Article

Noninvasive Deep Brain Stimulation via Temporally Interfering Electric Fields



COMMUNITY DETAILS

r/tDCS

10.7k Subscribers | 33 Online

A subreddit for discussing the science, technology, construction, and use of noninvasive brain stimulators.

SUBSCRIBE

CREATE POST

People's insights can help scientists discover novel ideas

Scientific research can better inform people's discussions

Allen B Weisse. 2012. Self-experimentation and its role in medical research. From the Texas Heart Institute of St. Luke's Episcopal Hospital, Texas Children's Hospital 39, 1. https://www.reddit.com/r/tDCS/comments/6epvs8/researchers_invent_new_method_for_noninvasive

Understanding the human microbiome requires insights into people's lifestyles

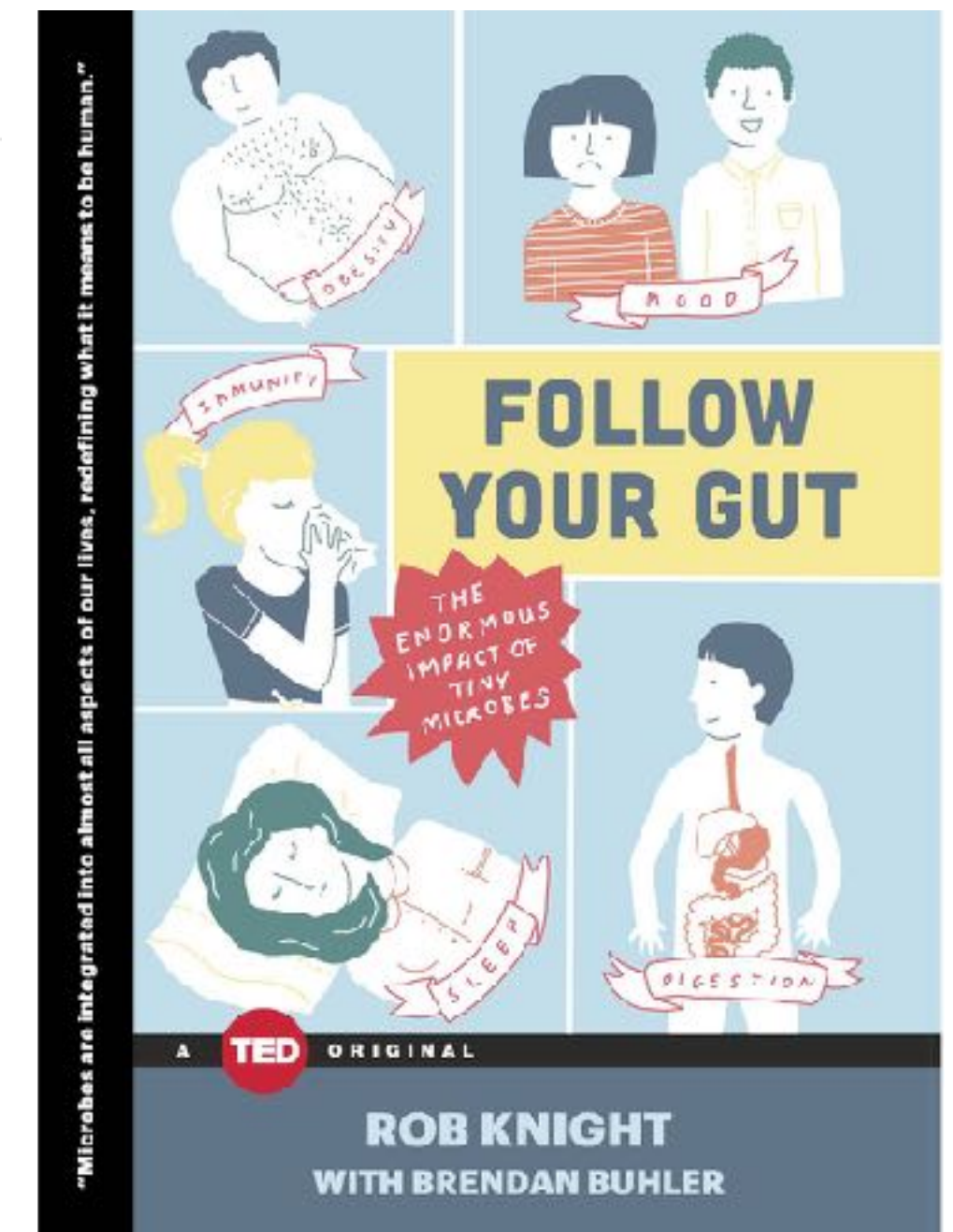
A Baffling Brain Defect Is Linked to Gut Bacteria,

By GINA KOLATA MAY 10, 2017



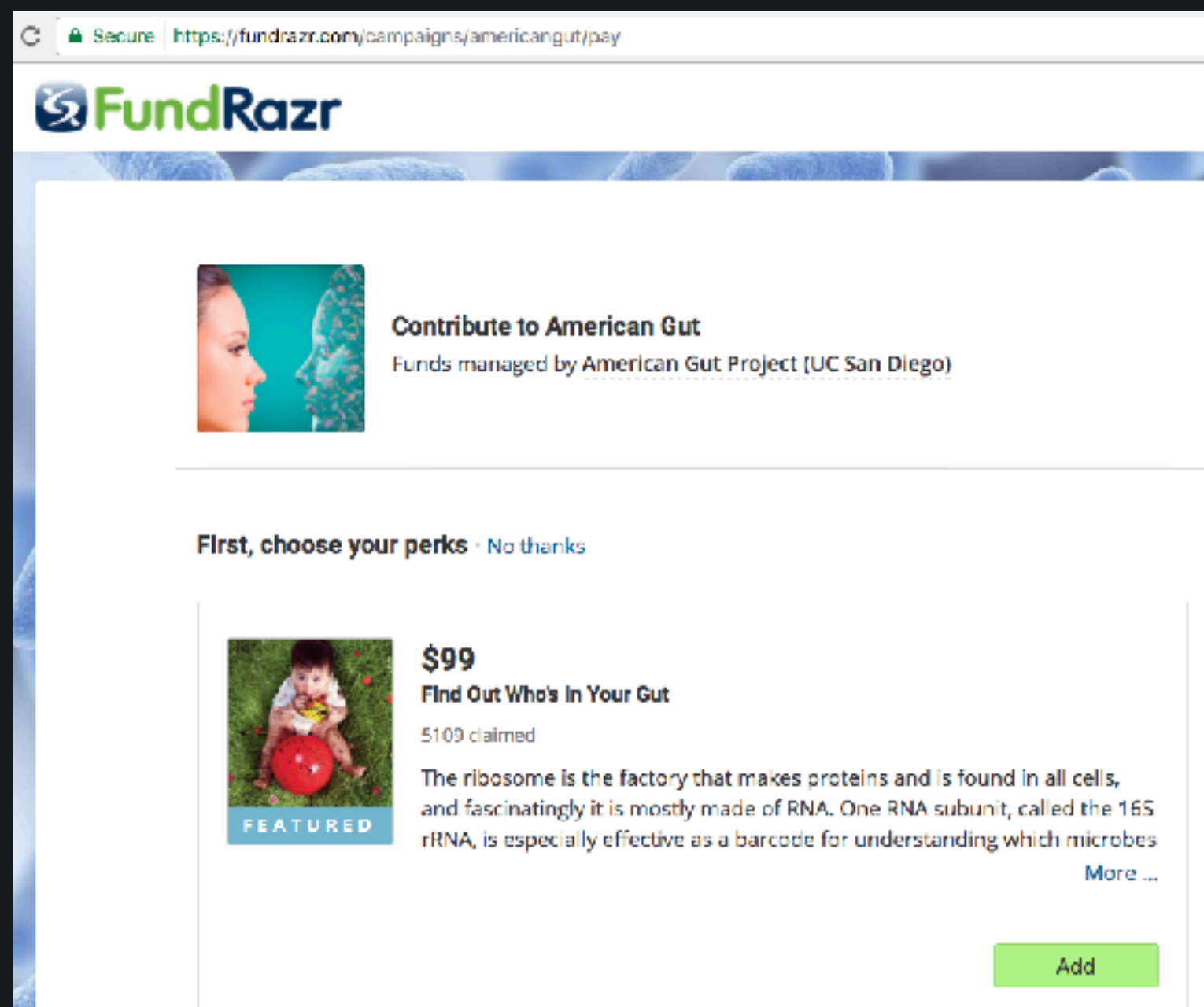
Are Pets the New Probiotic?

By RICHARD SCHIFFMAN JUNE 6, 2017



[Flegr et al. 1996] Induction of changes in human behaviour by the parasitic protozoan *Toxoplasma gondii*. Flegr J1, Zitková S, Kodym P, Frynta D. Parasitology 1996.

UC San Diego's American Gut is the world's largest microbiome citizen science project



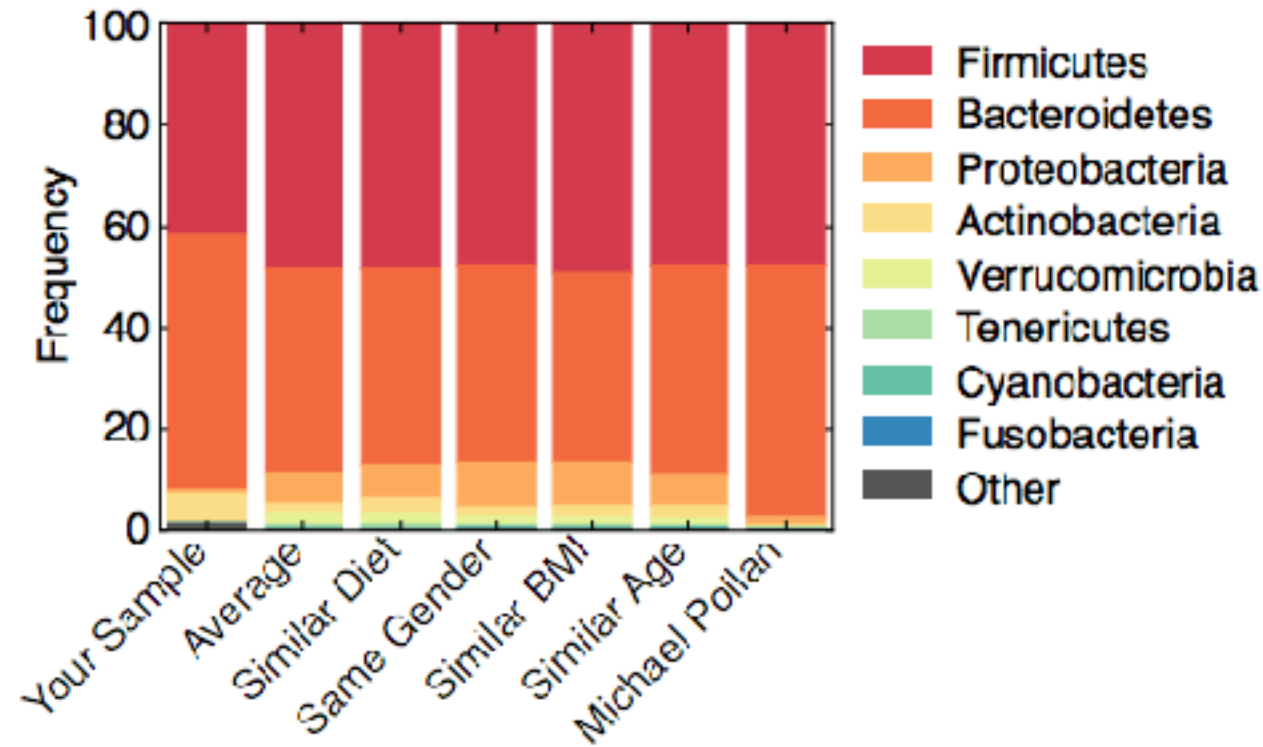
1: Create an online account and support the project



2: Send in your fecal/oral/skin samples using AGP provided swabs

americangut.org

What's in your American Gut sample?



Your most abundant microbes:

Taxonomy	Sample
Genus <i>Prevotella</i>	50.1%
Family Lachnospiraceae	12.0%
Family Ruminococcaceae	6.4%
Genus <i>Faecalibacterium</i>	5.8%

Your most enriched microbes:

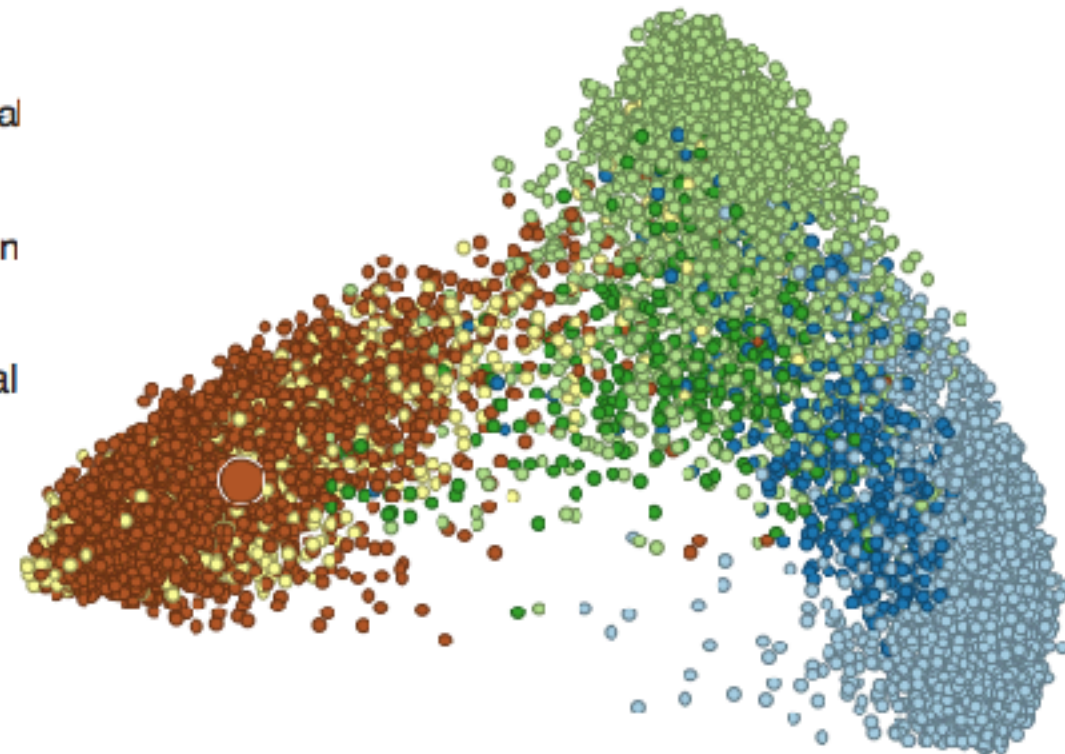
Taxonomy	Sample	Population	Fold
Genus <i>Slackia</i>	0.09%	0.01%	9x
Family Victivallaceae	1.04%	0.02%	60x
Family Lachnospiraceae	12.00%	6.98%	2x
cont. Genus <i>Eubacterium</i>	1.02%	0.28%	4x

Your sample contained the following rare taxa: Unclassified Family Microbacteriaceae, Genus *Pseudoclavibacter*.

How do your gut microbes compare to others?

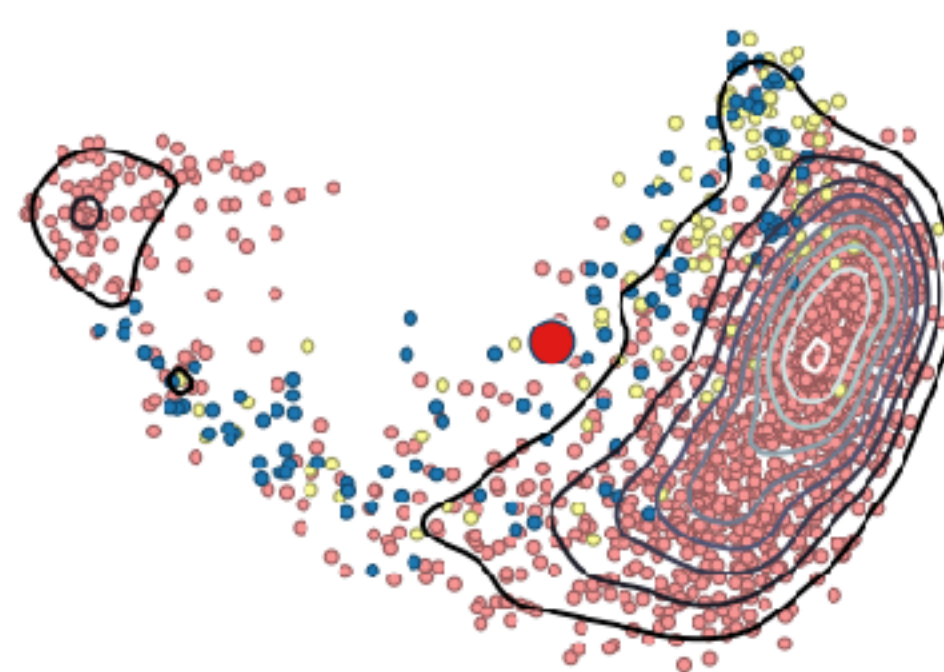
● Your sample is here ● Others ○ Unspecified

- AGP Fecal
- HMP/other Focal
- AGP Skin
- HMP/other Skin
- AGP Oral
- HMP/other Oral



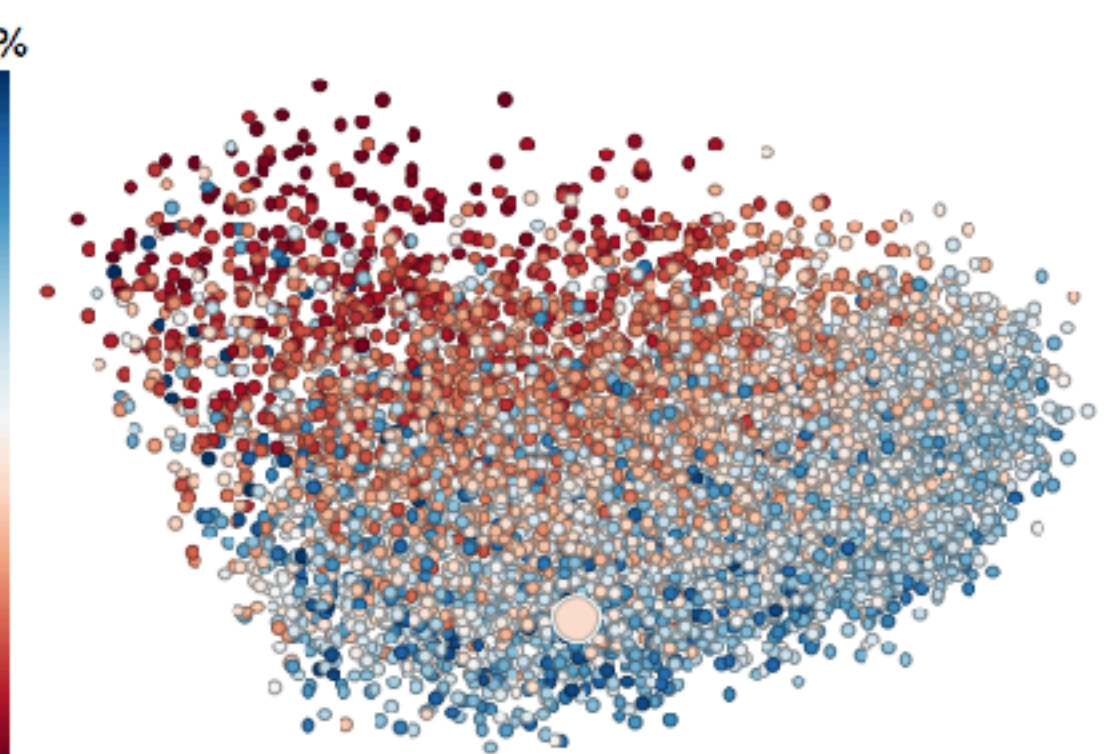
Different Body Sites

- Your Country
- Western Diet
- Amerindians
- Malawians



Different Nationalities

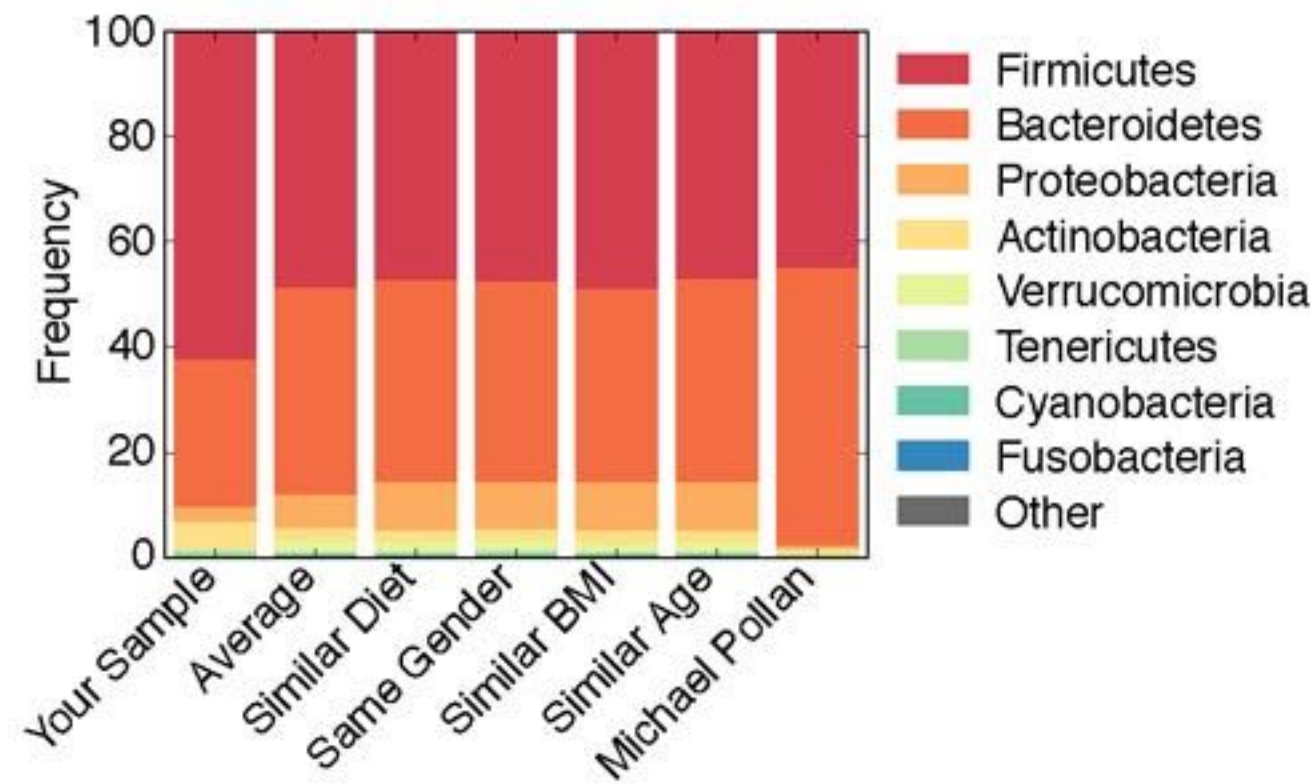
99%
Firmicutes Abundance
0%



The American Gut Population

SCOTT KLEMMER

What's in your American Gut sample?



Your most abundant microbes:

Taxonomy	Sample
Genus <i>Bacteroides</i>	18.3%
Order Clostridiales	11.3%
Family Ruminococcaceae	10.4%
Genus <i>Faecalibacterium</i>	9.8%

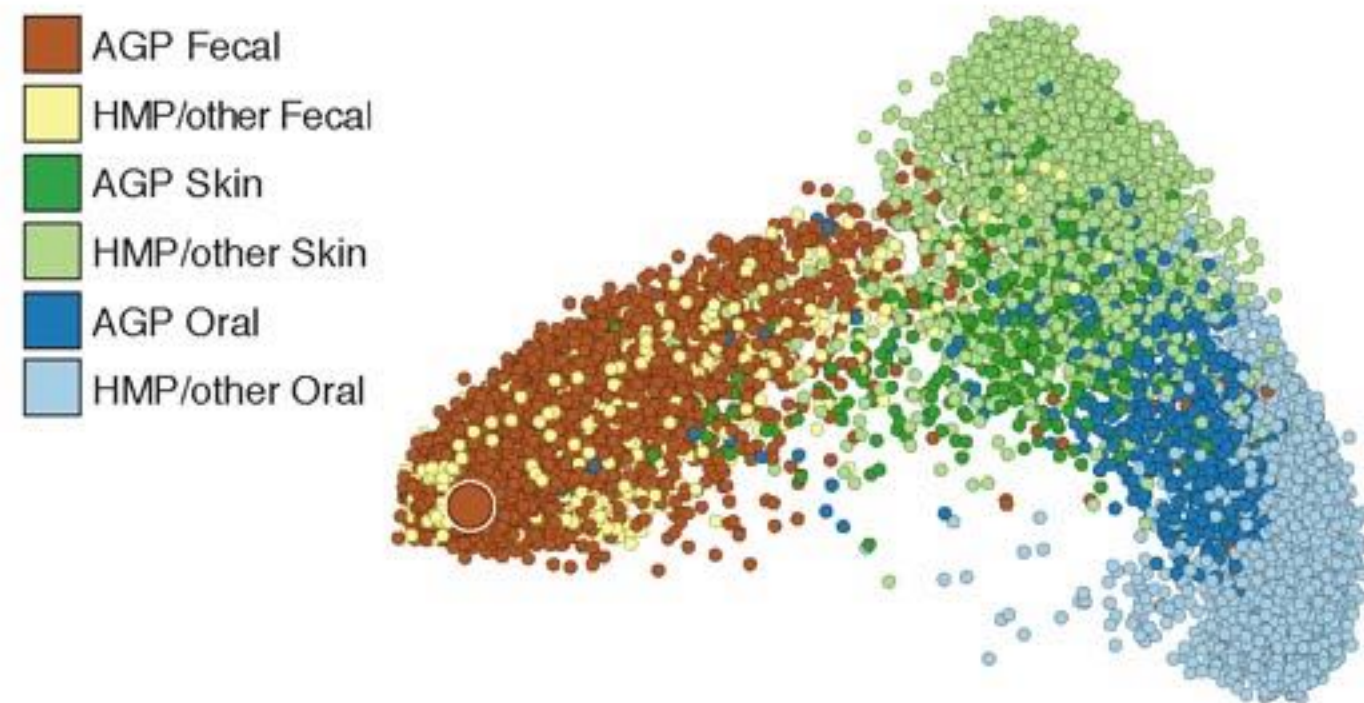
Your most enriched microbes:

Taxonomy	Sample	Population	Fold
Genus <i>Pseudoclavibacter</i>	0.25%	0.00%	63x
Genus <i>Brevibacterium</i>	0.44%	0.01%	33x
Genus <i>Faecalibacterium</i>	9.75%	6.83%	1x
Genus <i>Roseburia</i>	2.55%	1.04%	2x

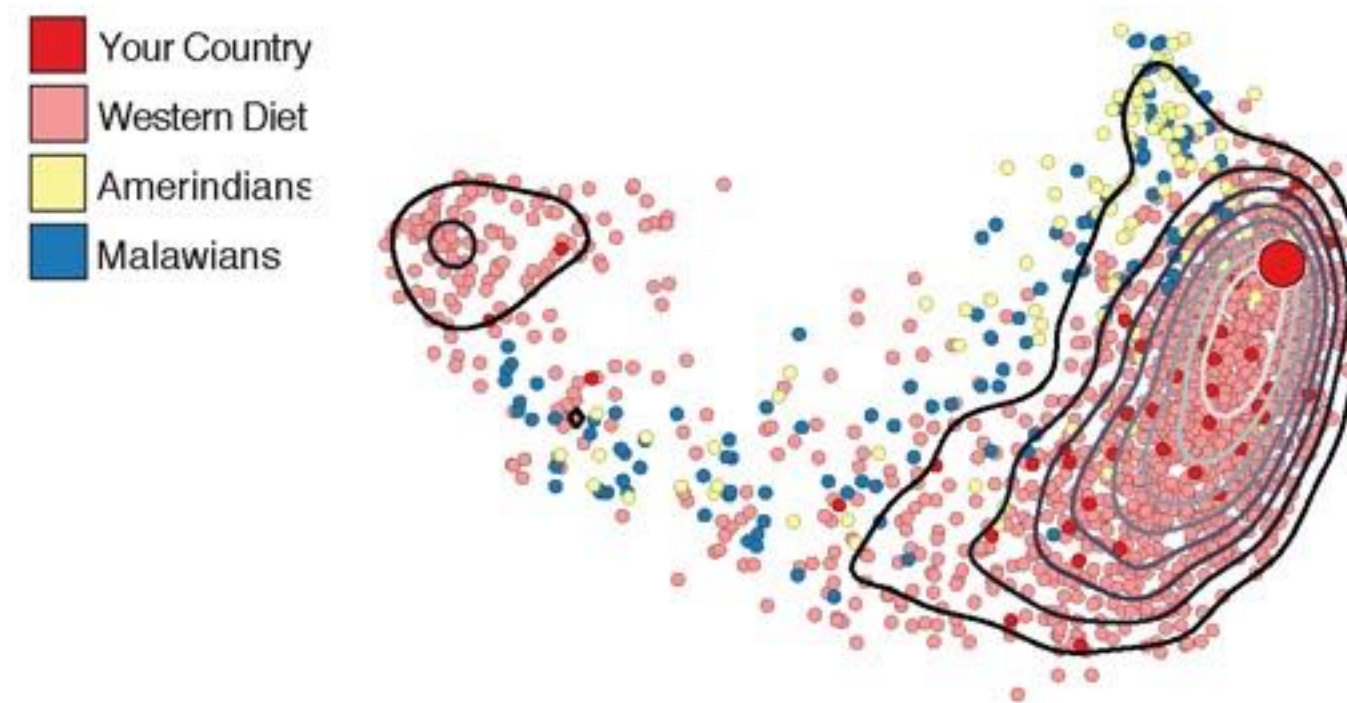
Your sample contained 13 rare taxa, including the following: Genus *Brevibacterium*, Genus *Dermabacter*, Genus *Kytococcus*, Genus *Pseudoclavibacter*, Genus *Micrococcus*.

How do your gut microbes compare to others?

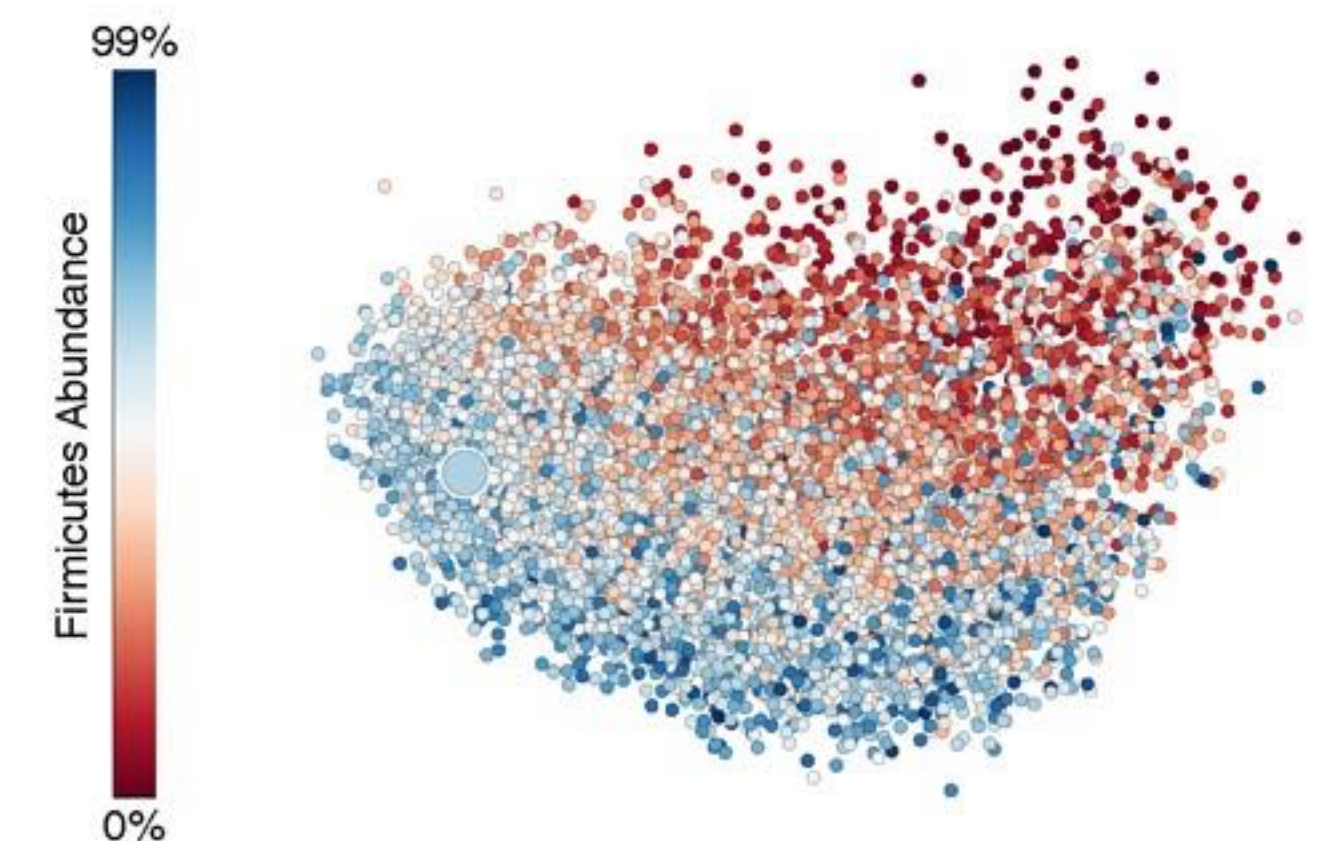
● Your sample is here ● Others ● Unspecified



Different Body Sites



Different Nationalities

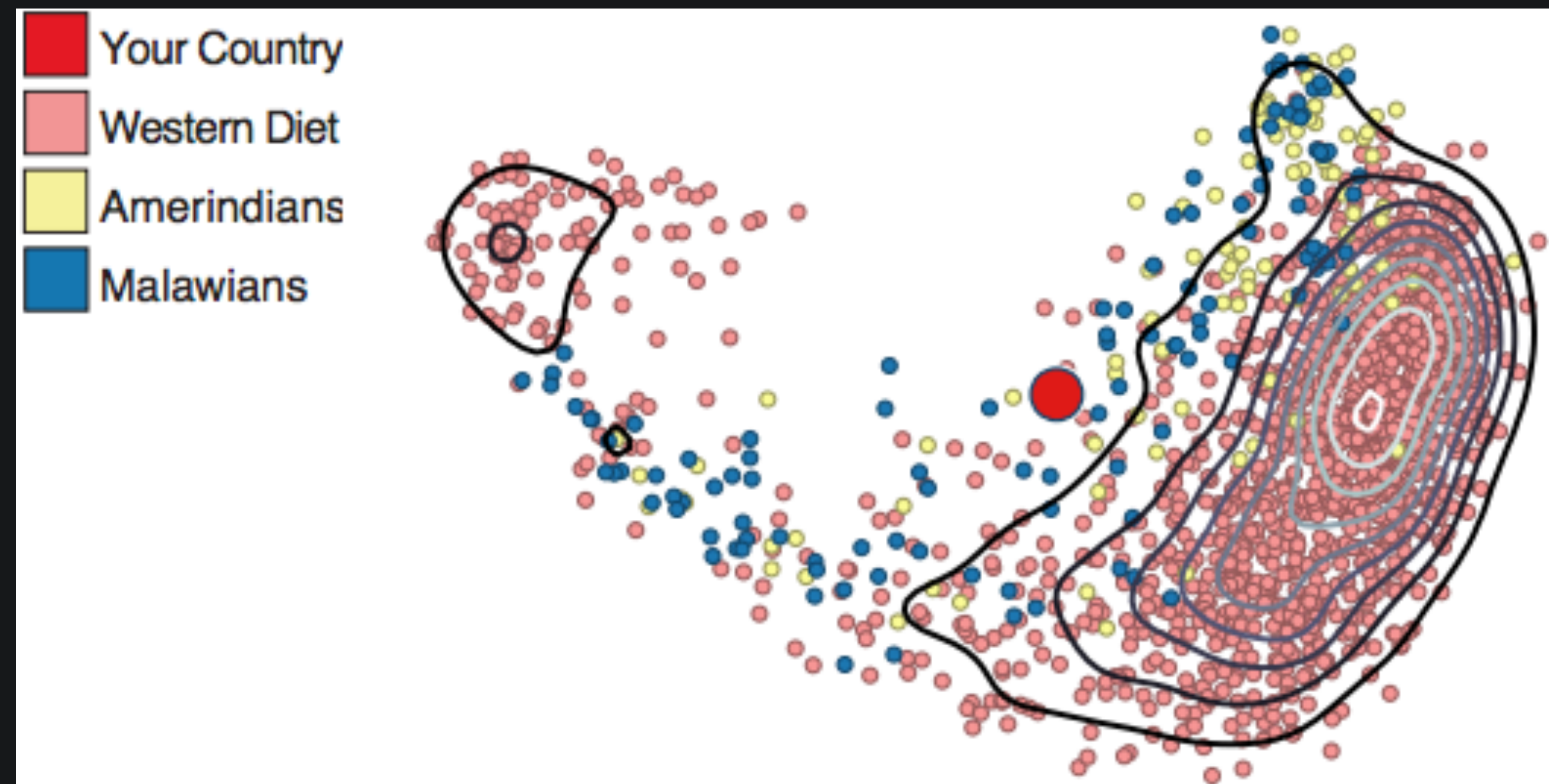


The American Gut Population

Participants generate hypotheses by looking at the data

Vineet wondered...

1. My diet is vegetarian?
2. I am of Indian descent?
3. I grew up in India?



Scientists and people can learn from and help each other (microbiome edition)

Antibiotics Weren't Used to Cure These Patients. Fecal Bacteria Were.

In a small study, doctors used so-called fecal transplants to treat a serious gut infection in patients. The transplants, from healthy donors, were as effective as antibiotics.

By Gina Kolata

June 2, 2018



Fecal transplants help improve C.Difficile condition

<https://www.nytimes.com/2018/06/02/health/fecal-transplants-bacteria-antibiotics.html>

TECH & SCIENCE

DIY FECAL TRANSPLANTS ARE DANGEROUS AND COULD TRANSMIT HIV, DOCTORS WARN

BY MELISSA MATTHEWS ON 2/17/18 AT 8:00 AM

Sham Poo Washes Out

A bacterial pill that tried to duplicate the benefits of a fecal transplant has failed a clinical trial. What does that mean for the microbiome field?

ED YONG | AUG 1, 2016 | SCIENCE

Ill-advised fecal transplants can do long-term harm

<http://www.newsweek.com/diy-fecal-transplants-are-dangerous-and-could-transmit-hiv-doctors-warn-810003>

What science most benefits from lived experiences?

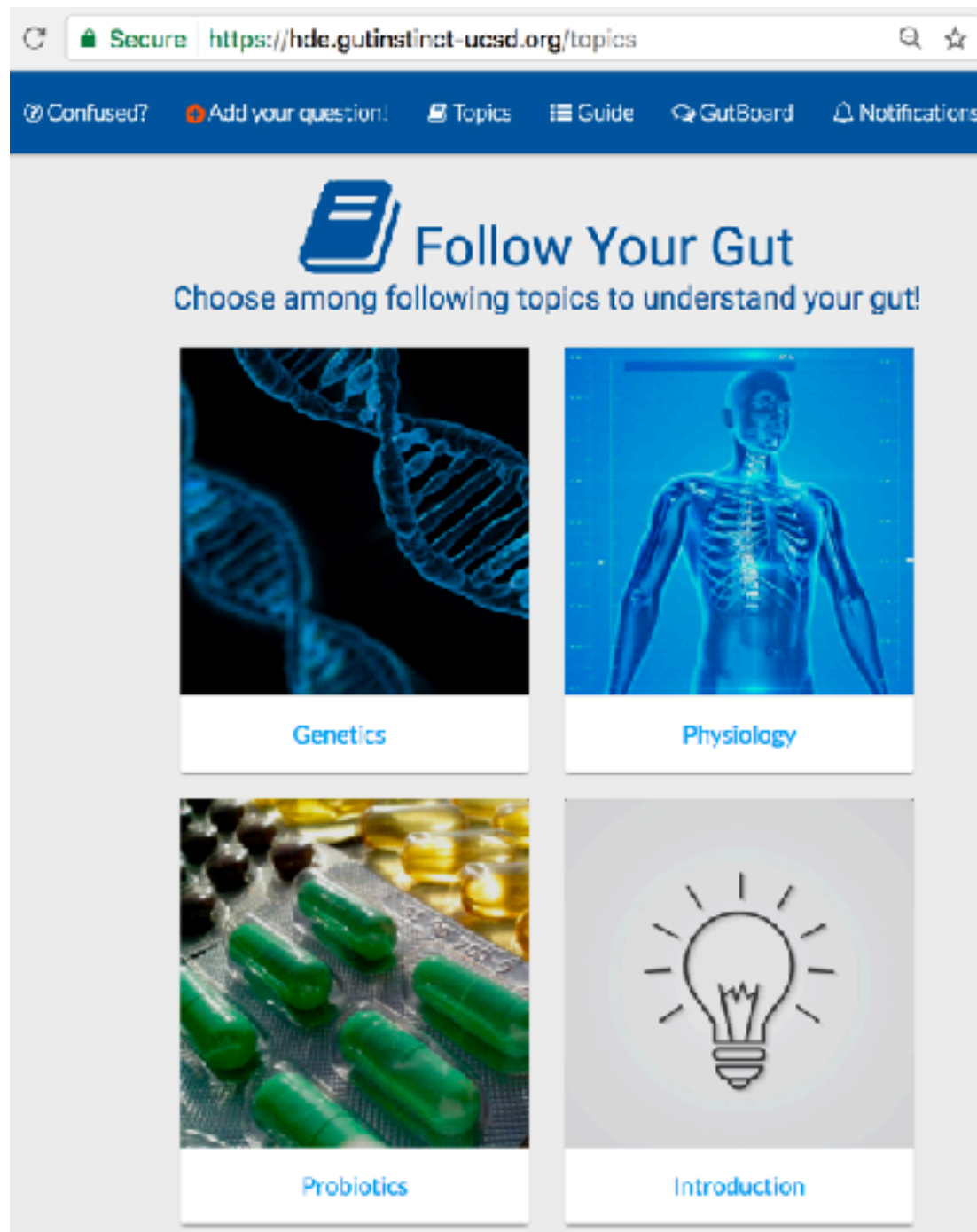
Domains that are

Nascent Experts know little

Contextual Huge individual differences

Motivating People care

3: Ask questions



Learn

43

5. Check the criteria

Make sure that the combination of your top-level and follow-up questions meets the Gut Instinct criteria!

- Answerable?**
Others should be able to answer your question
- Definite?**
A good question includes a clear timeframe
- Links a cause with an effect?**
Your question should attempt to link an activity with a specific result, allowing others to agree/disagree and share their insights
- Operational?**
Your question should avoid ambiguous terms that might be difficult to understand for most people
- Simple?**
A good question is simple to read, to understand, and to answer

Train

Dive deeper with these follow-up questions!

What type of alcoholic drinks (ex wine, beer, liquor, mixed with sugar) affect your bowel movements?

- wine
- beer
- liquor
- sugary mixed drinks
- [Add my option](#)

[Save my choice\(s\)](#)

[Skip](#)

How many drinks does it take to notice a difference in your bowel movements?

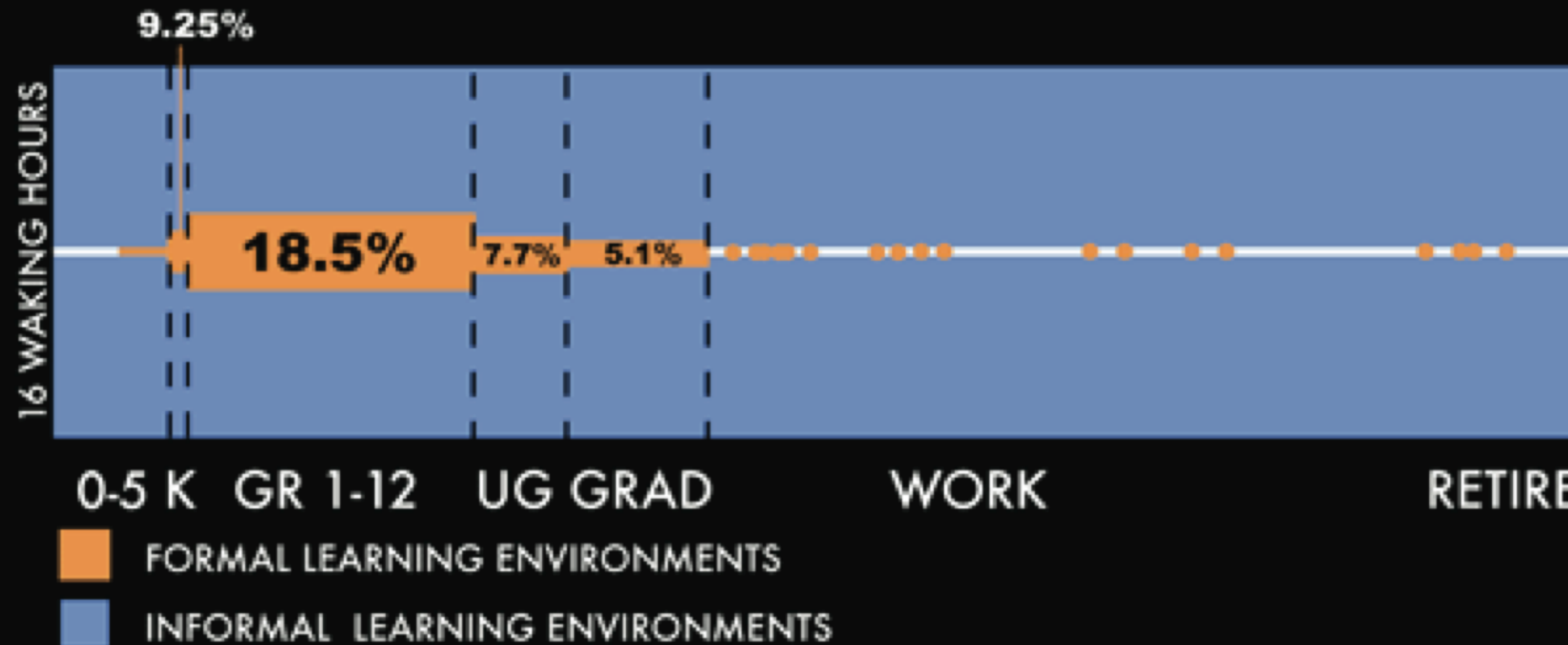
- 1-2
- 3-4
- 5+
- [Add my option](#)

[Save my choice\(s\)](#)

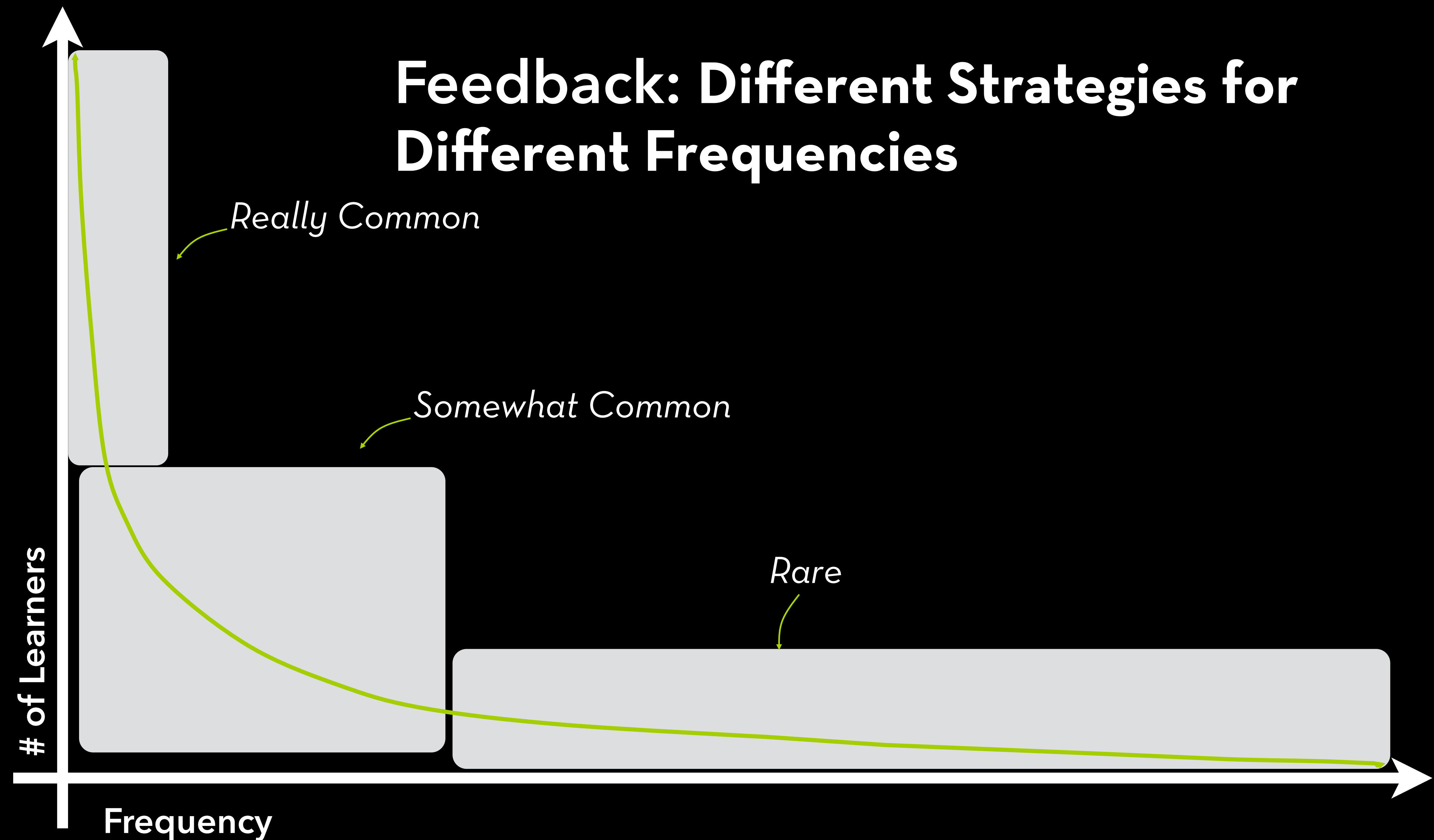
[Skip](#)

Ask

LIFELONG AND LIFEWIDE LEARNING

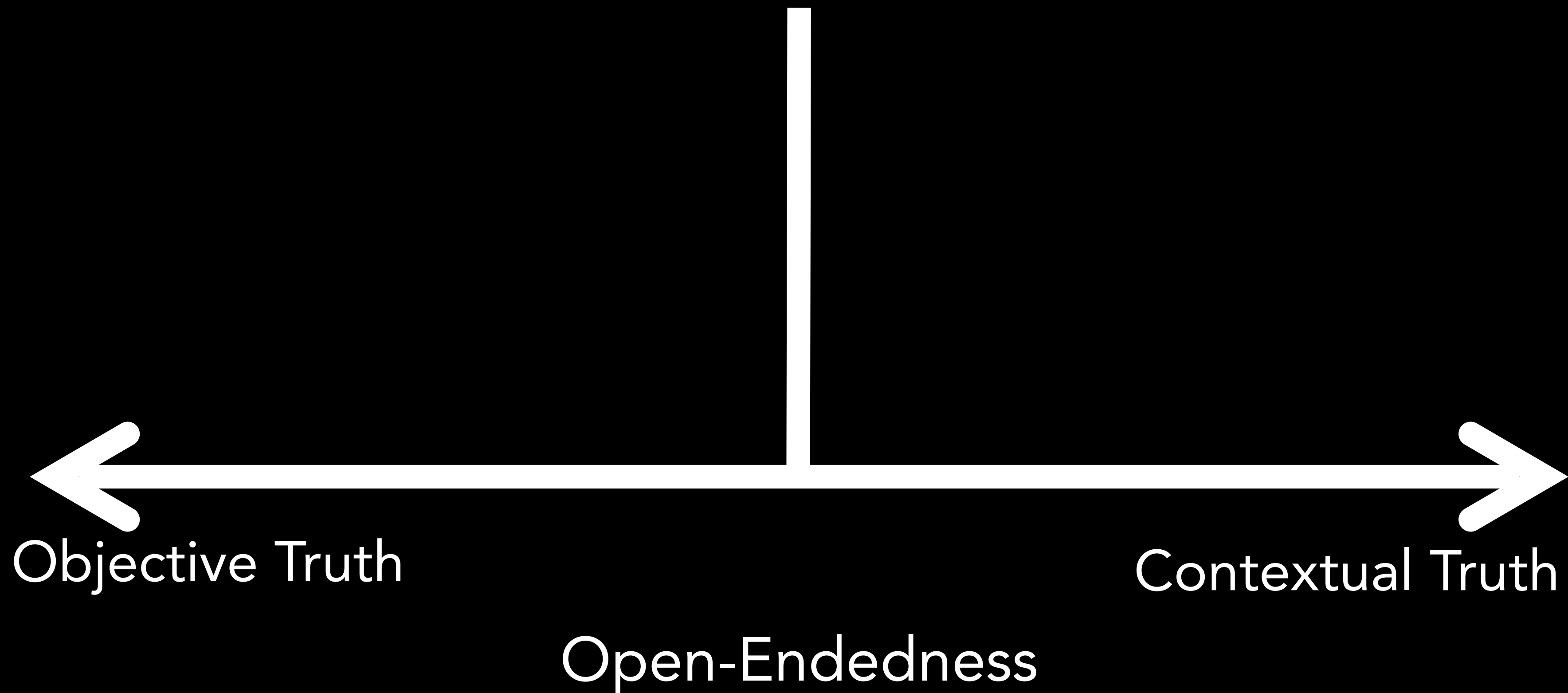


Feedback: Different Strategies for Different Frequencies



Truth Crispness: Where is Science?

h/t Eva Tardos



Scott Klemmer

 @DesignAtLarge

Sebastian Thrun
Co-founder, CEO Udacity
Educating Millions Online - A Revolution?
October 1, 2014

Wendy Ju
Executive Director
Interaction Design Research at
Stanford's Center for Design Research
Creating Connections
October 6, 2014

David Kirsh
Cognitive Science, UCSD
Thinking with your Body and Other Things
October 15, 2014

Iara Knight
UCSD Theatre and Dance
Designer Framings
October 22, 2014

Judith Donath
Harvard Berkman Faculty Fellow
Designer Framings
October 27, 2014

Gad Shaanan
Gadlight, Inc.
The #1 factor in great design is STRATEGY!
Without it, design is a commodity
November 3, 2014

Krzysztof Gajos
Intelligent Interactive Systems Group
Harvard
November 12, 2014

Carlos Olguin
Head of
Bio/Nano/Programmable Matter Group
Autodesk Research
Programming Matter
Across Domains and Scales
November 19, 2014

Alvy Ray Smith
Lucasfilm/Pixar/Altamira Software
From Pixels to Pixar
November 24, 2014

Jordan Crandall
Arts and Humanities Chair
Panel Discussion on Maker Spaces
December 3, 2014

Cristina Della Coletta
Dean of Arts and Humanities
Panel Discussion on Maker Spaces
December 3, 2014

Al Pisano
Dean, Jacobs School of Engineering
& Friends
Panel Discussion on Maker Spaces
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Richard Kenvin
Surf Historian, Exhibition Curator
Surf Craft
December 10, 2014