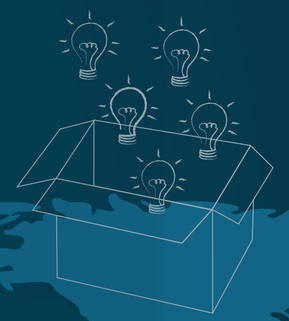
Learning through Collective Intelligence

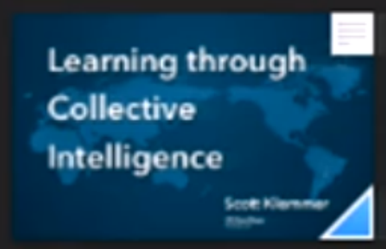


Scott Klemmer

UC San Diego
The Design Lab

Harvard Graduate School of Architecture

1



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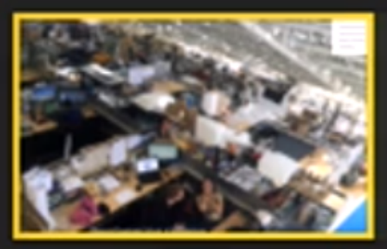

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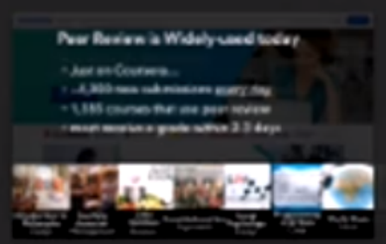

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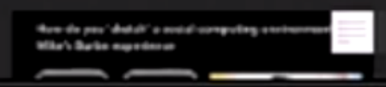
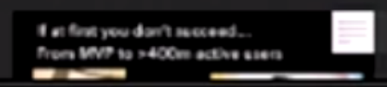
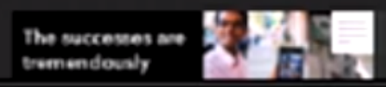
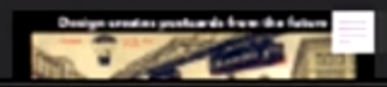


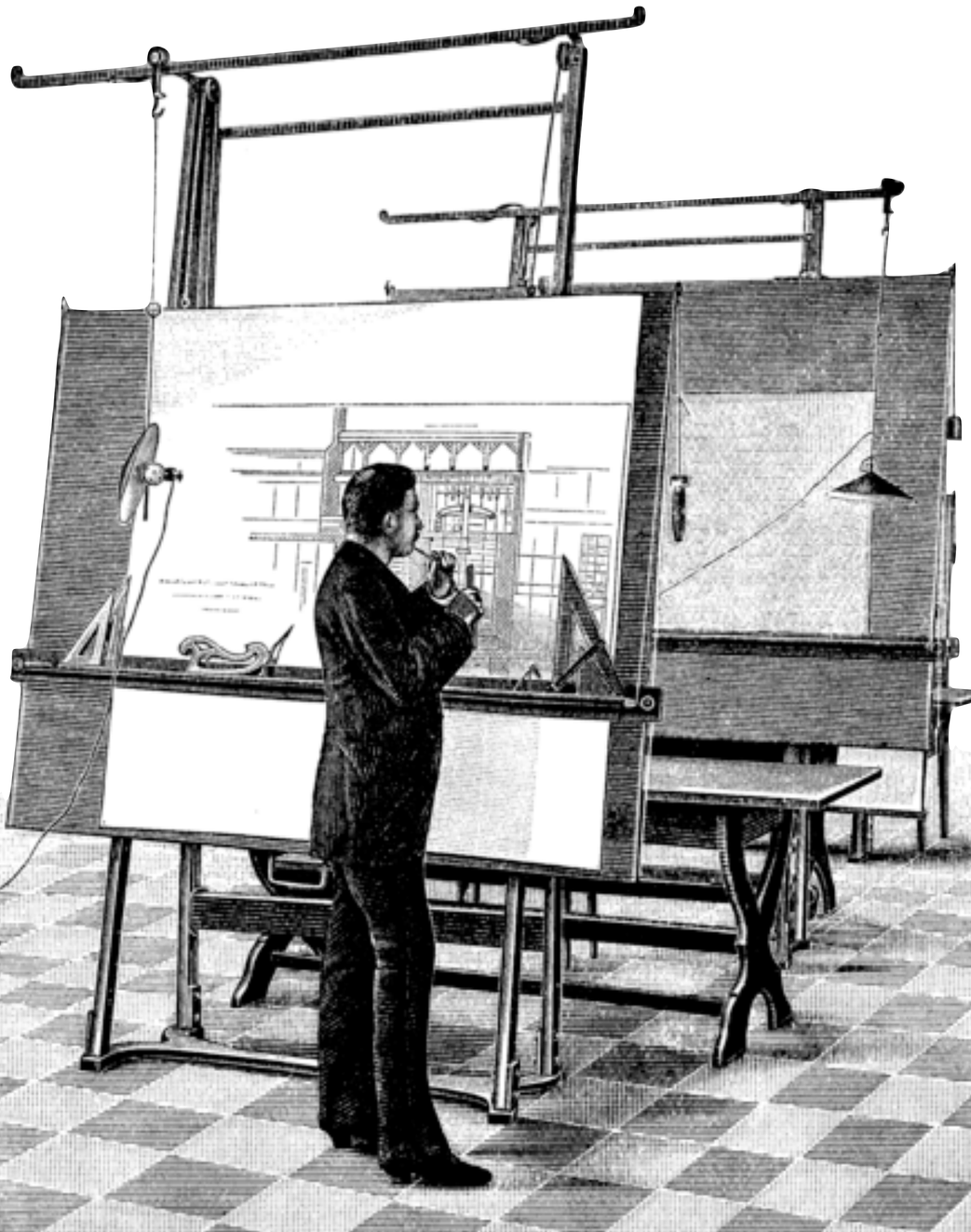






Design studios are really special learning places. Here are pictures I took in an architecture and a product design studio. You see barbie dolls, umbrellas, all sorts of half-baked ideas. The physical layout, the culture, and the practices mean that you learn both profound and really mundane things. 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

Objective Truth

Contextual Truth

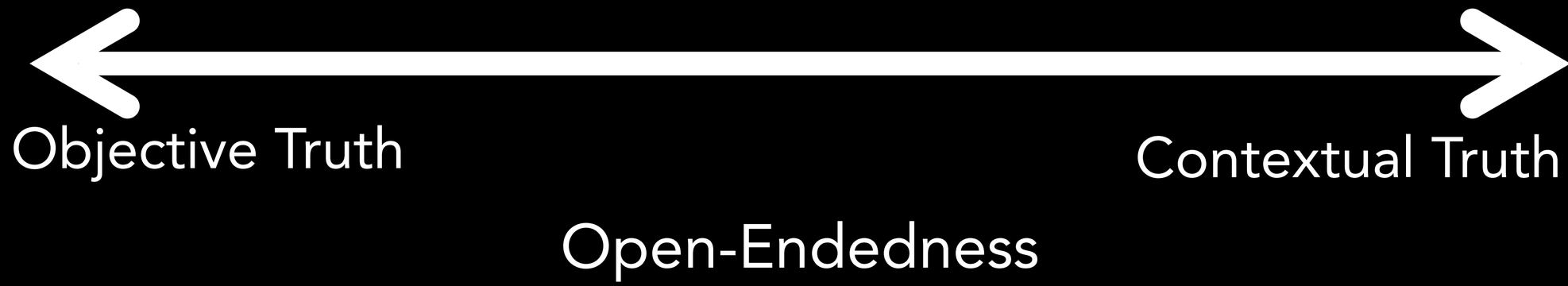
Open-Endedness

Scaling open-ended work is challenging

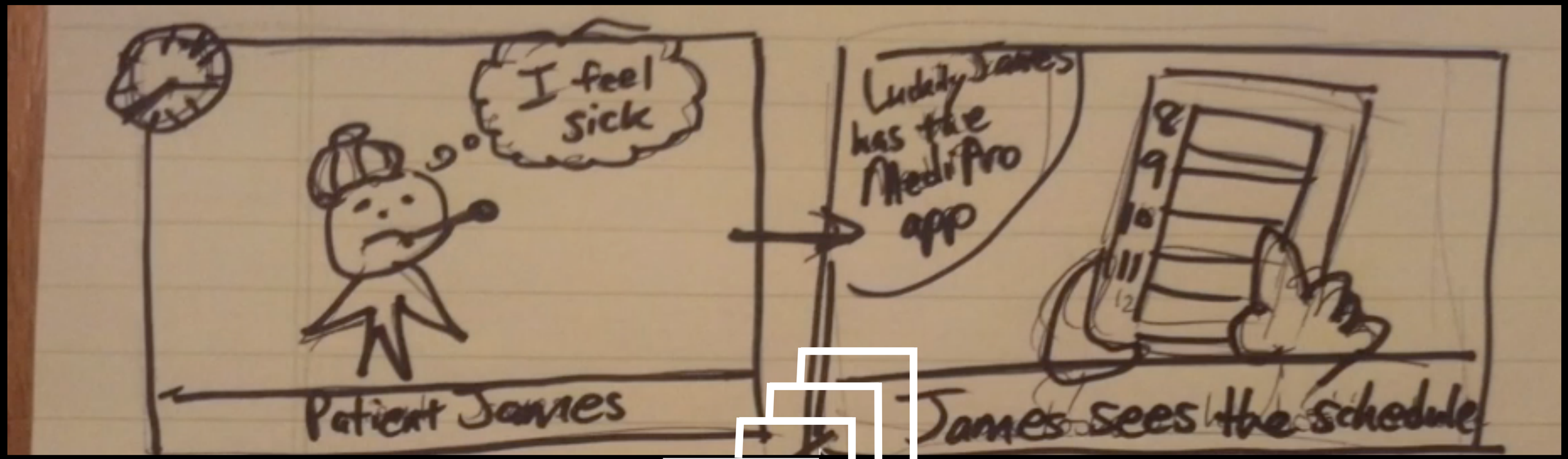
Canonical Wisdom of Crowds

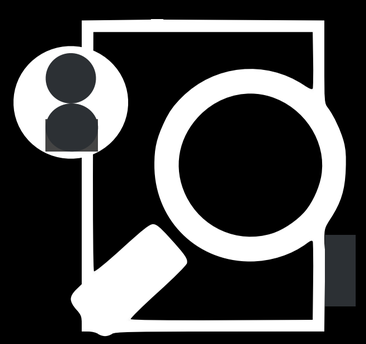
Galton's guess the weight of an ox,
Are these two product images the same

...



Scaling feedback on open-ended work





1) Train: calibrate

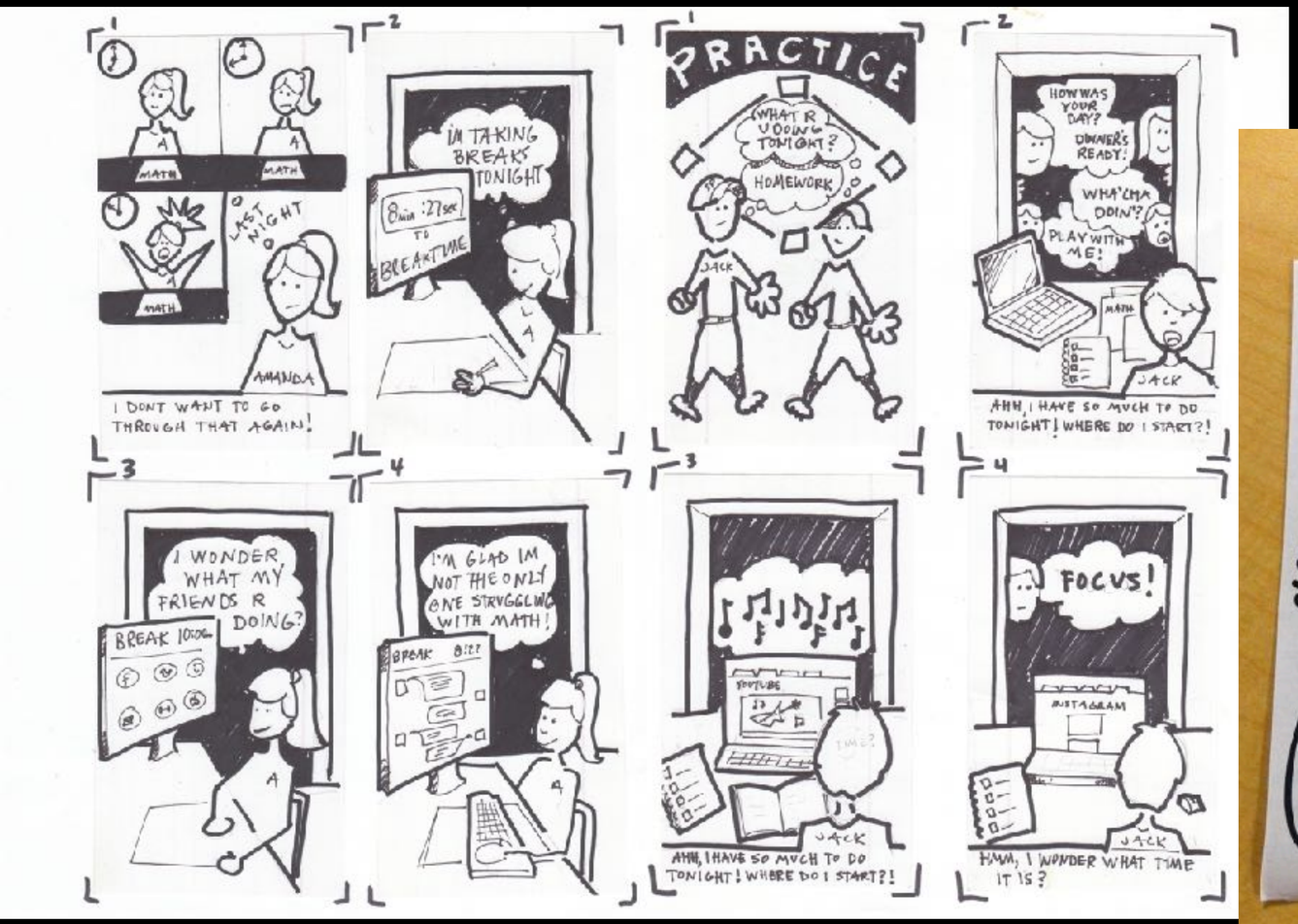
2) Assess: Peers

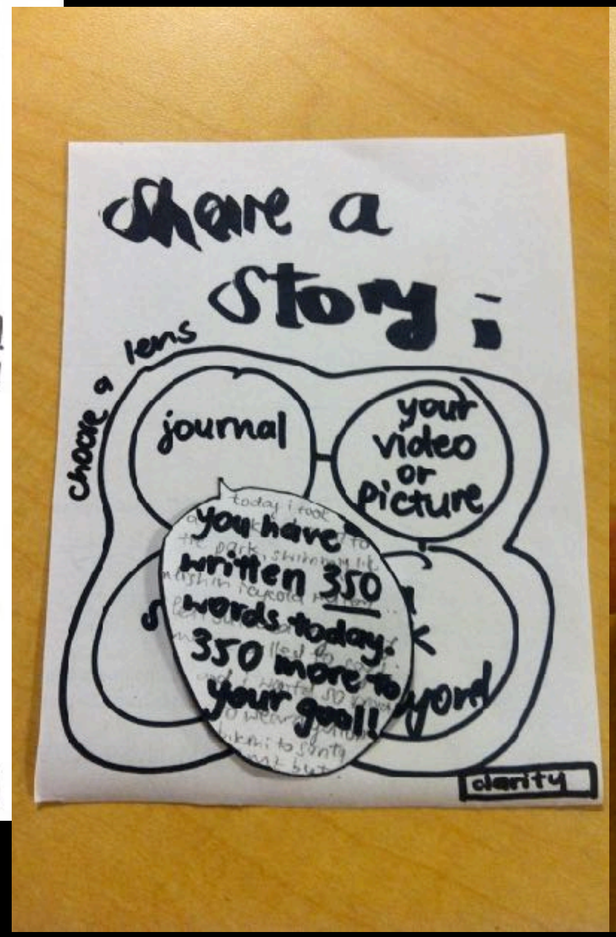
3) Reflect

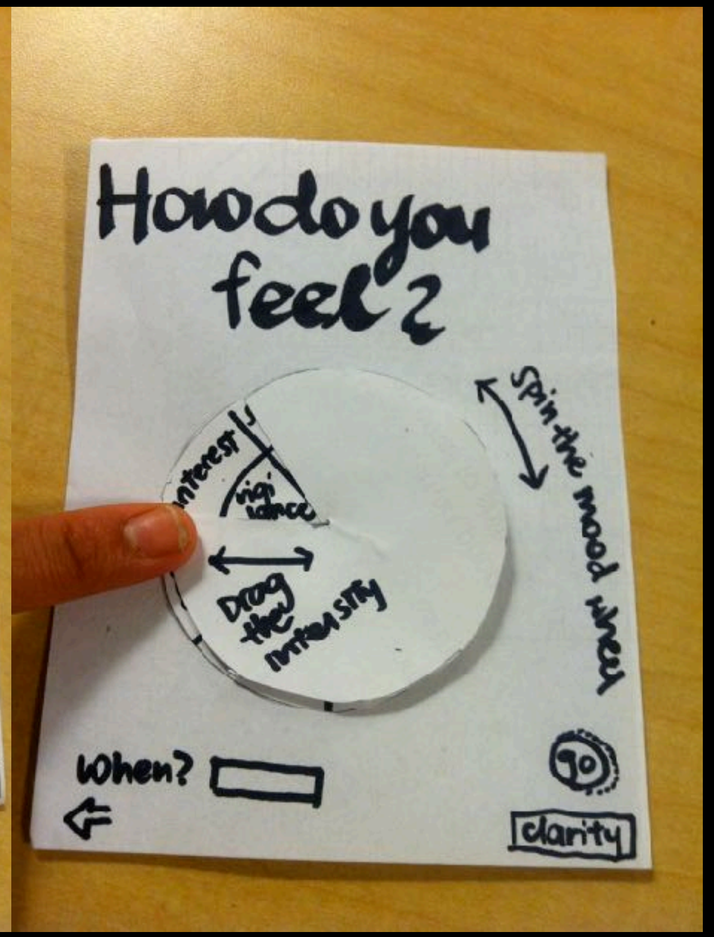
(Assess: Self)

Peer and Self Assessment in Massive Online Classes Chinmay Kulkarni, Koh Pang Wei, Huy Le, Daniel Chia, Kathryn Papadopoulos, Justin Cheng, Daphne Koller, Scott R Klemmer *TOCHI 2013*

Student Prototypes







http://hci-class.org

Peer Review is Widely-used today

- Just on Coursera…
- ~4,000 new submissions <u>every day</u>
- 1,385 courses that use peer review
- most receive a grade within 2-3 days

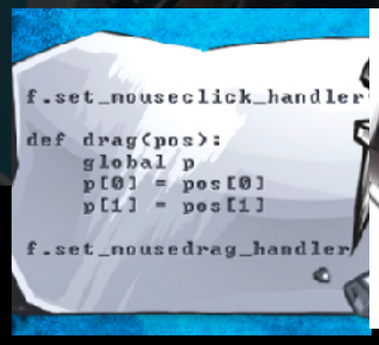
Introduction to Philosophy
Essays

Teaching character
Management

Child Nutrition
Recipes

Constitutional law
Arguments

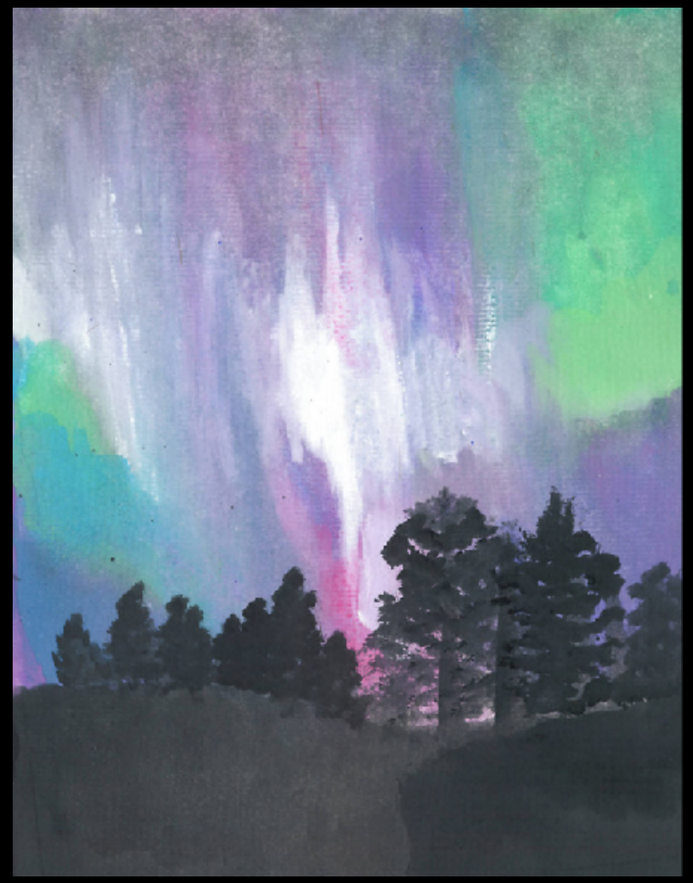
Social Psychology
Essays



Programming in Python
Code

World Music
Music

Engaging Diverse Perspectives



"Magical lights" from Norway

"Treasure Cage" from Canada

Introduction to Art

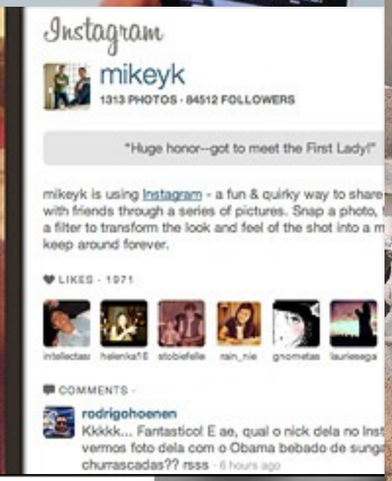
PROBLEM-FINDING
as well as
PROBLEM SOLVING

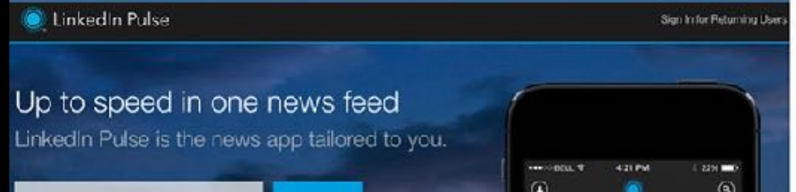
"A negotiation around the valuation criteria" —Jeff Nickerson

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

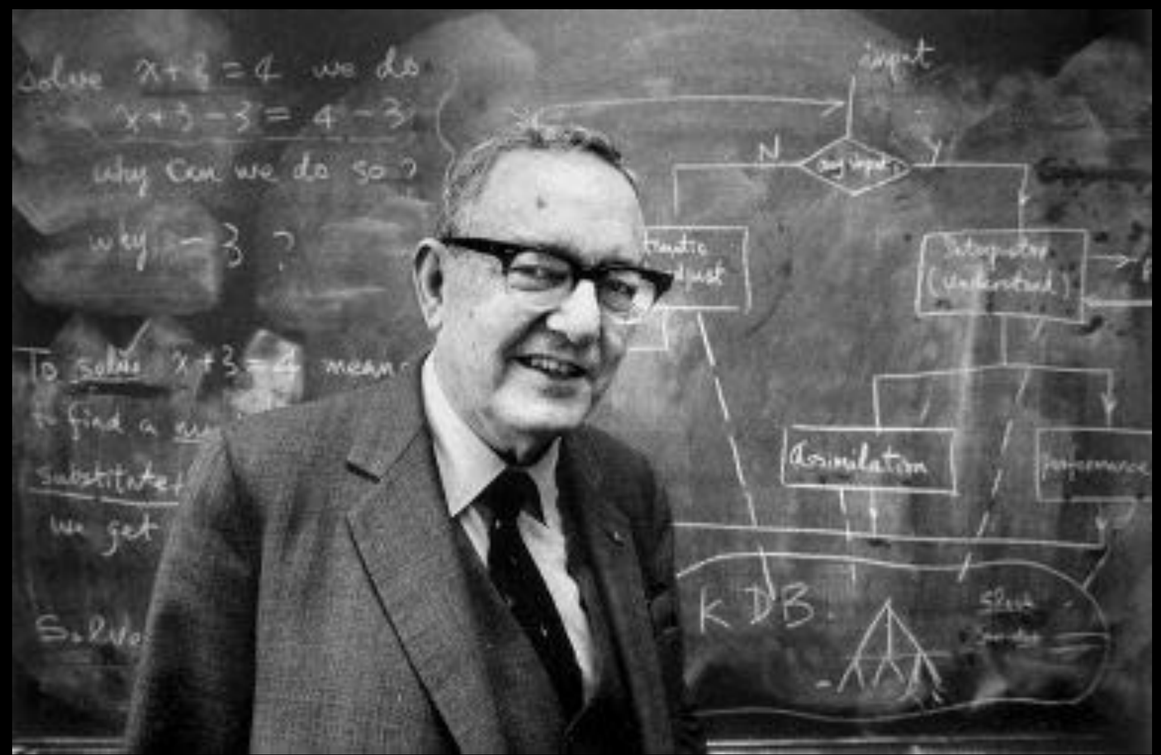
DIVERSITY
Bias against foreign submissions
Linguistic biases
Context biases
Groups with geographic diversity
Gender balanced discussions

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

Chinmay Kulkarni
Best Dissertation, Stanford CS, 2015

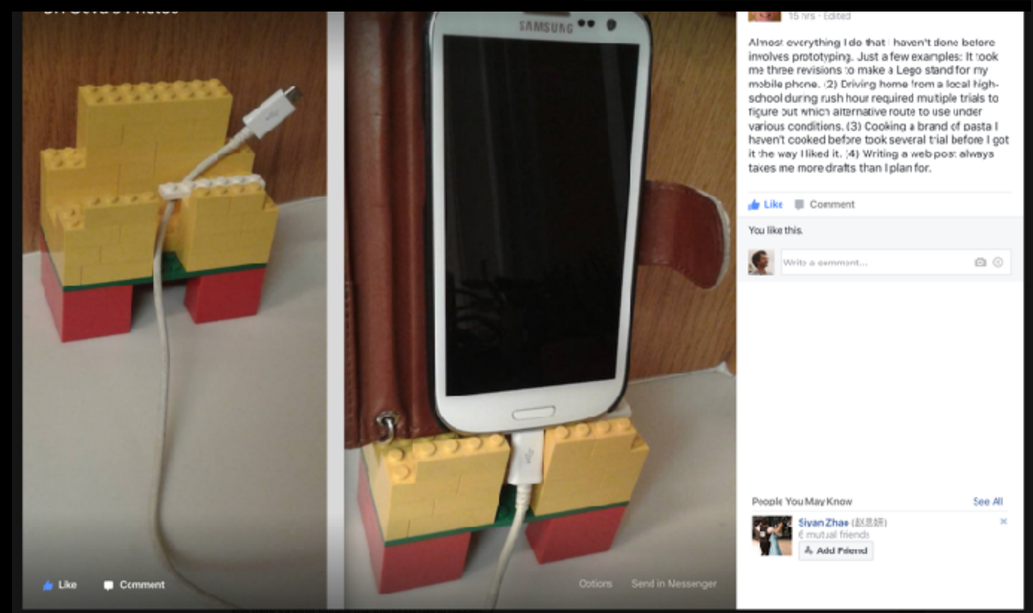
“Everyone designs who devises courses of action aimed at changing existing situations into preferred ones.”

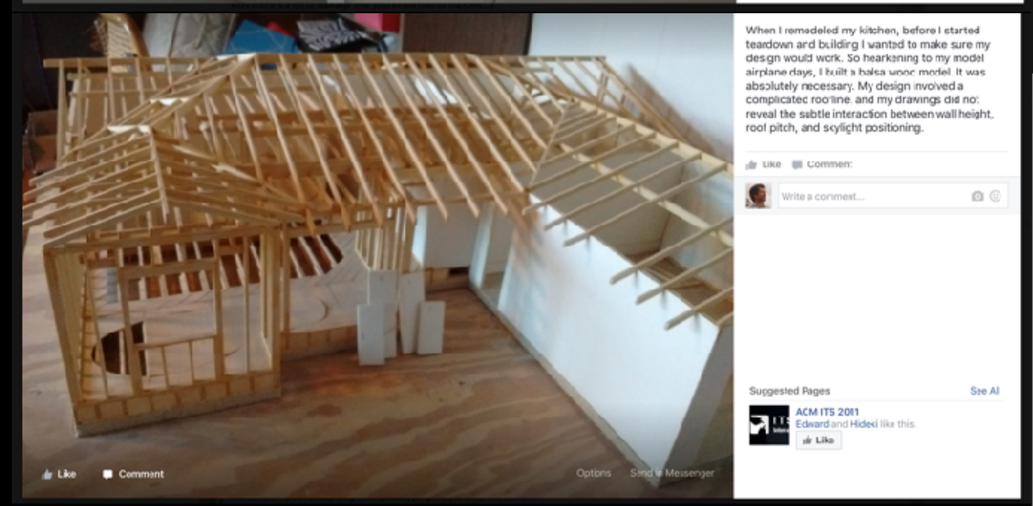
– Herb Simon

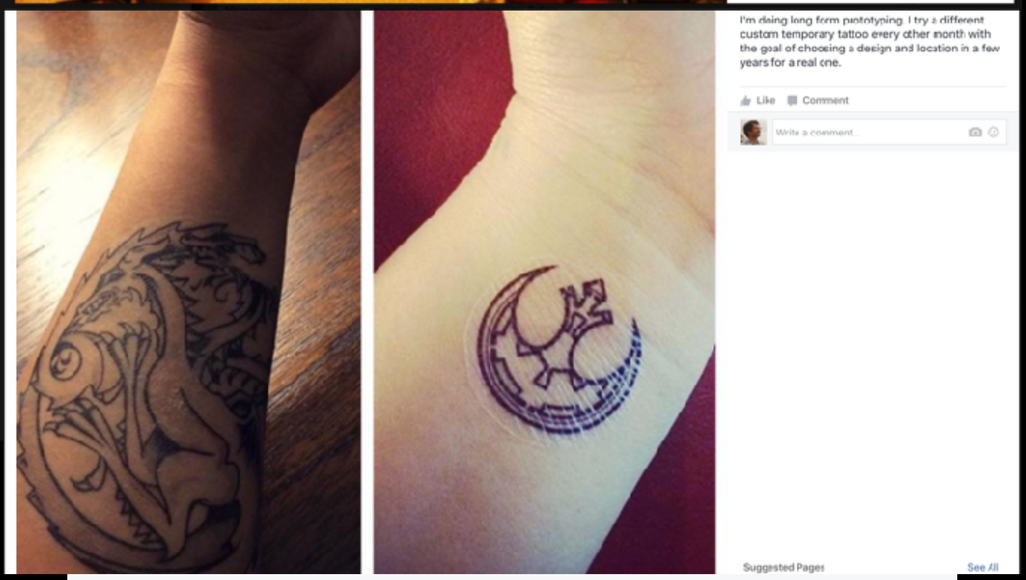


Prototyping in real life

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







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:

			Check

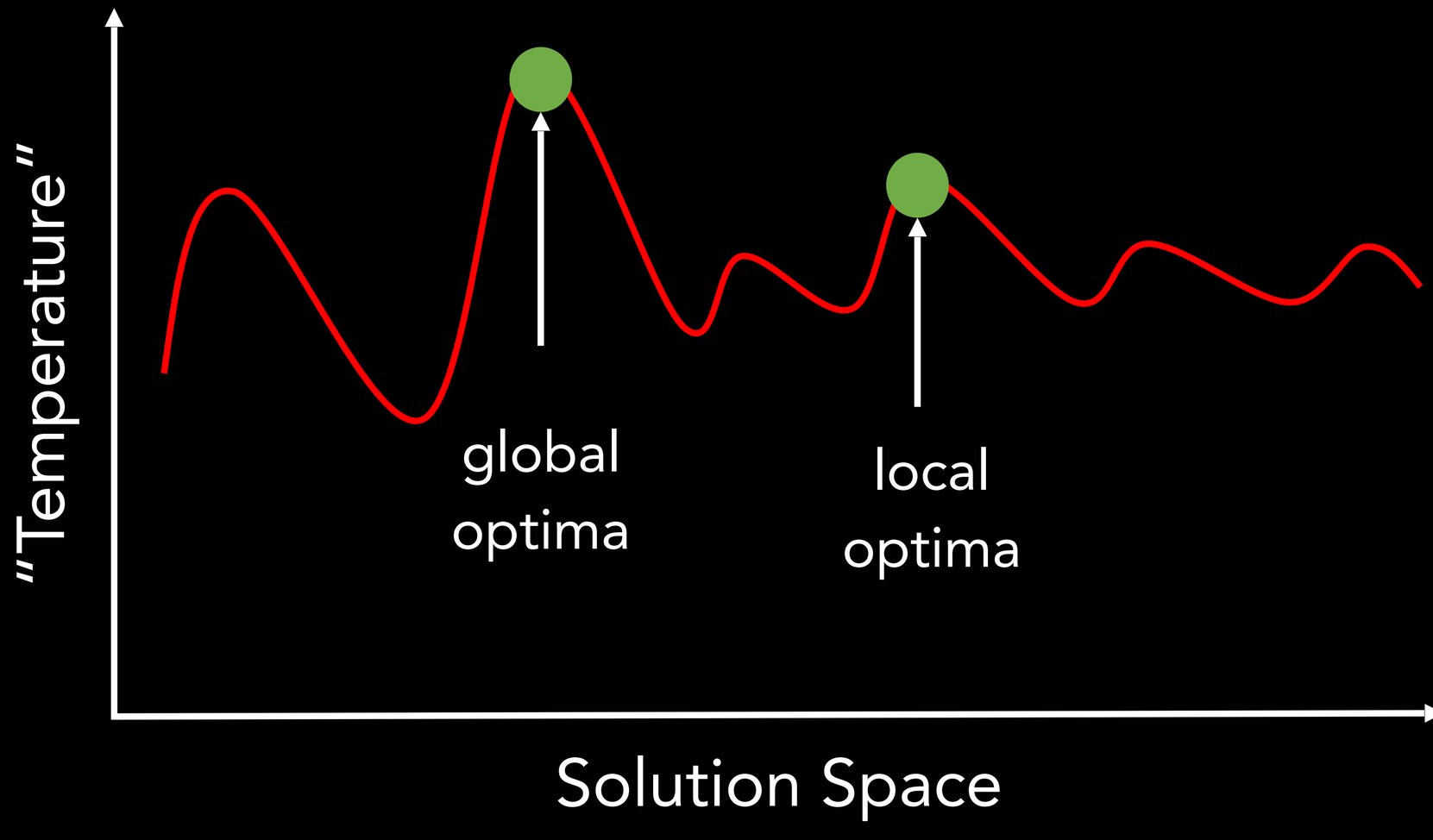
I don't want to play; just tell me the answer

A Quick Puzzle to Test Your Problem Solving David Leonhardt *The New York Times, July 2, 2015*

Participants picked their concept early

“[illegible]… 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

PSYCHOLOGICAL SCIENCE

A JOURNAL OF THE ASSOCIATION FOR PSYCHOLOGICAL SCIENCE aps

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*

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[illegible] 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

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).

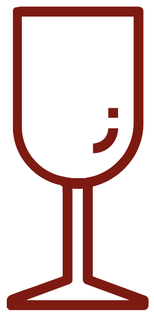
By Alex Williams

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

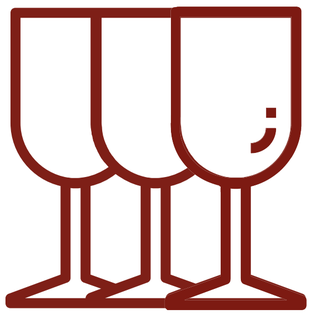
“It just tastes like red wine.”

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"



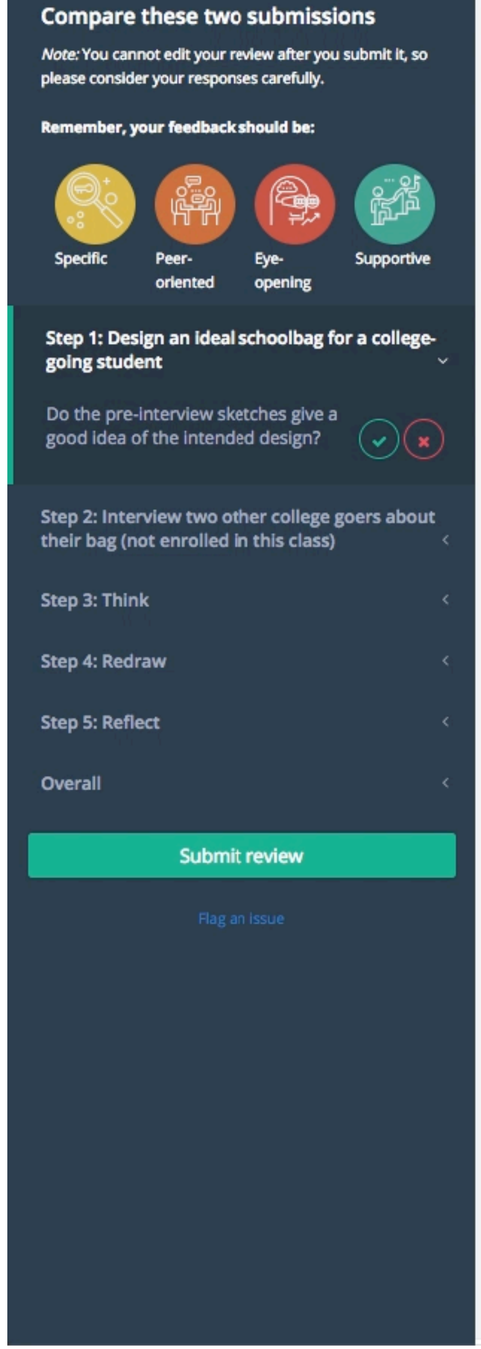
NOVICE

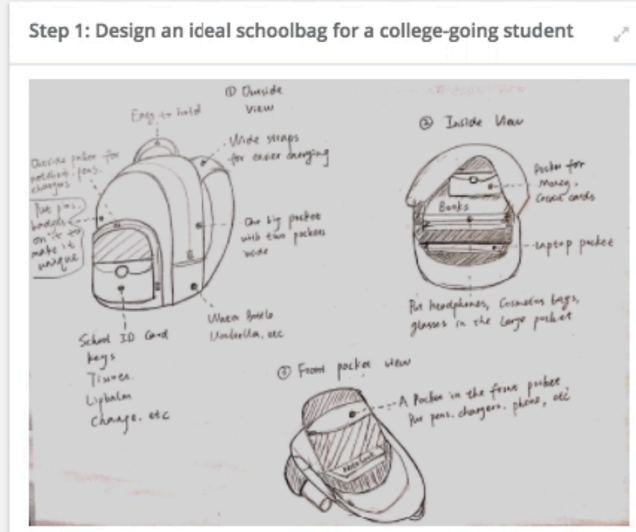
"The wines differ in sweetness, and the first wine is a bit earthy"

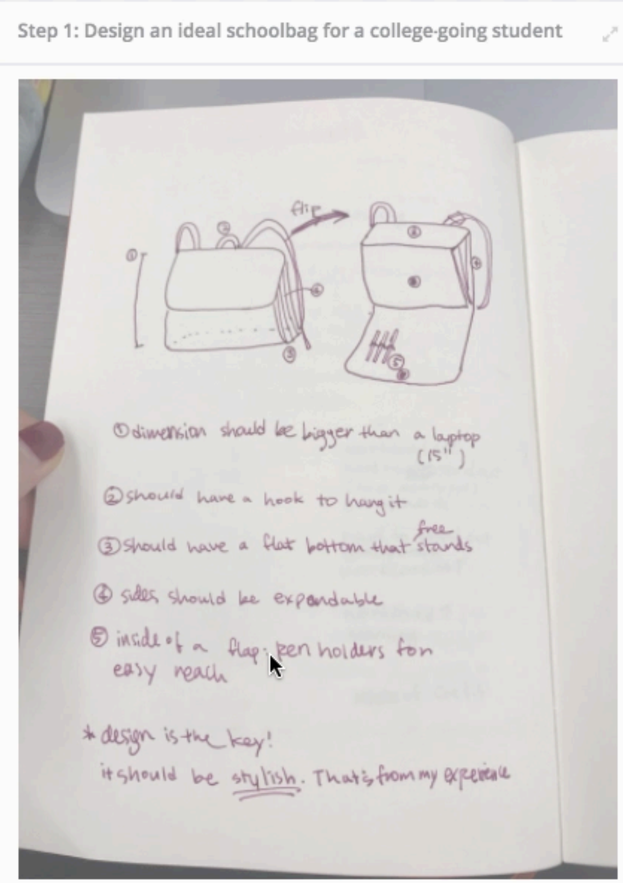
comparison helps us notice what only experts otherwise see

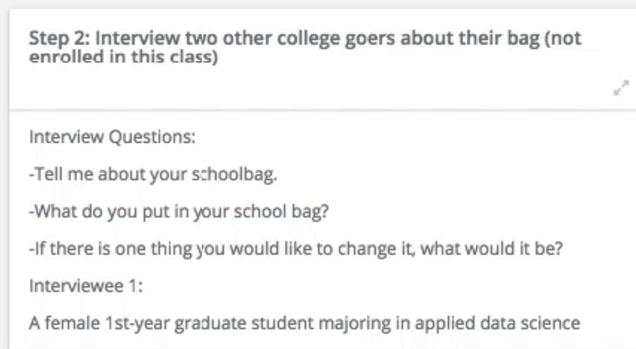
[Schwartz (*ABCs of How We Learn* '16)]

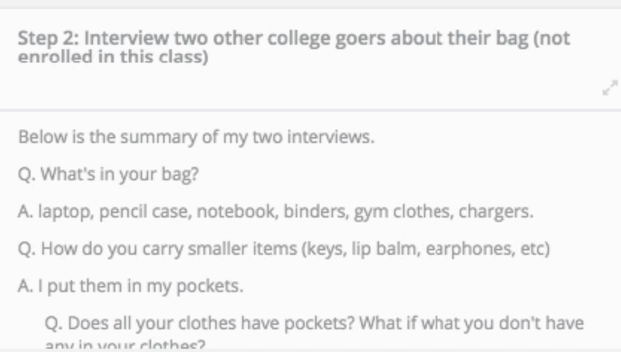
Juxtapeer: comparative peer review











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%)	$X^2(1) = 9.32, p = 0.011$
↑	**Use of expert terminology** (+16.4%)	$X^2(1) = 13.3, p = 0.0013$
↑	**Depth** (+0.5 pt)	$Z = 3.10, p = 0.010$
n.s.	**Supportive language**	$X^2(1) = 4.20, p = 0.20$
n.s.	**Suggest Action**	$X^2(1) = 3.45, p = 0.32$
↑	**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

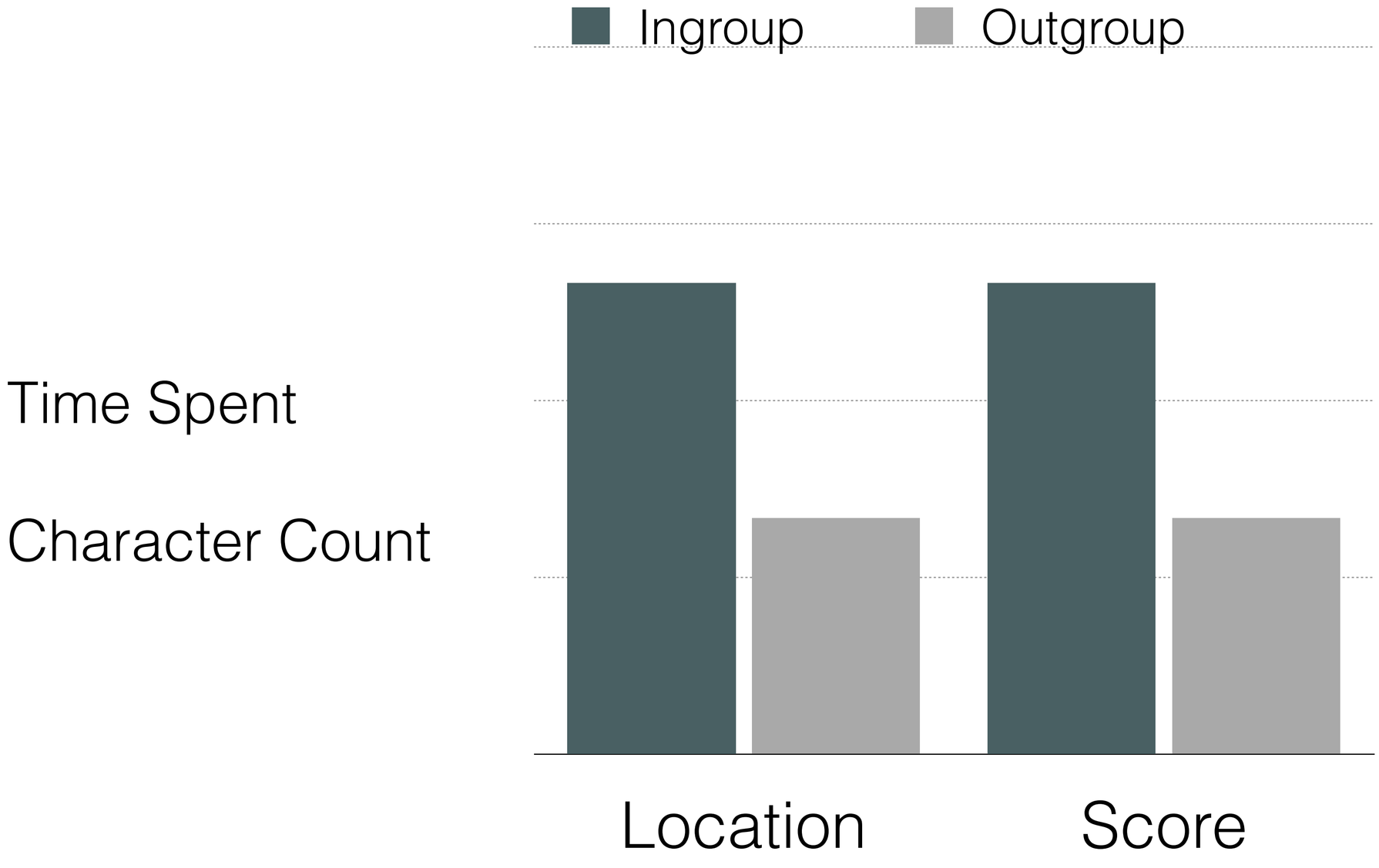
1 Outgroup

1 Ingroup

1 Outgroup

w/Celia Durkin & Federico Rossano (CSCW2018)

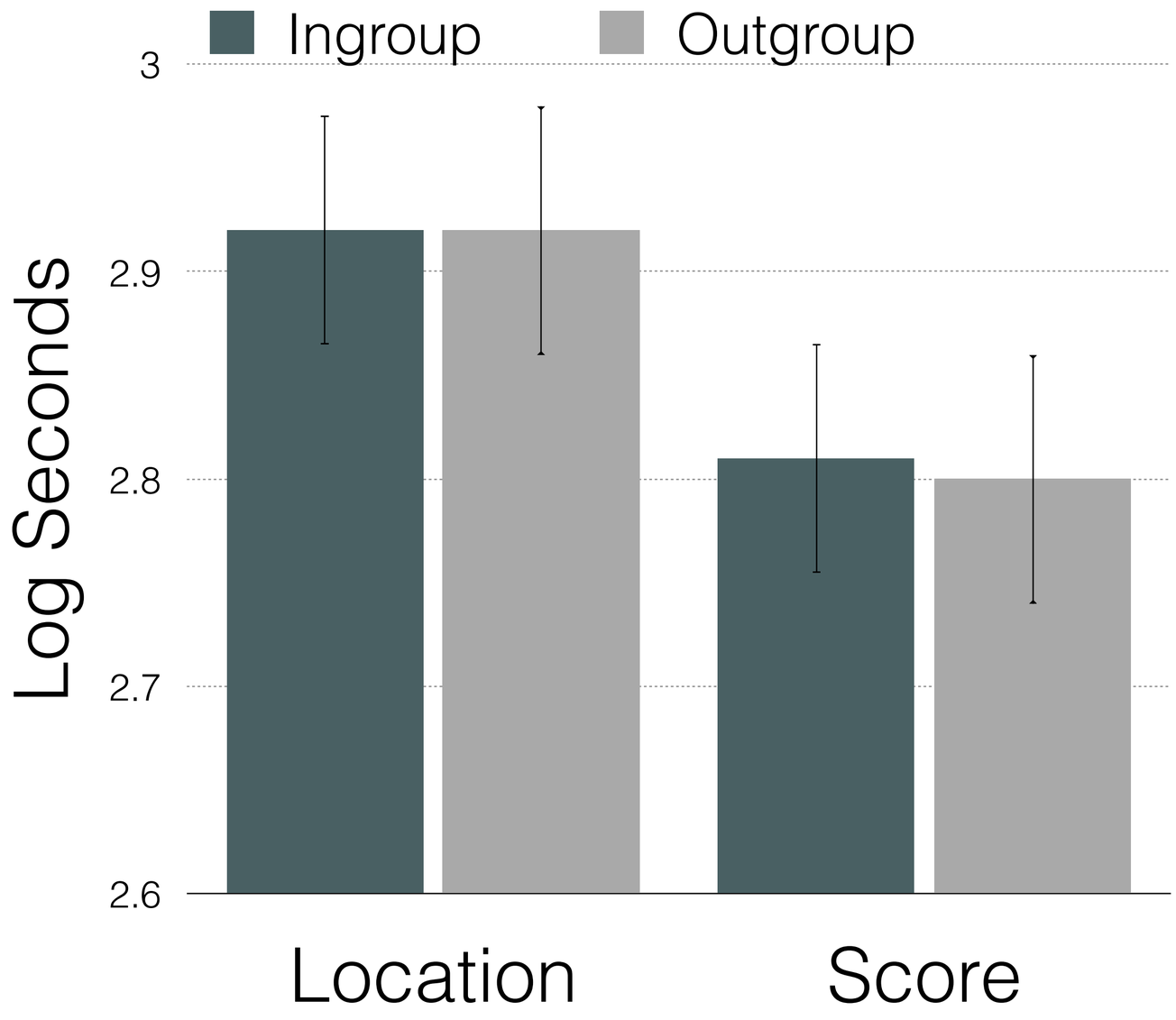
hypotheses


Ingroup
Outgroup
Time Spent
Character Count
Location
Score

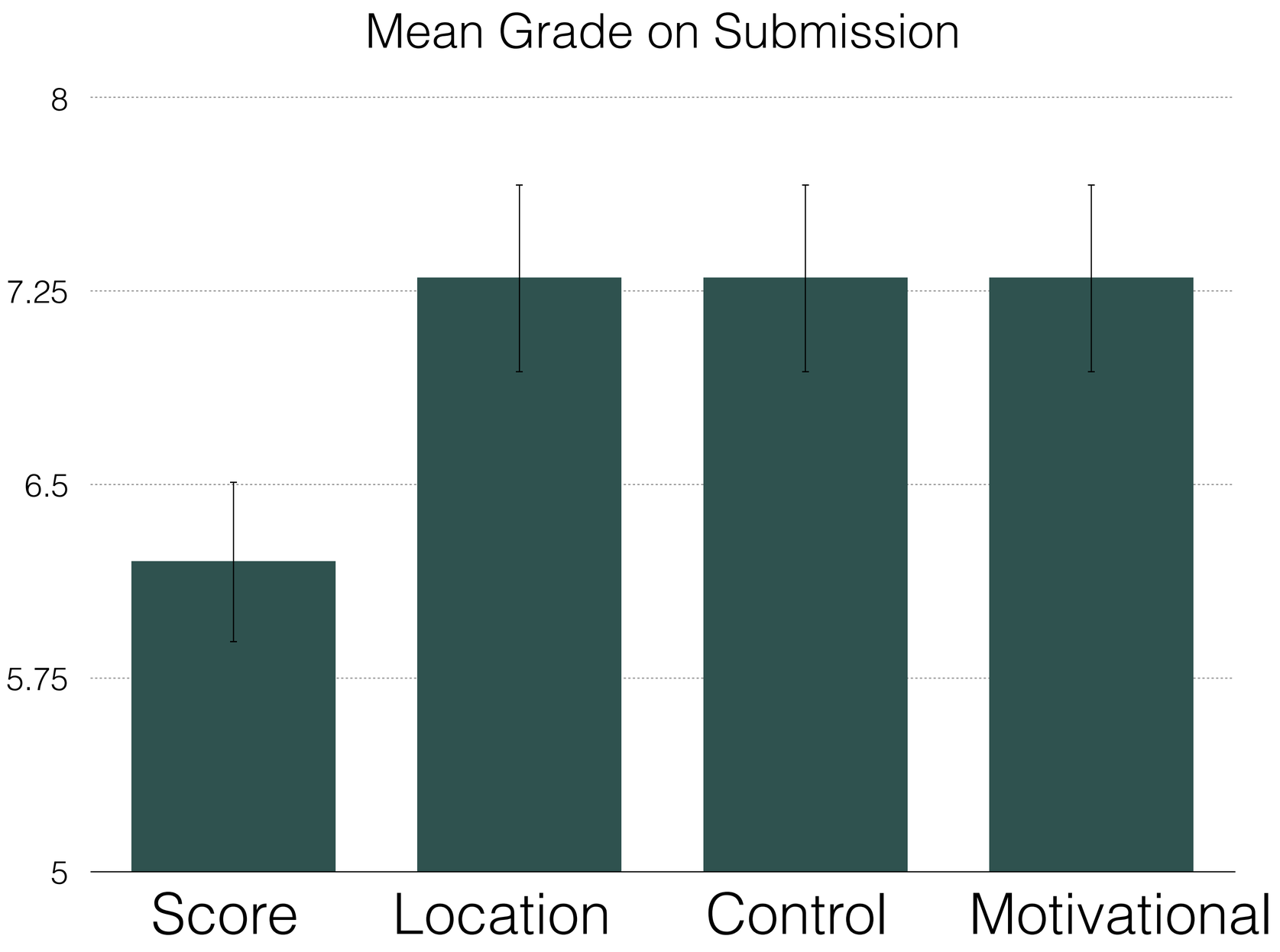
however, we saw neither of these.

Students spend less time when cued by Score

Time Spent



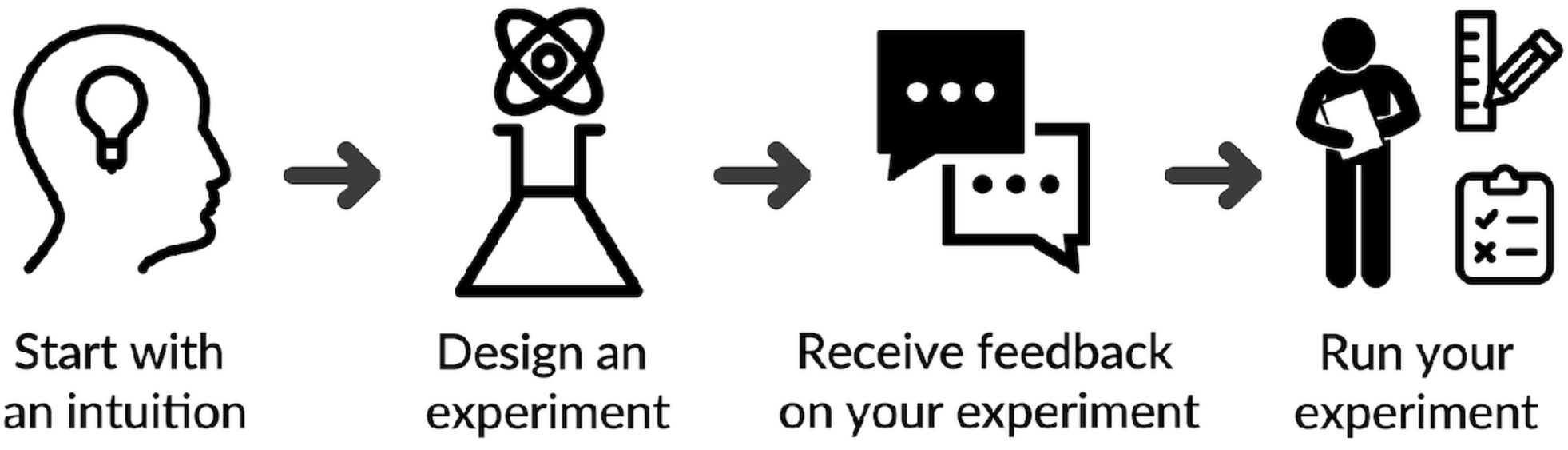
Students grouped by Score graded harsher



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

Gut Instinct

gutinstinct.ucsd.edu



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

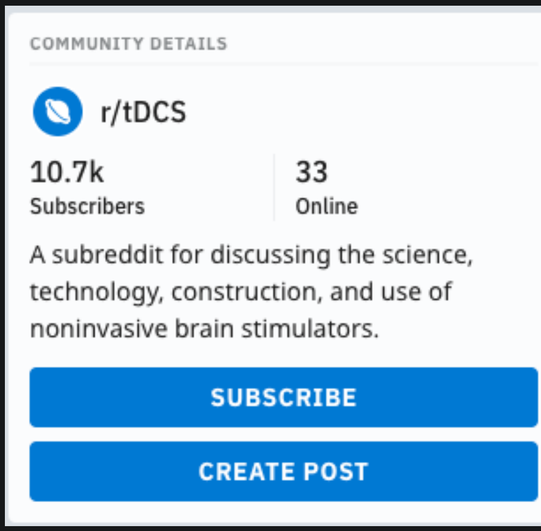
Although experimentation involving human volunteers has attracted intense study, the matter of self-experimentation among medical researchers has received much less attention. Many questions have been answered only in part, or have been left unanswered. How common is this practice? Is it more common 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

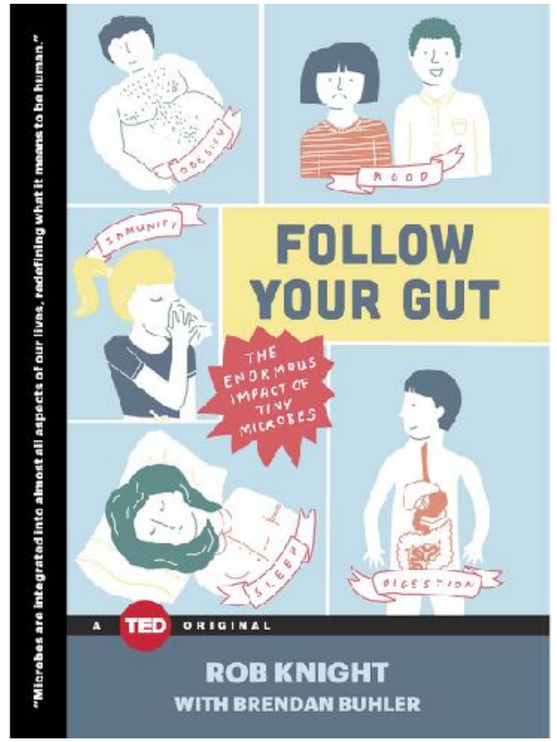
Understanding the human microbiome requires insights into people's lifestyles


A Baffling Brain Defect Is Linked to Gut Bacteria,

By GINA KOLATA MAY 10, 2017

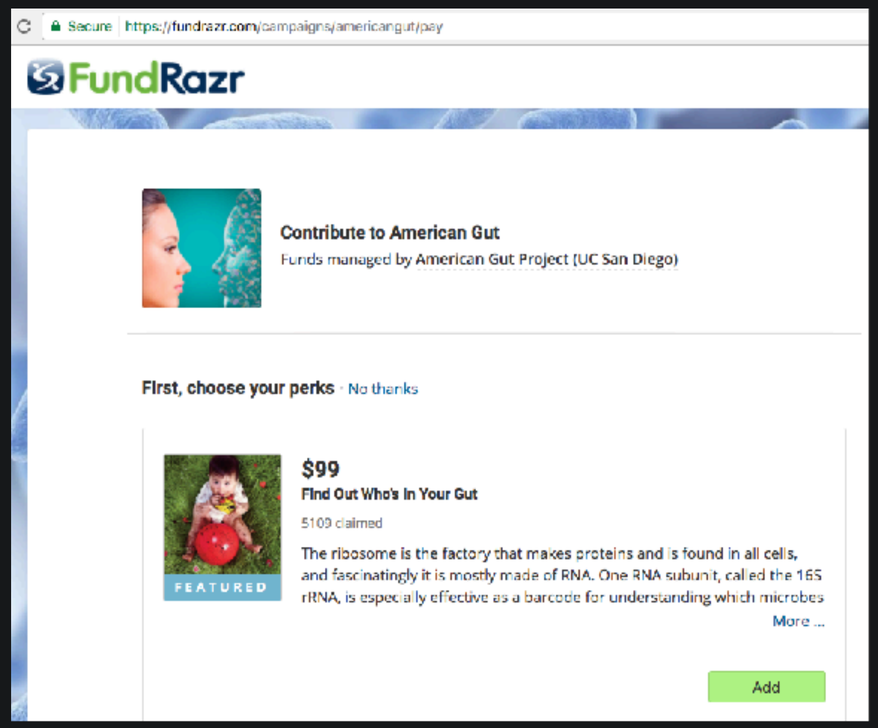

Are Pets the New Probiotic?

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

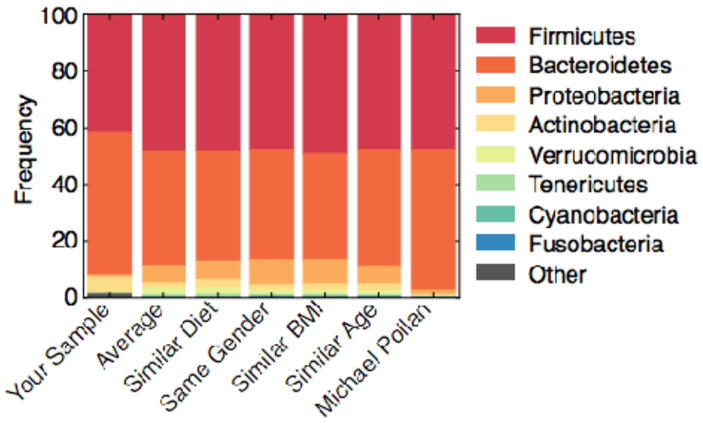
americangut.org

YOUR AMERICAN GUT SAMPLE

americangut.org

VINEET PANDEY

What's in your American Gut sample?



Your most abundant microbes:

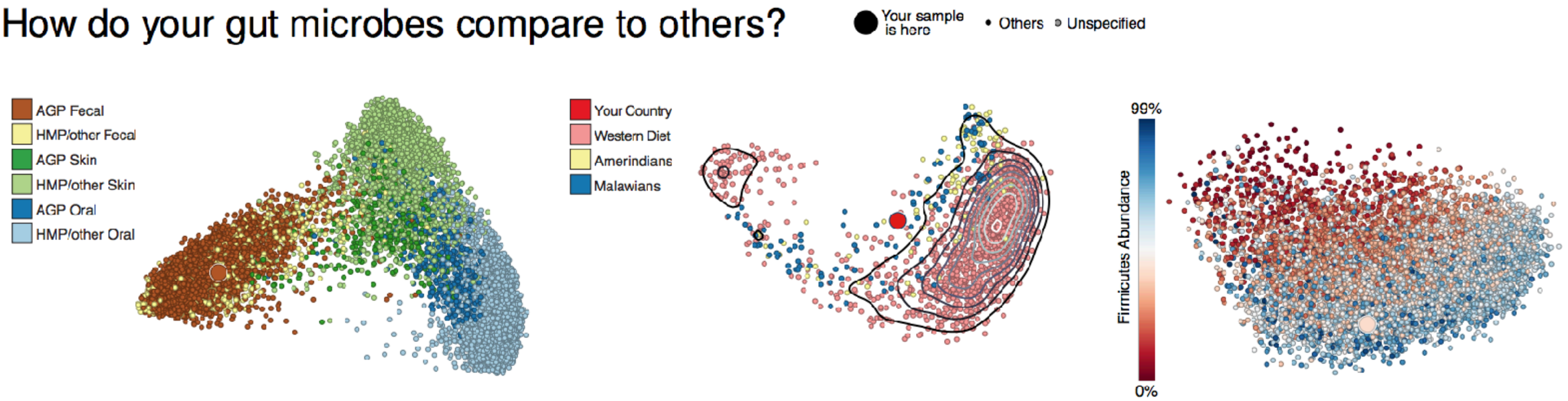
Taxonomy	Sample
Genus *Prevotella*	50.1%
Family Lachnospiraceae	12.0%
Family Ruminococcaceae	6.4%
Genus *Faecalibacterium*	5.8%

Your most enriched microbes:

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

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

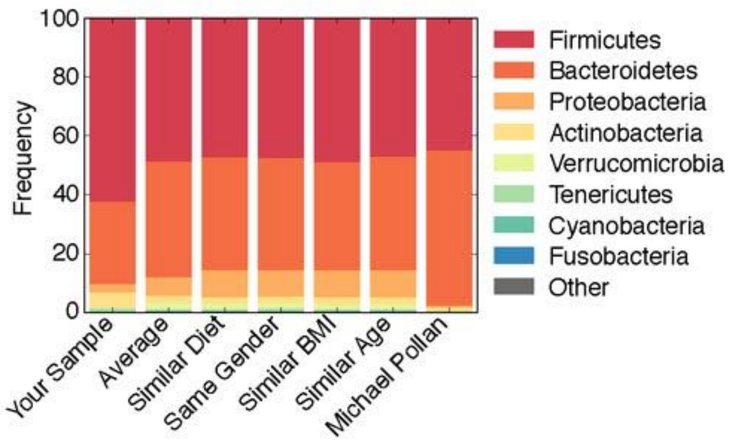
How do your gut microbes compare to others?



YOUR AMERICAN GUT SAMPLE

SCOTT KLEMMER

What's in your American Gut sample?



Your most abundant microbes:

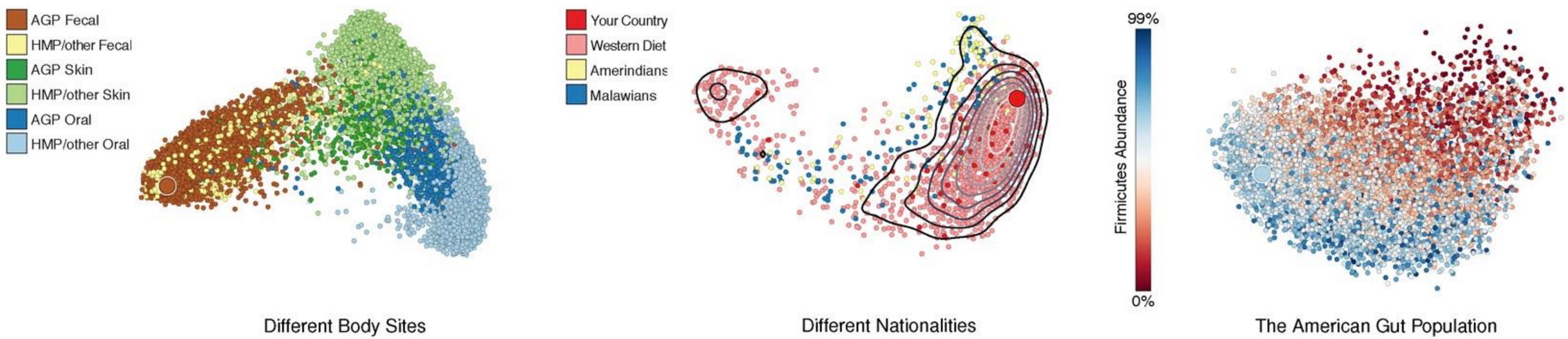
Taxonomy	Sample
Genus *Bacteroides*	18.3%
Order Clostridiales	11.3%
Family Ruminococcaceae	10.4%
Genus *Faecalibacterium*	9.8%

Your most enriched microbes:

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

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

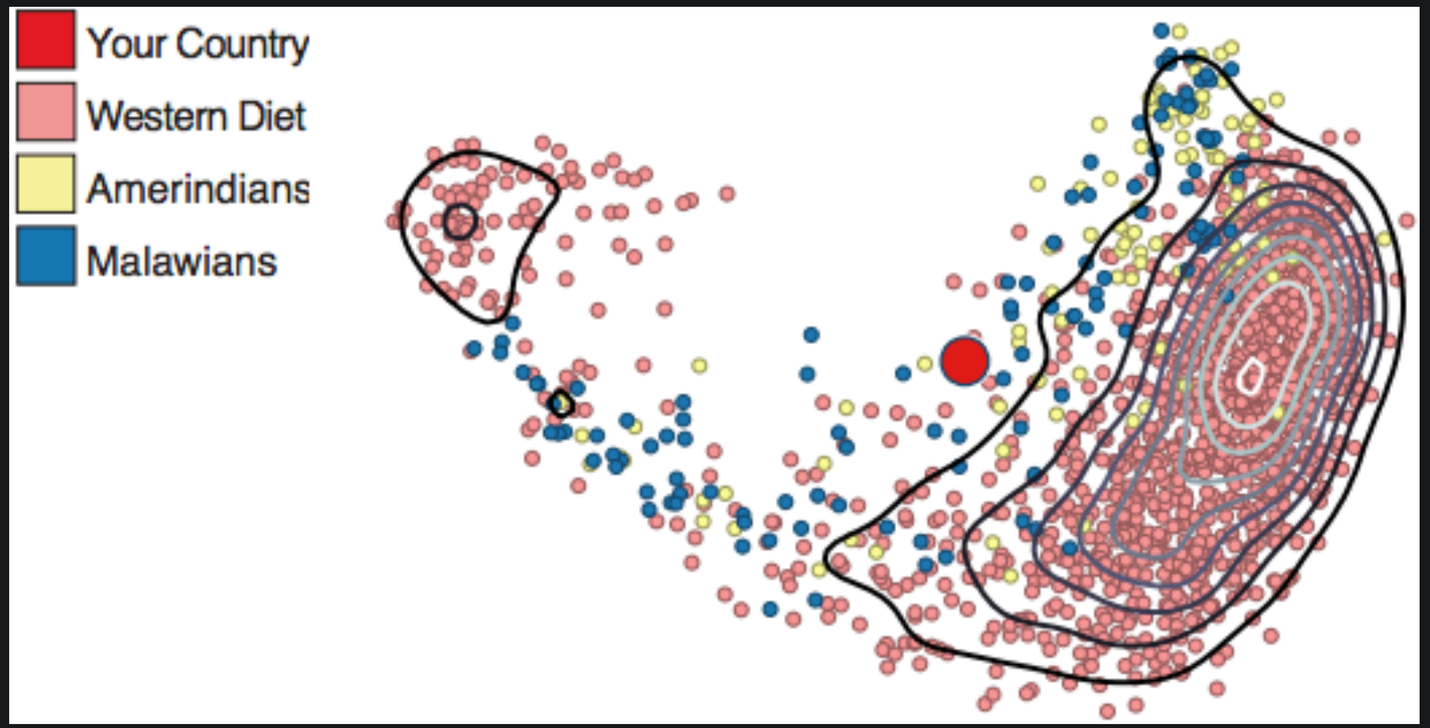
How do your gut microbes compare to others?



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

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

https://www.nytimes.com/2018/06/02/health/fecal-transplants-bacteria-antibiotics.html
http://www.newsweek.com/diy-fecal-transplants-are-dangerous-and-could-transmit-hiv-doctors-warn-810003

What science most benefits from lived experiences?

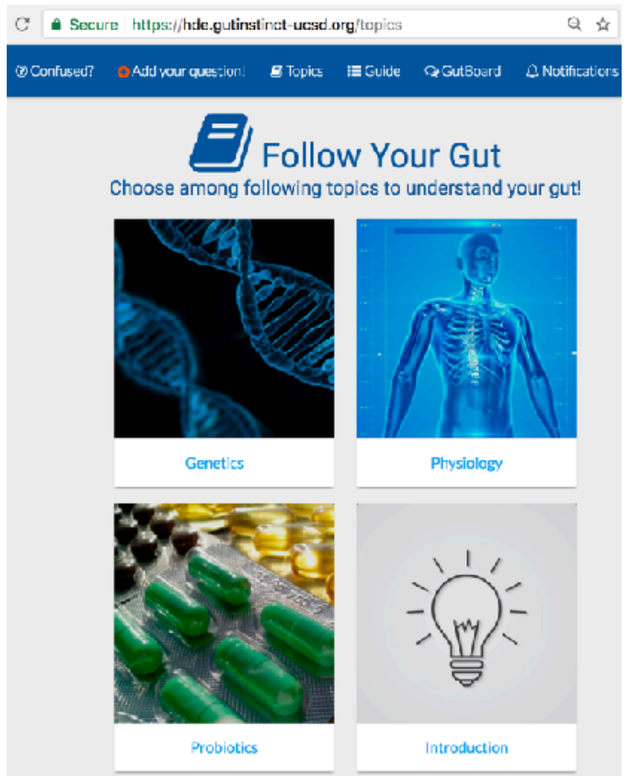
Domains that are

Nascent Experts know little

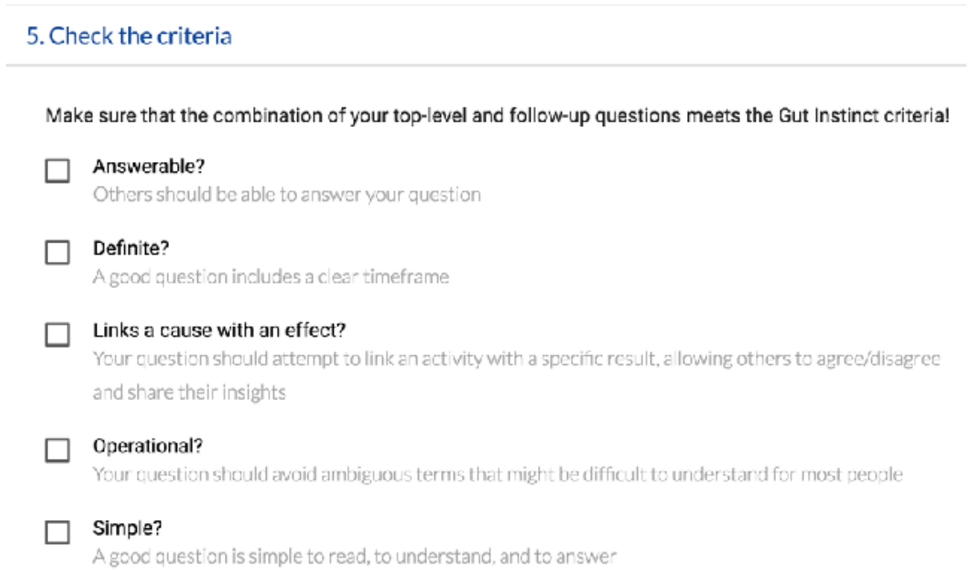
Contextual Huge individual differences

Motivating People care

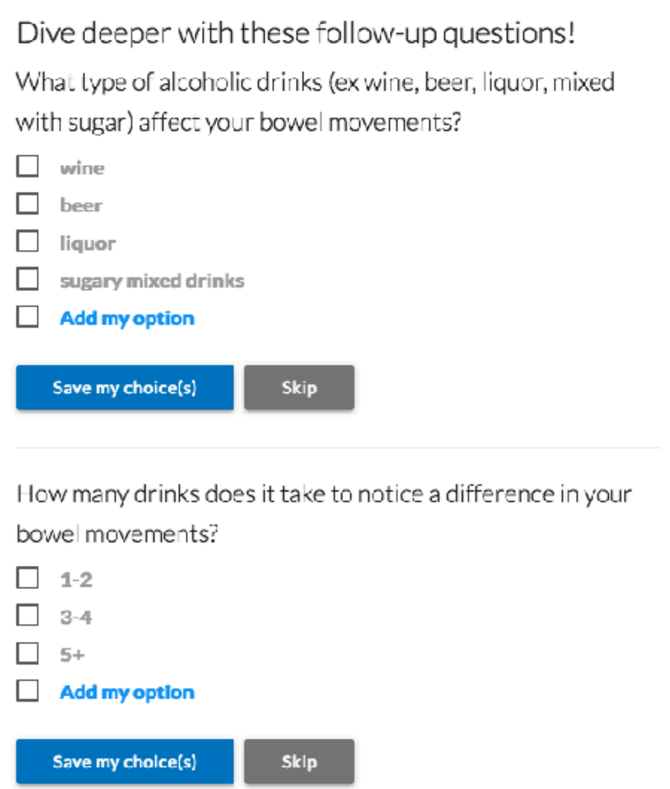
3: Ask questions



Learn

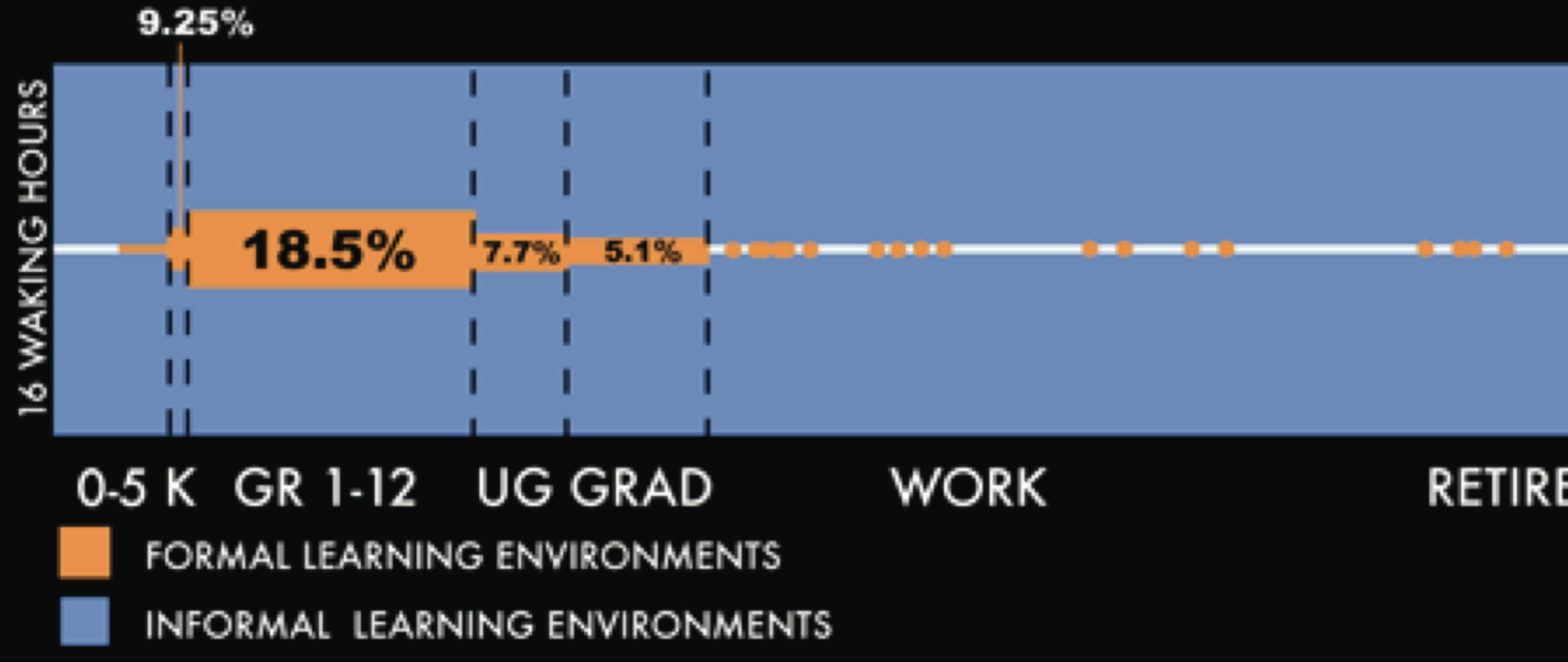


Train

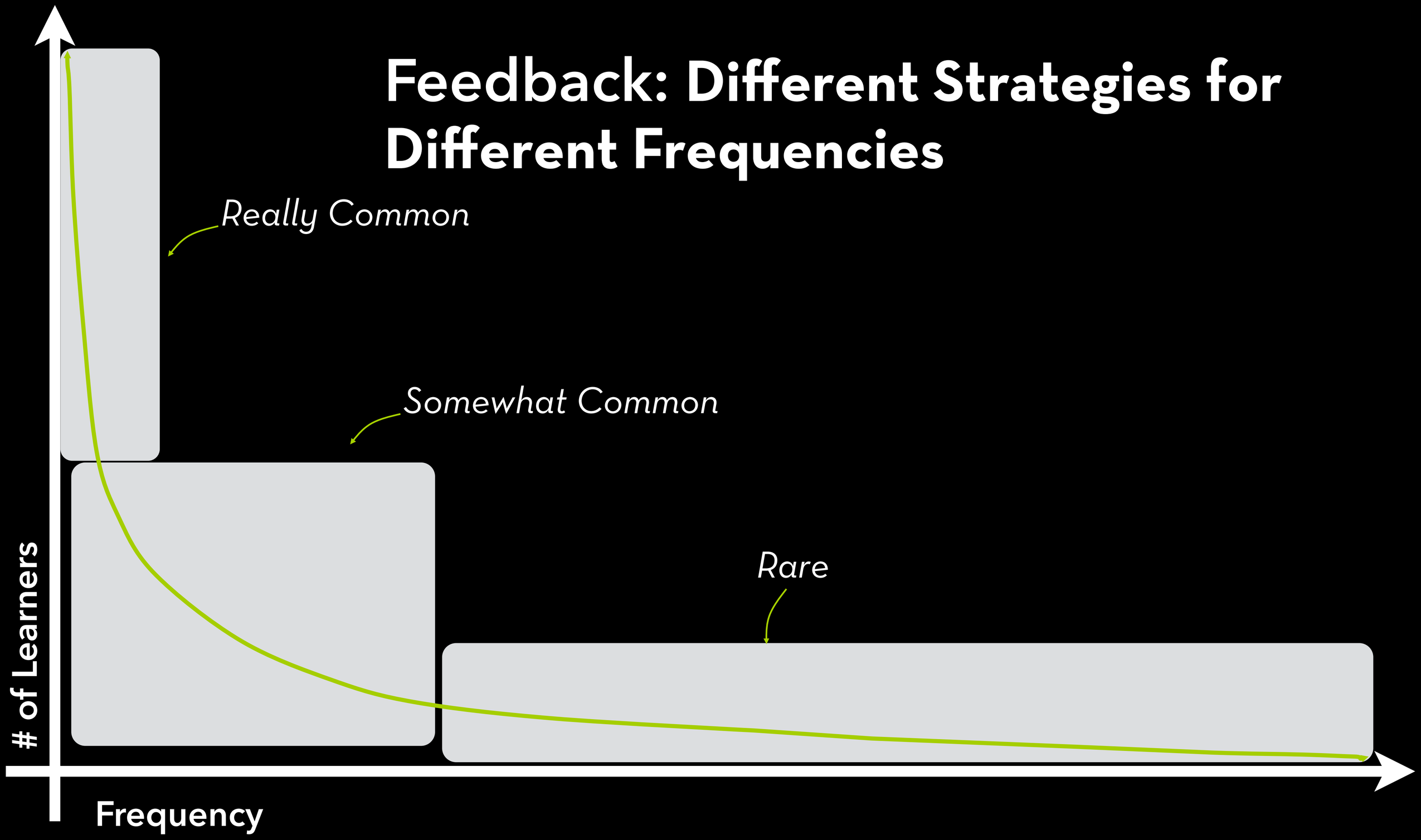


Ask

LIFELONG AND LIFEWIDE LEARNING

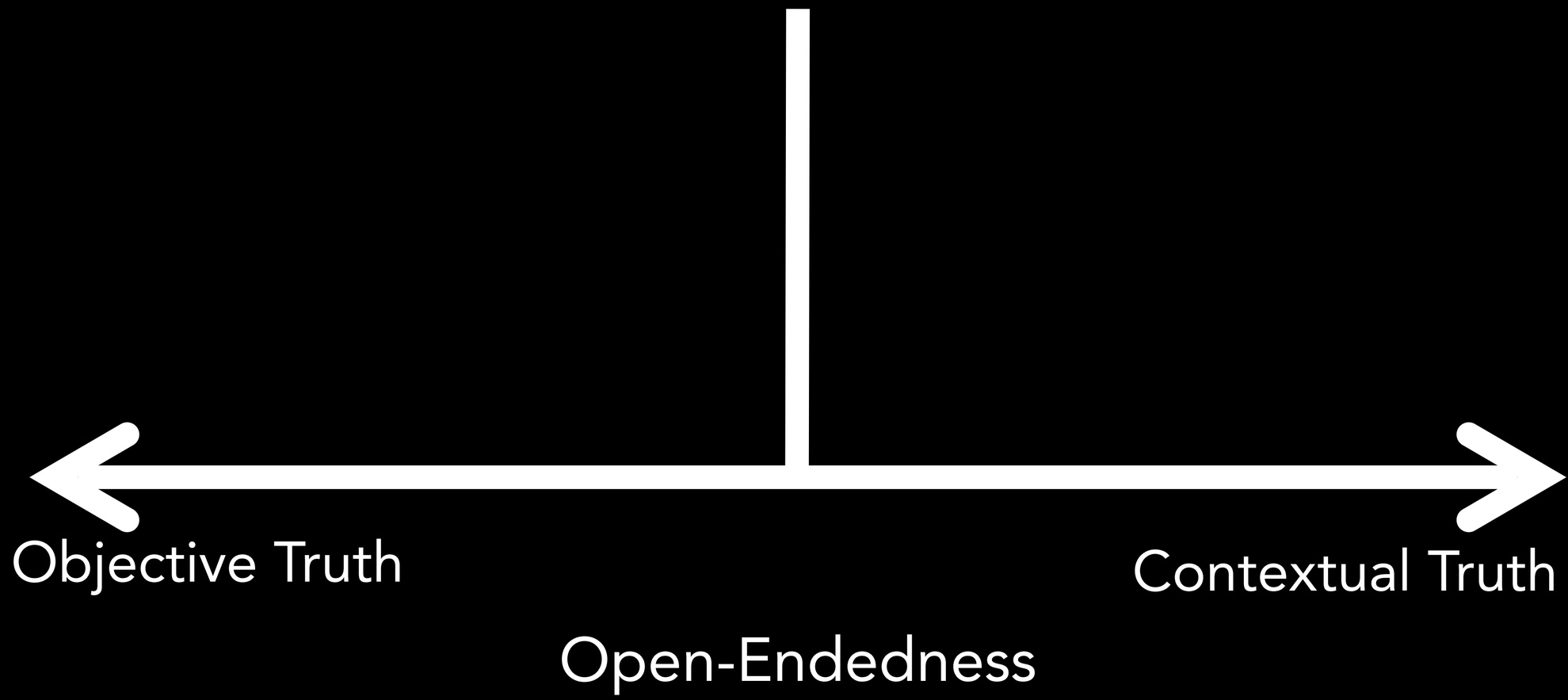


Feedback: Different Strategies for Different Frequencies



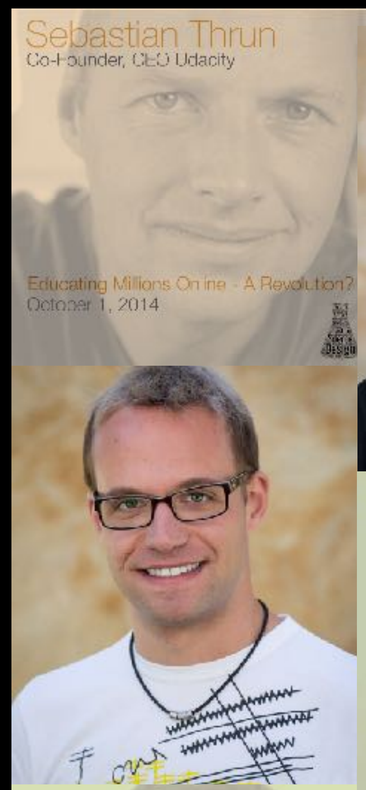
Truth Crispness: Where is Science?

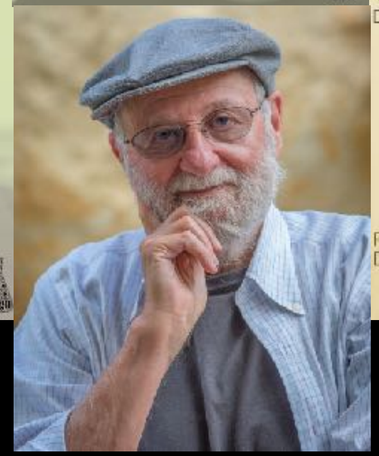
h/t Eva Tardos

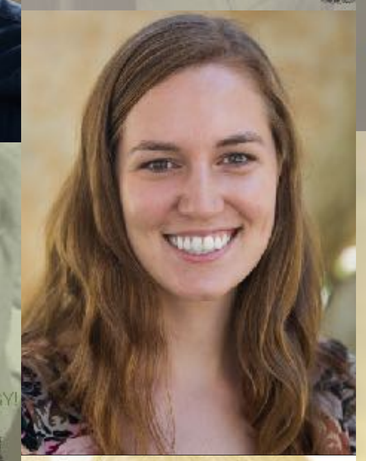


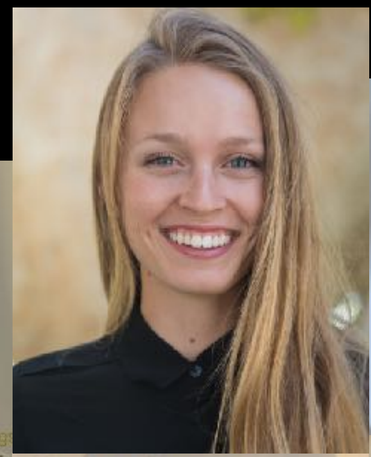
Scott Klemmer

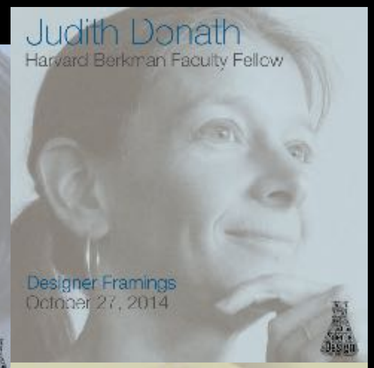
@DesignAtLarge

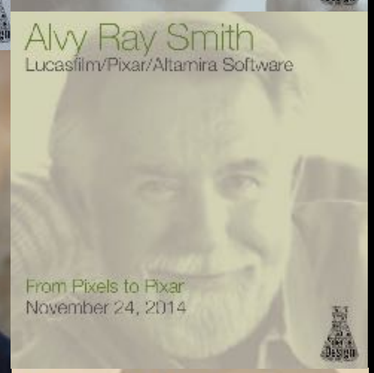












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