

Creating Scientific Theories with Online Communities

CSCI 490: Computing and Global Change
University of Southern California
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How did we get here in the first place?

Exercise left to the reader

The **current** approach of relying primarily on **institutional experts** to **create generalized knowledge** to **solve humanity's problems** is insufficient to meet the **scale, diversity, and novelty** of people's needs.

We need a **new** approach that **supports** people in creating **specific knowledge** to **solve their problems**; this includes **building tools** for people so they **develop relevant expertise** or they can **access expertise** when needed.

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Research Tip: Engage in Socratic dialogue

People design, build, and track to better understand and improve their health



Dana Lewis
Created DIY Pancreas

People design, build, and track to better understand and improve their health



Created DIY Pancreas



Pebble watch with glucose monitoring

<https://openaps.org> github.com/openaps

A screenshot of a GitHub repository page for "openaps / openaps". The page shows basic repository statistics: 360 commits, 7 branches, 34 releases, and 12 contributors. The MIT license is visible. Below the stats, a list of recent commits is shown, each with a small icon, the author's name, the commit message, and the time since the commit. The commits are from various contributors, including "egirard" and "scottleibrand".

Author	Commit Message	Date
egirard	Update CONTRIBUTING.md (#124)	10 days ago
bin	bless many uses with --gaps and other features	a year ago
openaps	Add new radio_locale parameter for Medtronic pumps (#112)	6 months ago
tests	update the module references for testing	2 years ago
.gitignore	ignore vim swp files	2 years ago
.travis.yml	Make read_bg_targets only ever return data in mg/dL, not mmol/L	2 years ago
CONTRIBUTING.md	Update CONTRIBUTING.md (#124)	10 days ago
LICENSE.txt	use copyright to apply MIT license	a year ago
MANIFEST.in	fix install problems for @scottleibrand	2 years ago
Makefile	Make read_bg_targets only ever return data in mg/dL, not mmol/L	2 years ago
OpenAPS_rig_with_phone_watch.j...	Sub in new rig image to README (#122)	16 days ago
README.md	Sub in new rig image to README (#122)	16 days ago

Code on Github

OpenAPS Design Details

Medical device communication

OpenAPS periodically (i.e. every 5 minutes) reads new data from the CGM as it becomes available. It also periodically (every few minutes) queries the insulin pump for current settings and recent activity, such as current (scheduled or temporary) and maximum basal rates, recent boluses, IOB (if available), ISF, DIA, carb ratio, BG target/range, etc. If that query is successful, OpenAPS updates its bolus wizard calculations (detailed below) and determines whether any action is required (canceling or issuing a temporary basal).

If action is required, OpenAPS issues the appropriate insulin dosing command to the pump, confirms that it was received and acknowledged by the pump, and then performs another query for recent activity to make sure any new temporary basal successfully took effect.

Algorithms

Basic overnight operation (oref0)

Design with algorithm details at OpenAPS blog

Worldwide, people use online health fora to share insights and look for answers

I've discovered that **finding relief from IBS** is like finding a needle in a haystack. I am still searching. **My faith is what is getting me through each day. I am listing all the things that I have done or tried.** Maybe it will be someones needle in the haystack: **Upper GI, Colonoscopy, Vaginal ultrasound, Gluten and food allergy test, Gallbladder ultrasound, Stomache scoped, Abdominal CT scan, Dicyclomine, Probiotics, Colestipol...Glutten Free Diet and Special Carb Diet.** Let me know if any of these help you.

People draw ideas from current research by reading and discussing papers

[Researchers Invent New Method for Non-Invasive Deep Brain Stimulation](#) (spectrum.ieee.org)
14 submitted 3 days ago by DIYtDCS
3 comments share

all 3 comments
sorted by: best ▾

[-] DIYtDCS [S] 3 points 3 days ago
And their research paper: [Noninvasive Deep Brain Stimulation via Temporally Interfering Electric Fields](#)
permalink embed

[-] malo5tak 2 points 3 days ago
Tldr

Neurons typically don't respond to high frequency electric signals. But they do respond to low frequency signals. Boyden and Grossman hypothesized that if they sent to a deep brain target two high frequency signals that differed by a small amount, the signals would pass through the more superficial tissues of the brain. When these signals interfered with each other at the target, they would create a field with an amplitude that oscillates at a frequency equal to the small difference between the two high frequency signals. That electrical wave would be low enough to engage neurons.

Lithium delays progression of amyotrophic lateral sclerosis

Francesco Fornai^{*†‡}, Patrizia Longone[§], Luisa Cafaro[†], Olga Kastsiuchenka^{*}, Michela Ferrucci^{*}, Maria Laura Manca[¶], Gloria Lazzeri^{*}, Alida Spalloni[§], Natascia Bellio^{||}, Paola Lenzi^{*}, Nicola Modugno[†], Gabriele Siciliano[¶], Ciro Isidoro[¶], Luigi Murri[¶], Stefano Ruggieri[†], and Antonio Paparelli^{*}

^{*}Department of Human Morphology and Applied Biology, and [†]Department of Neuroscience, Clinical Neurology, University of Pisa 56100 Pisa, Italy; [‡]Istituto Neurologico Mediterraneo, Istituto Di Ricovero e Cura a Carattere Scientifico Neuromed, 86077 Pozzilli (IS), Italy; [§]Molecular Neurobiology Unit, Santa Lucia Foundation, 00179 Rome, Italy; and [¶]Department of Medical Sciences, University of Novara, 28100 Novara, Italy

Edited by Thomas C. Südhof, University of Texas Southwestern Medical Center, Dallas, TX, and approved December 21, 2007 (received for review August 24, 2007)

Letter to the Editor

Real-World Use of Open Source Artificial Pancreas Systems

Dana Lewis¹, Scott Leibrand¹, and the #OpenAPS Community

Keywords
artificial pancreas, APS, OpenAPS, #WeAreNotWaiting, closed loop, DIY diabetes technology

American Diabetes Association
77TH SCIENTIFIC SESSIONS
EXPERIENCE NEW HORIZONS IN DIABETES
SAN DIEGO, CA JUNE 9-13, 2017

← American Diabetes Association - 77th Scientific Sessions Home
Session LB-01 - Late Breaking Poster Session
127-LB / 127 - Automatic Estimation of Basals, ISF, and Carb Ratio for Sensor-Augmented Pump and Hybrid Closed-Loop Therapy
June 11, 2017, 12:00 - 1:00 PM Hall B

Authors
DANA M. LEWIS, SCOTT LEIBRAND, Seattle, WA
Disclosures
D.M. Lewis: None. S. Leibrand: None.

Okay, so people benefit from accessing papers and other resources. Does science benefit from this?

Lead users have created different—and in some cases better designs—than experts



Lead users have created different—and in some cases better designs—than experts



Activity 1

- 1) Which factors enable lead users to perform their work?

- 2) What are some examples of lead-user work that you do?

Lead users have created different—and in some cases better designs—than experts



1. Lived experience
2. A tight feedback loop
3. Strong personal motivation

Okay, so people benefit from accessing papers and other resources. Does science benefit from this?

Science can benefit from

1. Creative insights -> New ideas
2. Real-world reports -> External validity

1 Generating and validating new ideas

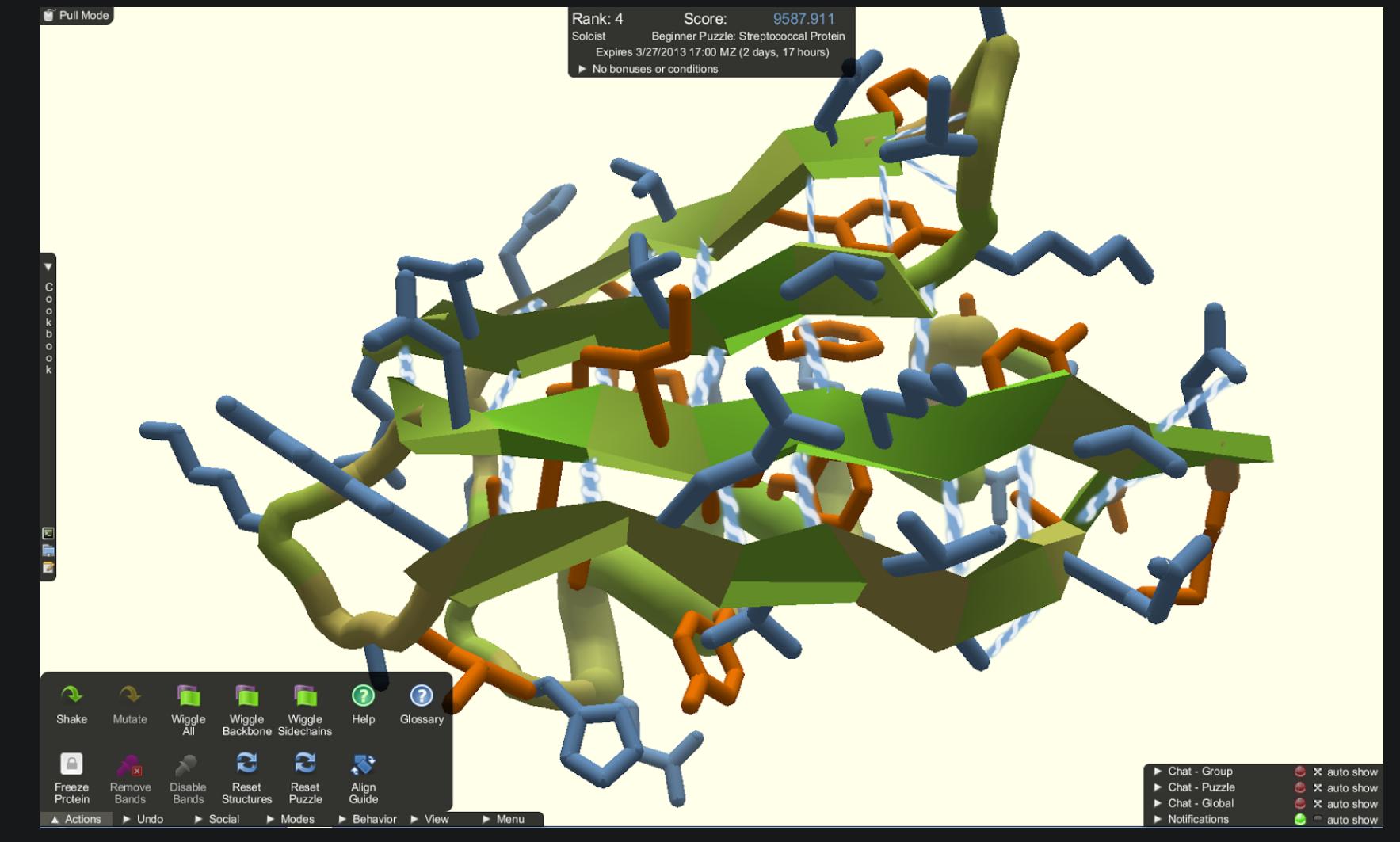
Citizens have successfully solved expert-defined problems as sensors or algorithms



Tracking bird migration

eBird

eBird: A citizen-based bird observation network in the biological sciences. Brian L. Sullivan *, Christopher L. Wood, Marshall J. Iliff, Rick E. Bonney, Daniel Fink, Steve Kelling. 17
Predicting protein structures with a multiplayer online game. Seth Cooper, Firas Khatib, Adrien Treuille. Nature 2010.



Folding proteins

Foldit

How might citizens design and run experiments?

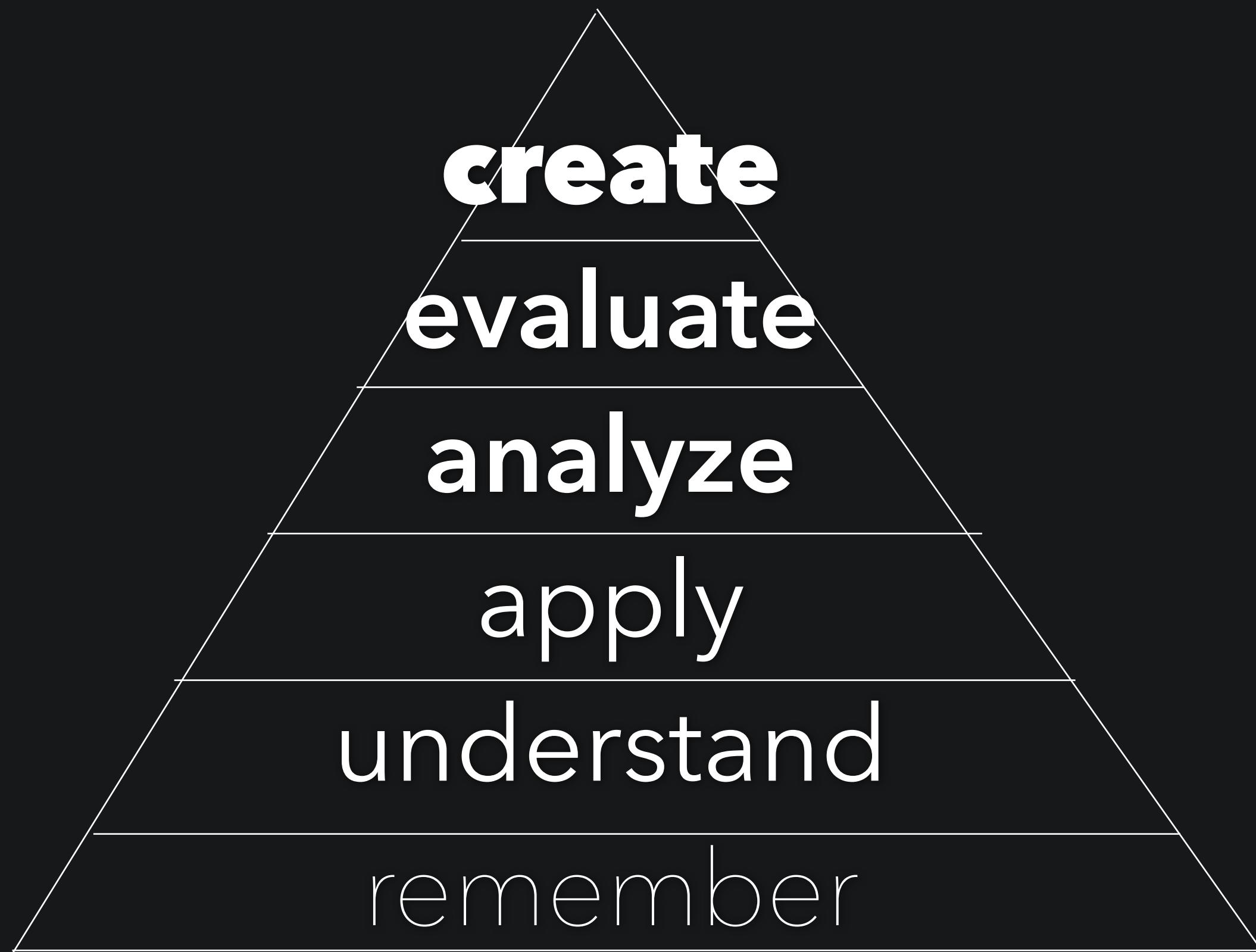


Kombucha bacteria: a gut probiotic?



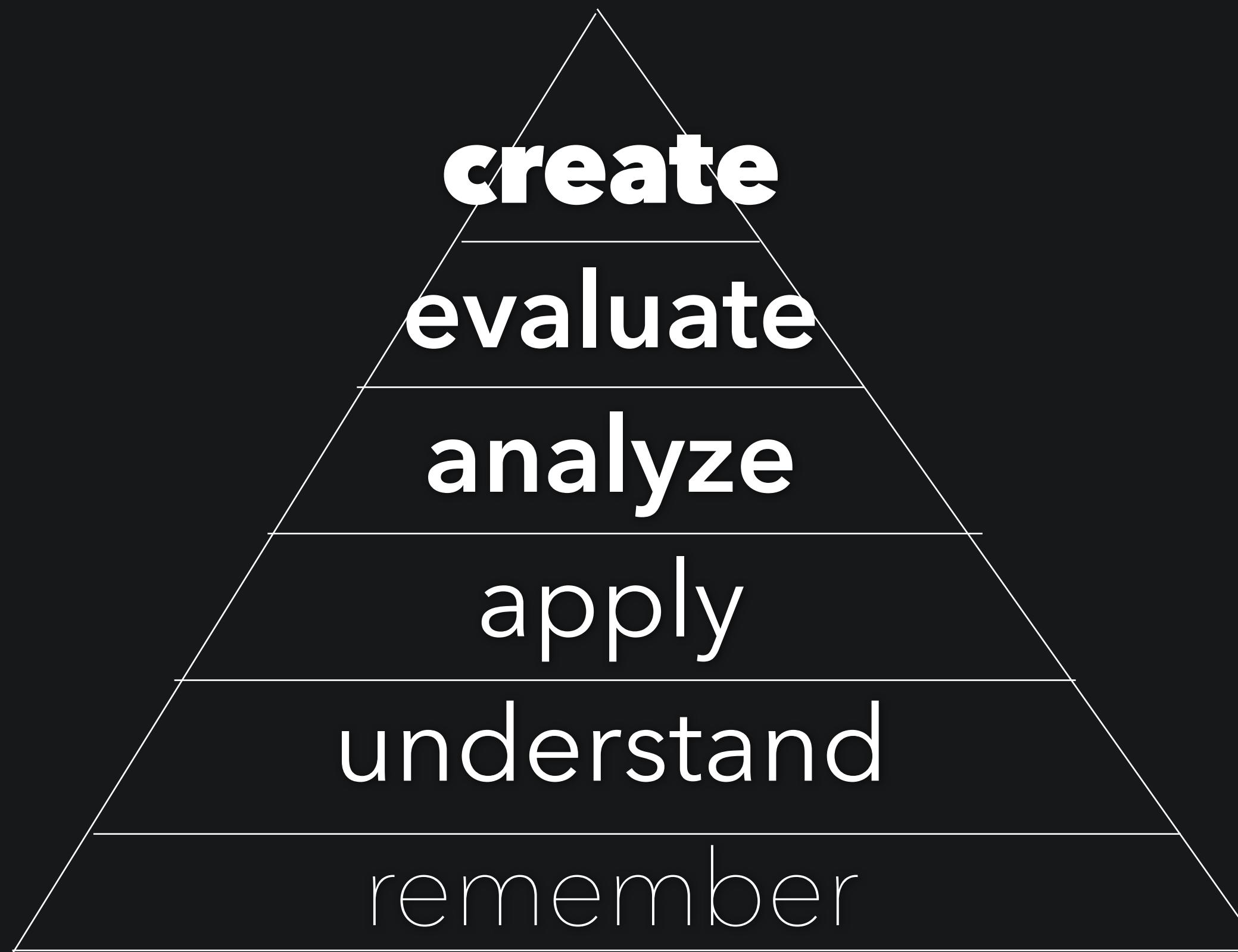
Adriana: Kombucha producer from Rio

Complex work: learning



Learning hierarchy (Bloom)

Complex work: learning & collaboration

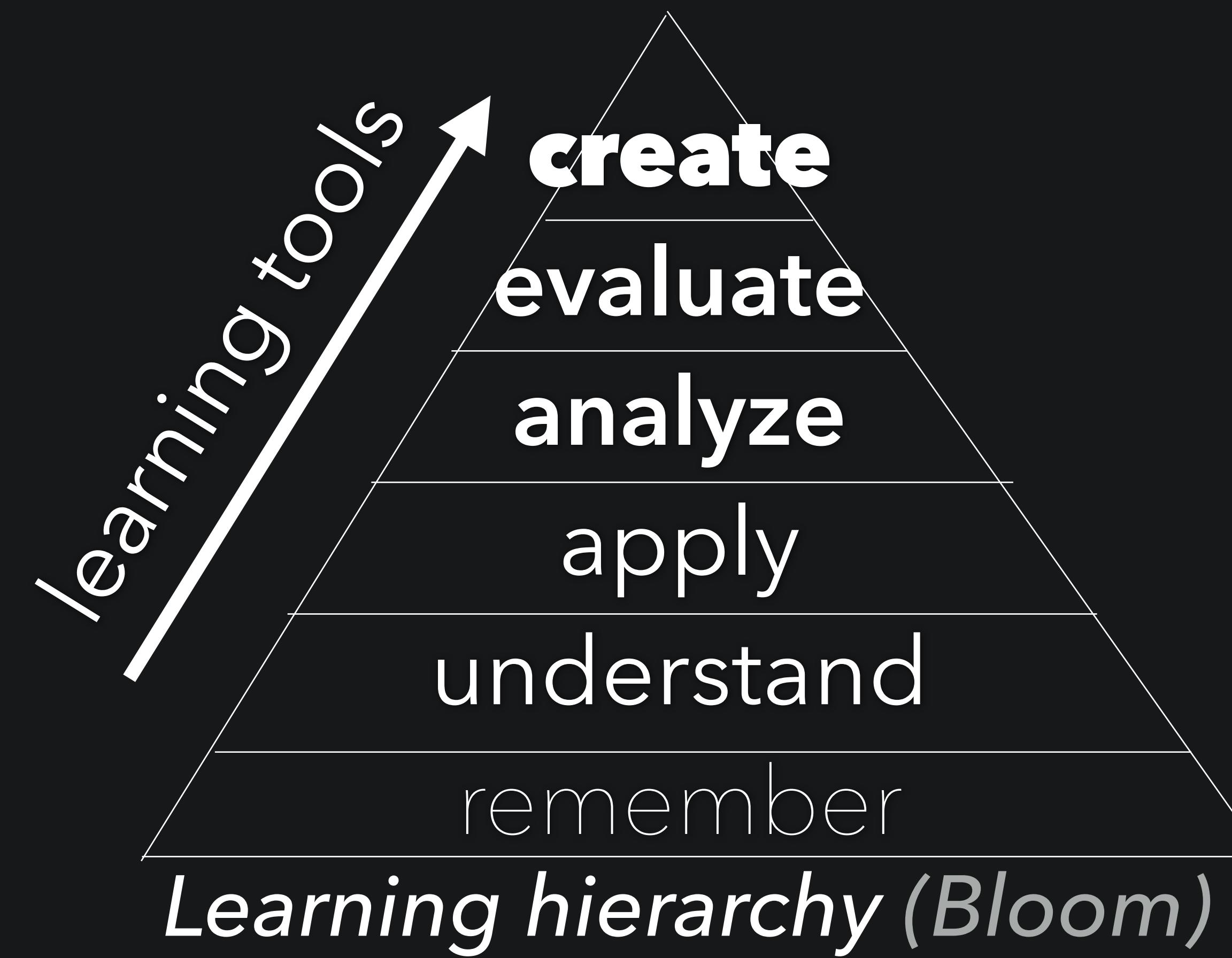


Learning hierarchy (Bloom)

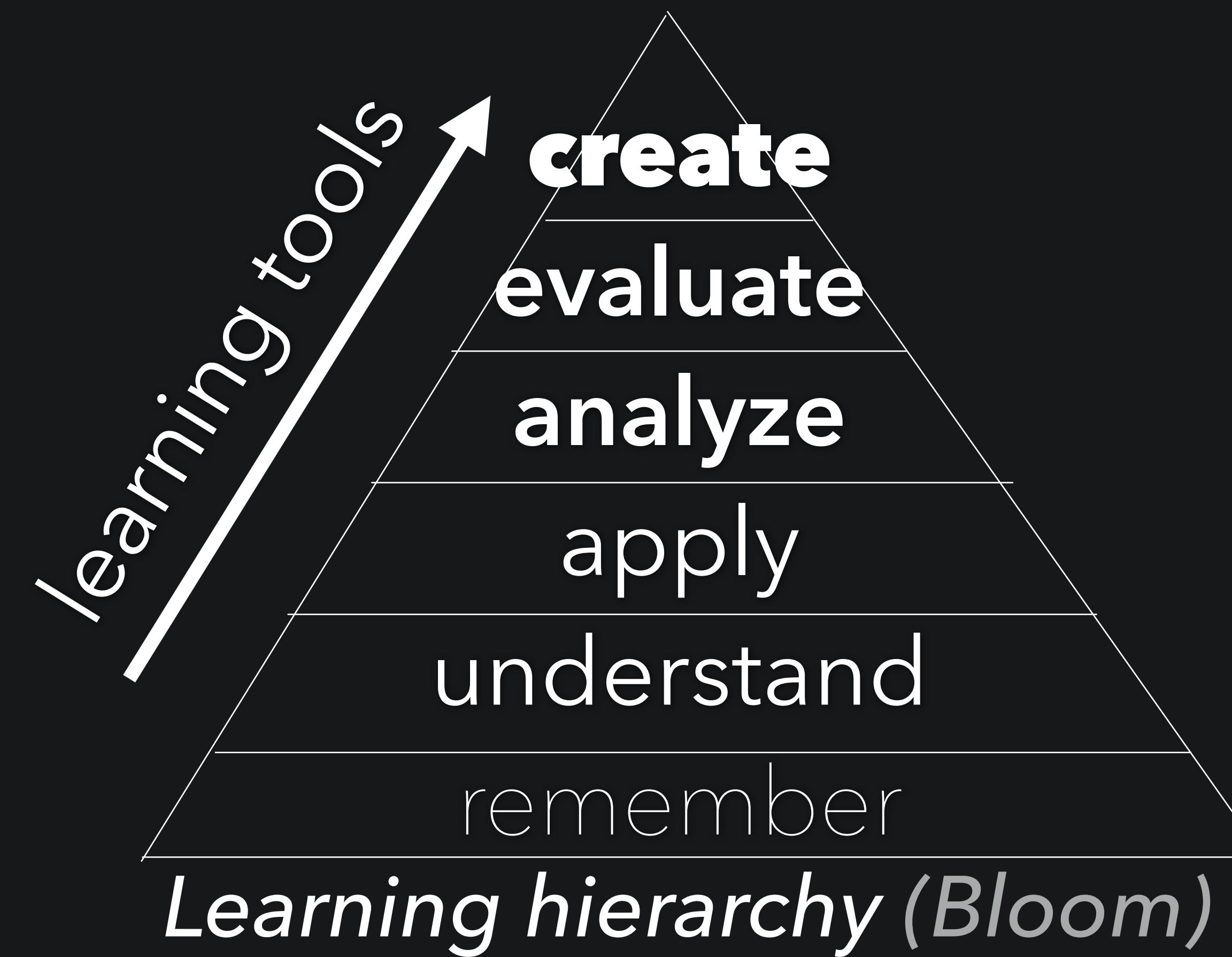


Participation levels (Arnstein)

Complex work: learning & collaboration



Activity 2: Where do current online platforms show up on these pyramids?



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



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

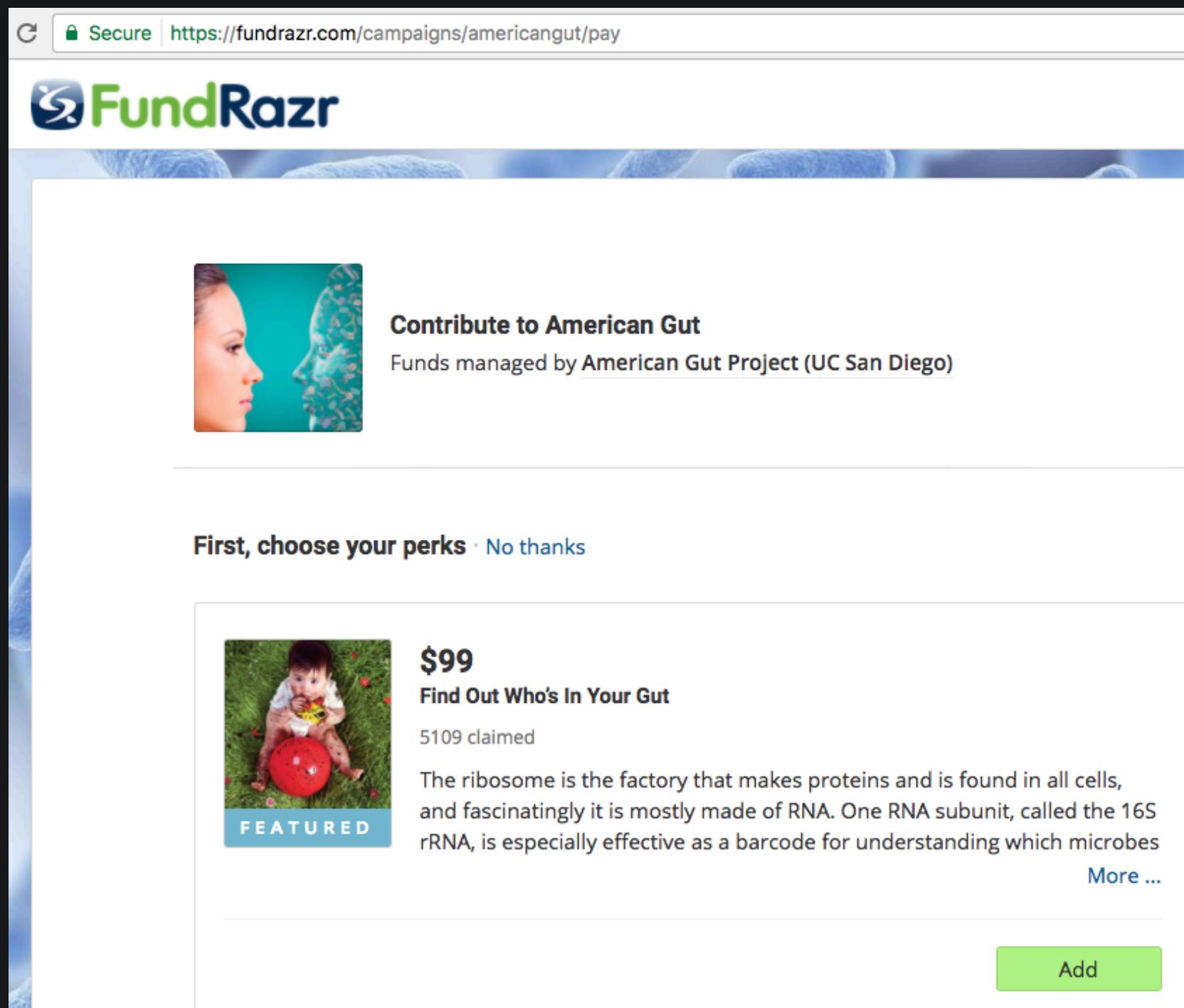
Are Pets the New Probiotic?

By RICHARD SCHIFFMAN JUNE 6, 2017



Nascent Experts know little
Contextual Huge individual
differences
Motivating People care

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



The screenshot shows a FundRazr campaign page for the American Gut Project. At the top, it says "Secure | https://fundrazr.com/campaigns/american gut/pay". The title is "Contribute to American Gut" and it's managed by "American Gut Project (UC San Diego)". Below this, there's a "First, choose your perks" section with a "No thanks" link. A featured perk is shown: "\$99 Find Out Who's In Your Gut" (5109 claimed). It describes the ribosome as a factory for proteins and mentions the 16S rRNA barcode. There's a "More ..." link and a green "Add" button.

1: Create an online account and support the project



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

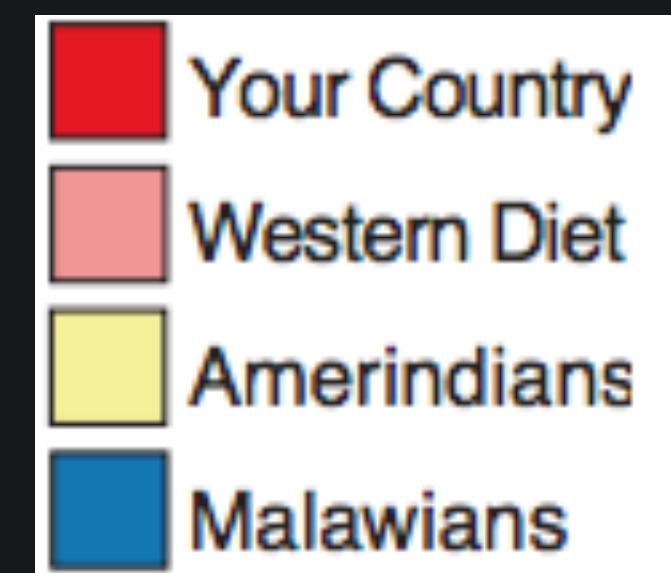
americangut.org

Participants generate hypotheses by looking at the data

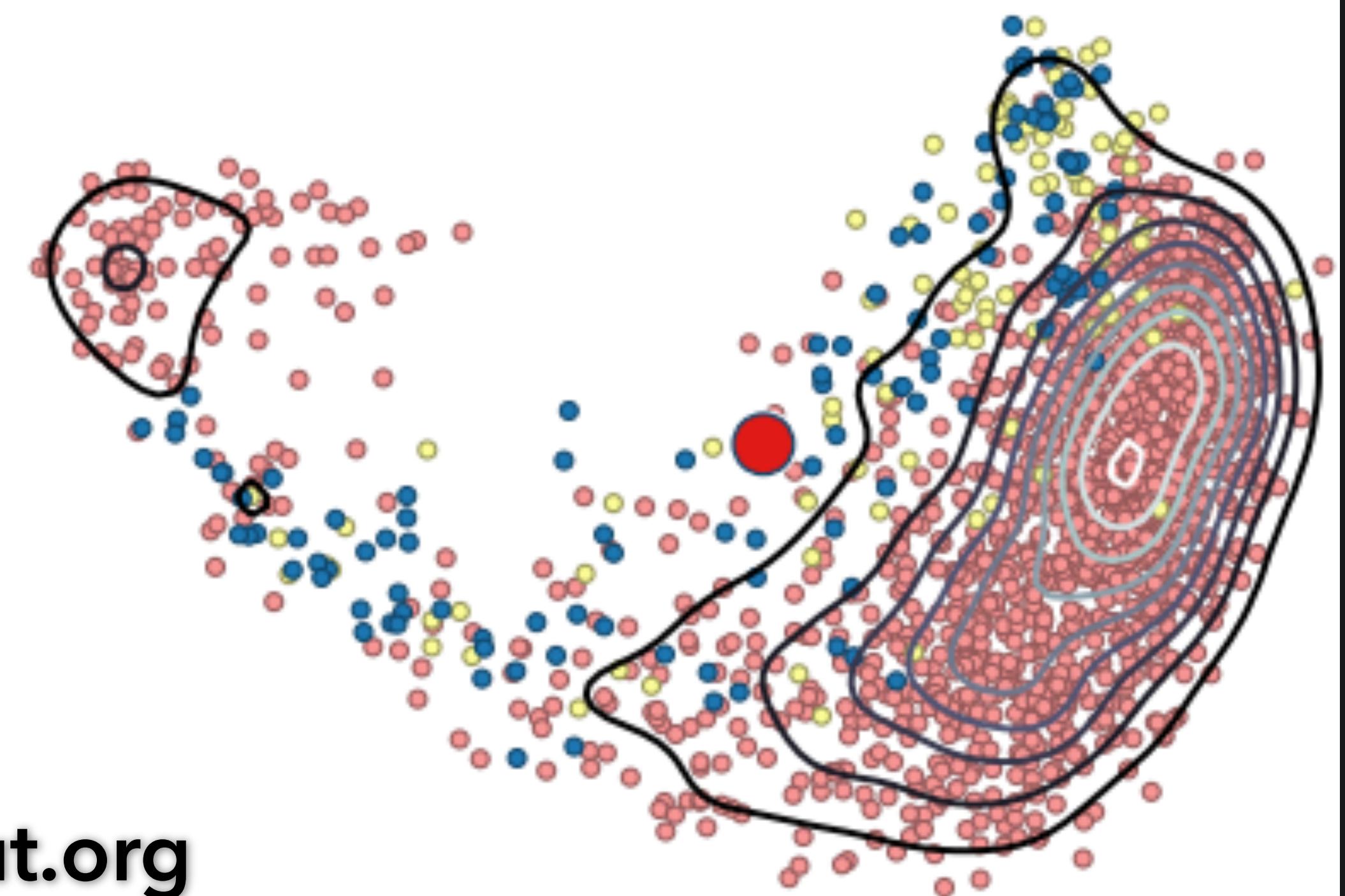


Is my data point unique because

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



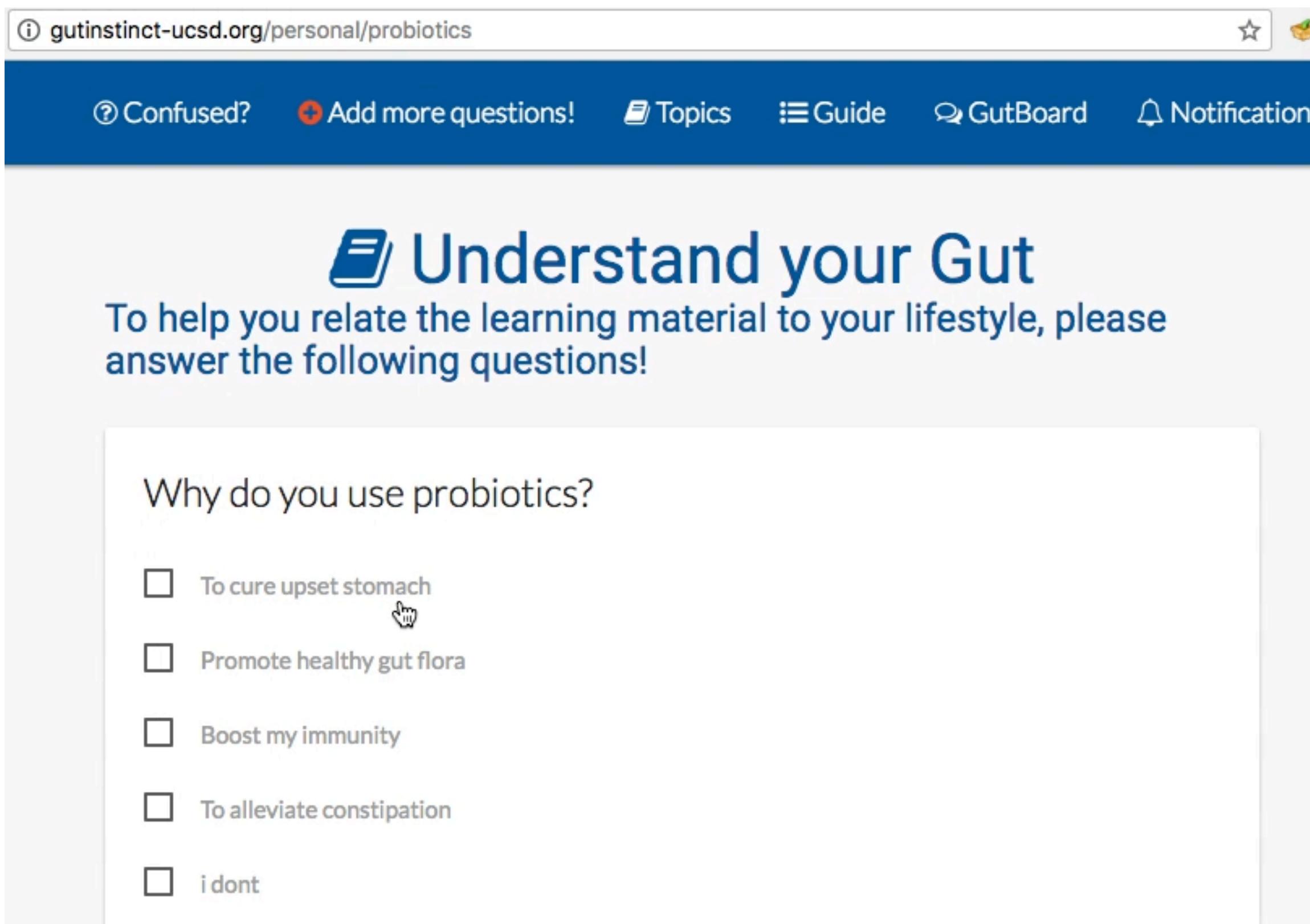
americangut.org



Insight: Scaffold hypothesis-generation using procedural training

- 1) Teach people about the success criteria of sharing questions, and
- 2) Support this in the interface

Learn about a lifestyle topic + the microbiome



The screenshot shows a web page with a blue header bar. The URL in the address bar is gutinstinct-ucsd.org/personal/probiotics. The header includes links for "Confused?", "Add more questions!", "Topics", "Guide", "GutBoard", and "Notifications". Below the header, there's a section titled "Understand your Gut" with the sub-instruction: "To help you relate the learning material to your lifestyle, please answer the following questions!". A question "Why do you use probiotics?" is followed by a list of options with checkboxes. The first option, "To cure upset stomach", has a cursor icon pointing to its checkbox. Other options include "Promote healthy gut flora", "Boost my immunity", "To alleviate constipation", "i dont", and "Add your own option".

**Reflect on lifestyle by
answering basic questions
about probiotics use**

Which probiotics do you use?

Learn about probiotics + the microbiome

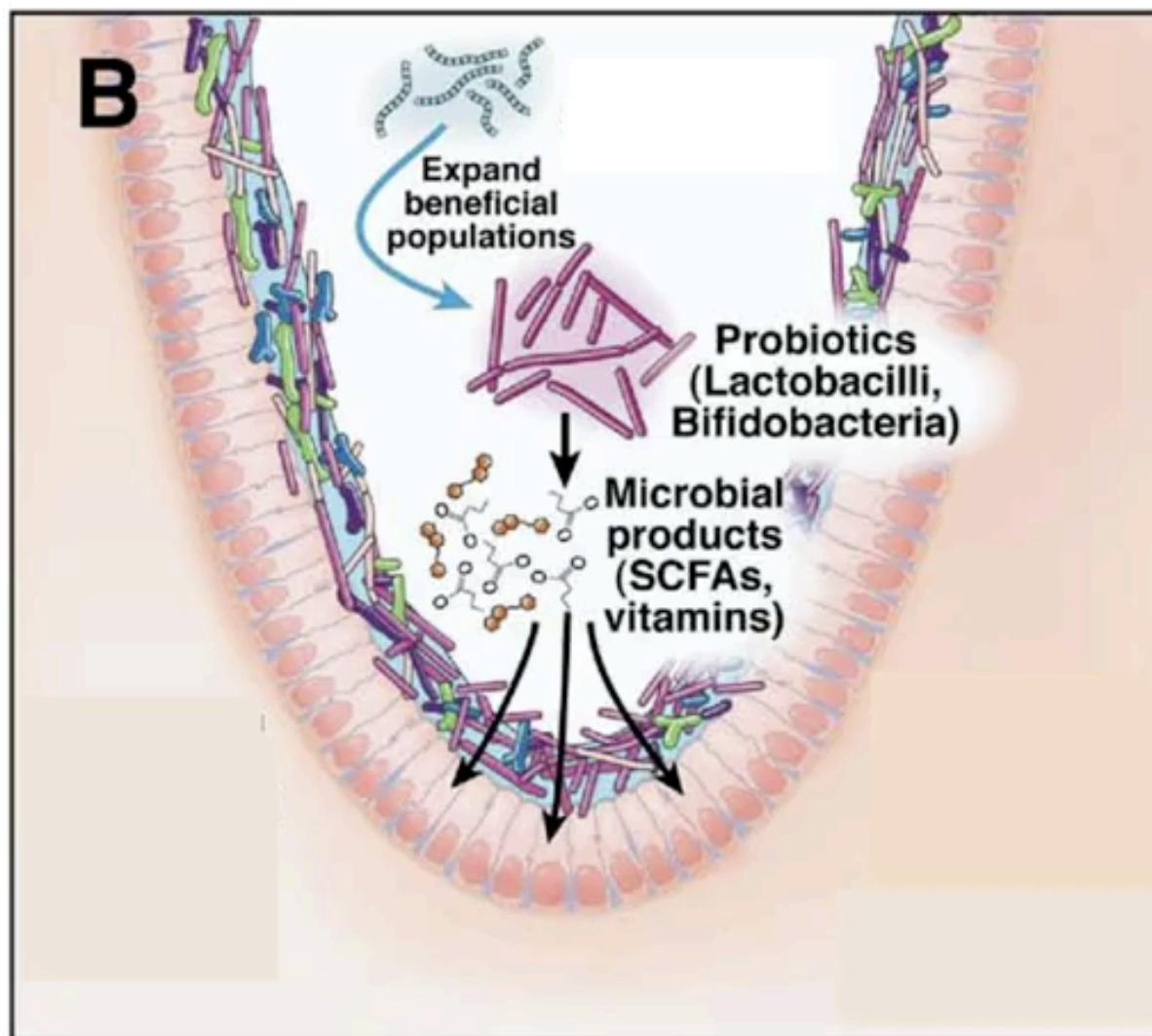
gutinstinct-ucsd.org/t/probiotics

Confused? Add more questions! Topics Guide GutBoard Notifications

Back to Topics

#probiotics

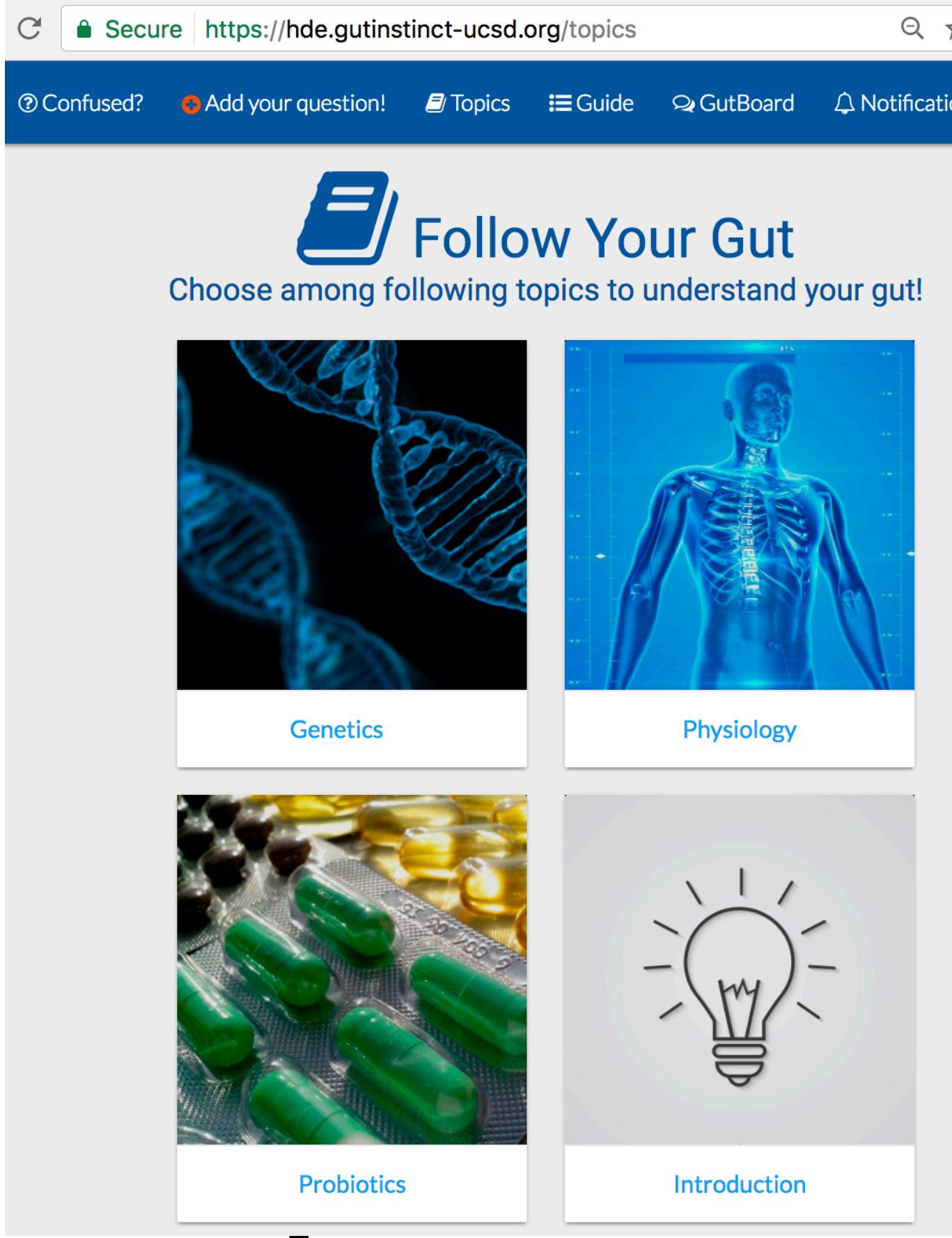
Video
Provided
By coursera



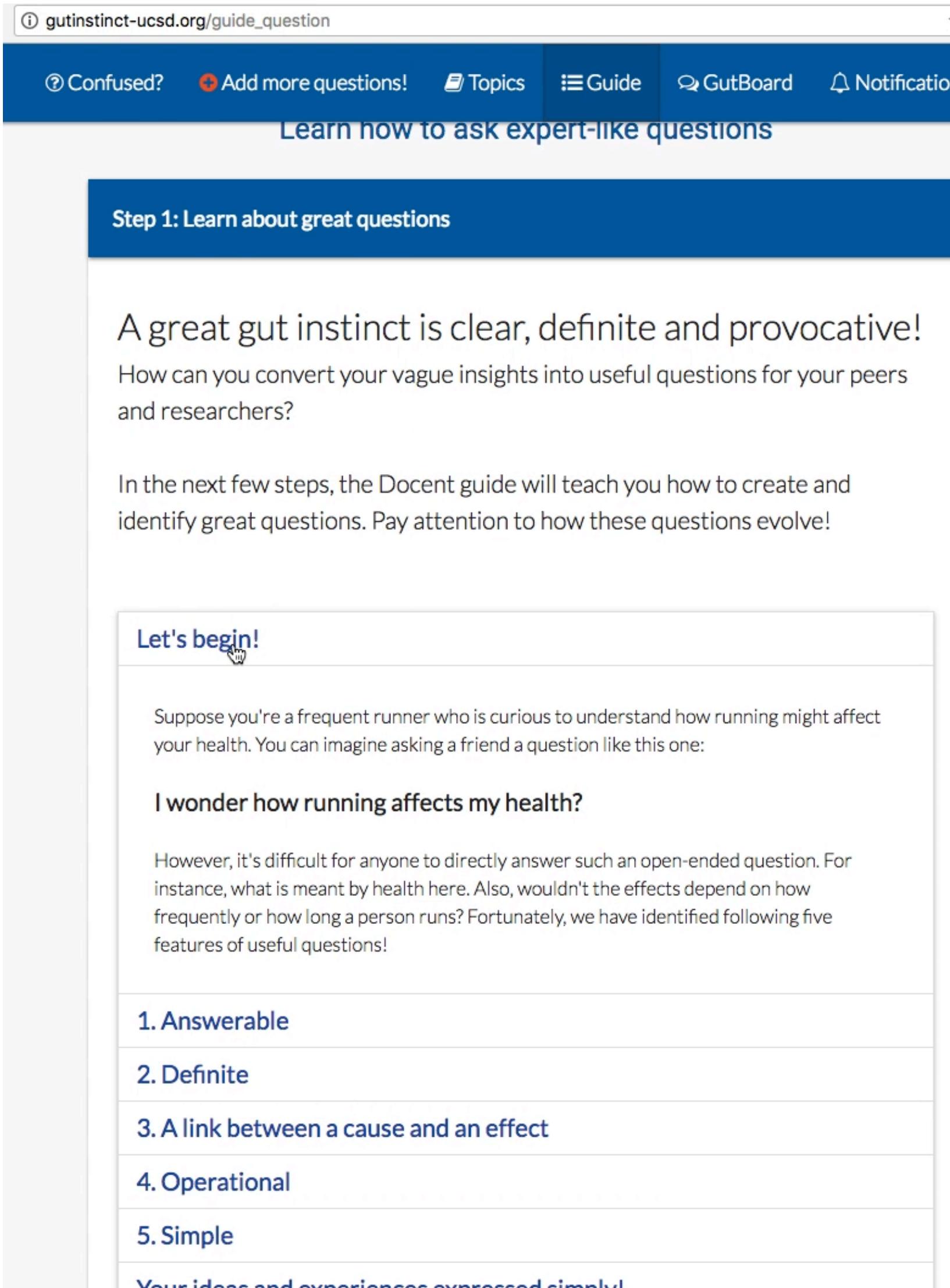
Preidis and Versalovic 2009, Gastroenterology

**Watch a 4-minute lecture
that synthesizes current
research about probiotics**

Train to frame useful questions



The screenshot shows the homepage of the 'Follow Your Gut' website. At the top, there's a navigation bar with links for 'Secure', 'Topics', 'Guide', 'GutBoard', and 'Notifications'. Below this, the main heading 'Follow Your Gut' is displayed with a blue icon. A sub-headline says 'Choose among following topics to understand your gut!'. There are four main topic cards: 'Genetics' (with a DNA helix image), 'Physiology' (with a human body diagram), 'Probiotics' (with a photo of capsules), and 'Introduction' (with a lightbulb icon). The URL in the browser bar is <https://hde.gutinstinct-ucsd.org/topics>.



The screenshot shows a guide page titled 'Learn how to ask expert-like questions'. The top navigation bar includes links for 'Confused?', 'Add more questions!', 'Topics', 'Guide', 'GutBoard', and 'Notifications'. A sub-header 'Step 1: Learn about great questions' is followed by text: 'A great gut instinct is clear, definite and provocative! How can you convert your vague insights into useful questions for your peers and researchers?'. It also states: 'In the next few steps, the Docent guide will teach you how to create and identify great questions. Pay attention to how these questions evolve!'. A section titled 'Let's begin!' contains the text: 'Suppose you're a frequent runner who is curious to understand how running might affect your health. You can imagine asking a friend a question like this one: I wonder how running affects my health?'. Below this, it says: 'However, it's difficult for anyone to directly answer such an open-ended question. For instance, what is meant by health here. Also, wouldn't the effects depend on how frequently or how long a person runs? Fortunately, we have identified following five features of useful questions!'. A numbered list follows: 1. Answerable, 2. Definite, 3. A link between a cause and an effect, 4. Operational, 5. Simple. The footer of the page says: 'Your ideas and experiences expressed simply!'. The URL in the browser bar is https://gutinstinct-ucsd.org/guide_question.

Understand what makes a question useful

Ask questions of people

The screenshot shows the homepage of the 'Follow Your Gut' website. At the top, there's a navigation bar with links for 'Secure', 'Topics', 'Guide', 'GutBoard', and 'Notifications'. Below the header, the main title 'Follow Your Gut' is displayed with a blue icon. A sub-header says 'Choose among following topics to understand your gut!'. There are four main topic sections: 'Genetics' (represented by a DNA helix image), 'Physiology' (represented by a human torso image), 'Probiotics' (represented by a blister pack of capsules), and 'Introduction' (represented by a lightbulb icon). Each topic has a small description below it.

The screenshot shows a 'Share your Gut Instinct!' page. At the top, there's a navigation bar with links for 'Topics', 'Guide', 'GutBoard', and 'Notifications'. Below the header, the main title 'Share your Gut Instinct!' is displayed with a question mark icon and a 'Show me examples' link. A large central box contains five numbered steps for adding a question:

1. Add a top-level question for others to answer:
Something that you do (*a cause*)
2. Add a follow-up question:
Something that happens (*an effect*) due to the cause above
3. Add more follow-up questions: More effects
4. Guess the mechanism for your Gut Instinct
5. Check the criteria

Use the
criteria when
adding a
question

Contribution: Learn-Train-Ask workflow

The screenshot shows a web browser window with the URL <https://hde.gutinstinct-ucsd.org/topics>. The page title is "Follow Your Gut". Below the title, it says "Choose among following topics to understand your gut!". There are four topic cards: "Genetics" (image of DNA), "Physiology" (image of a human skeleton), "Probiotics" (image of green capsules), and "Introduction" (image of a lightbulb).

Learn

31

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

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](#)

Train

Ask

Method

Between-subjects experiment (N=344) for Learn and Train w/ 2x2 factorial study

H1 Access to learning
improves question's
content

H2 Just-in-time training
improves question's
structure

		Train=Yes			
		Train	Both		
Learn=No	Learn=Yes	What type of alcoholic drinks (with sugar) affect your bowel movements?	What type of alcoholic drinks (with sugar) affect your bowel movements?		
		<input type="checkbox"/> wine	<input type="checkbox"/> wine		
Learn=Yes	Train=No	What type of alcoholic drinks (with sugar) affect your bowel movements?	What type of alcoholic drinks (with sugar) affect your bowel movements?		
		<input type="checkbox"/> beer	<input type="checkbox"/> beer		

Method

Between-subjects experiment (N=344) for Learn and Train w/ 2x2 factorial study

H1 Access to learning improves question's content

H2 Just-in-time training improves question's structure

Content

Insightful: Does the question & discussion link to existing knowledge of the microbiome?
Novel: Is there a chance the world will learn something?

Structure

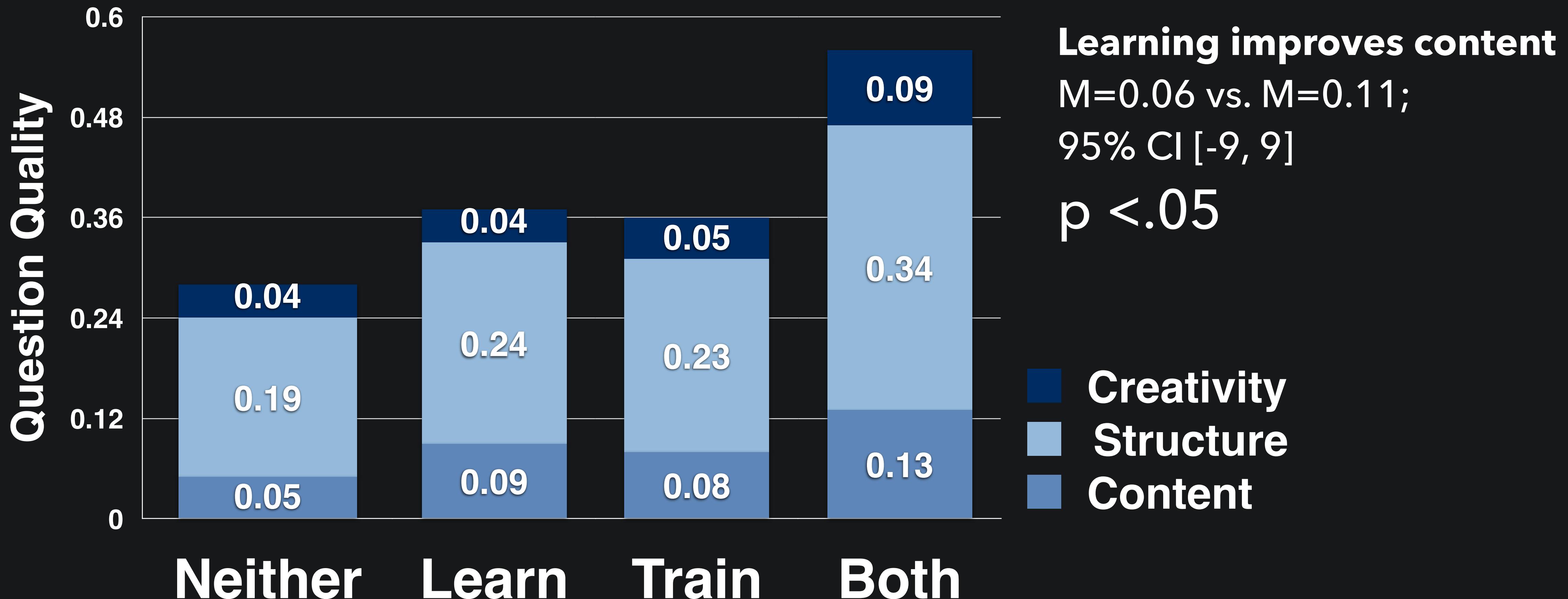
Answerable: Is it a question about the participant?
Specific: Does it ask about only one topic?

Creativity

Is it reasonably interesting/ creative?

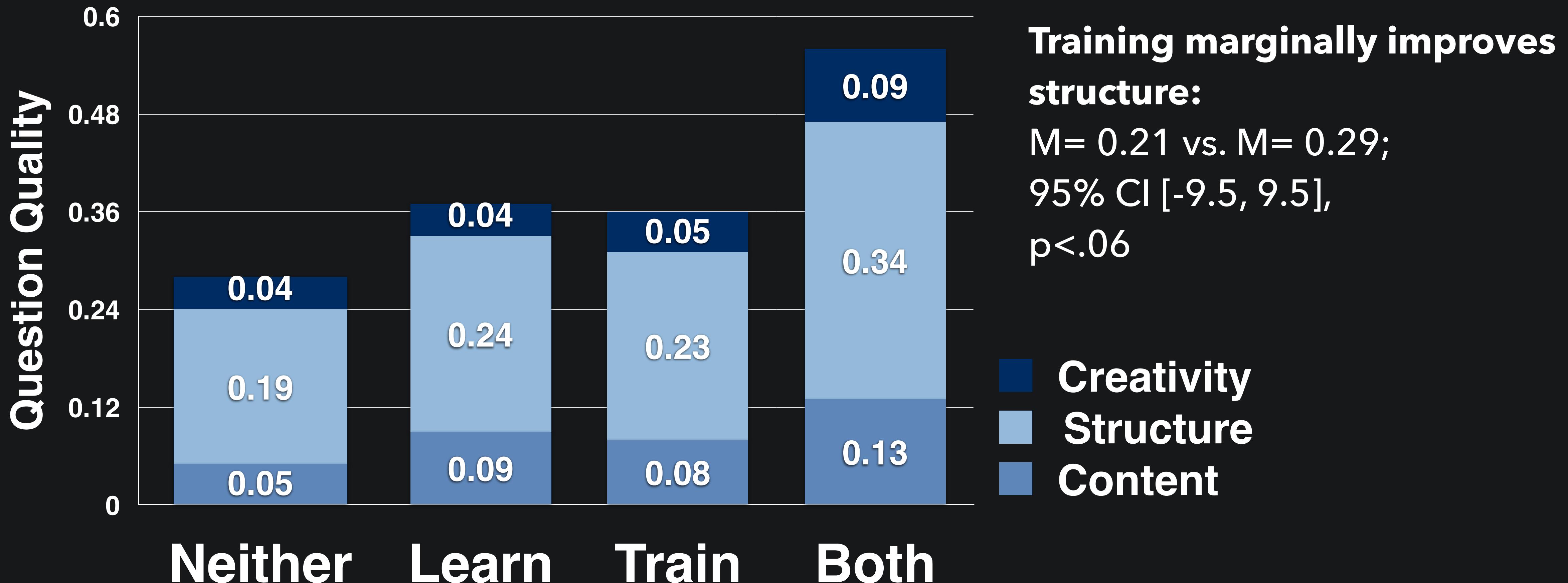
Results

Learn-Train yields better questions ($N=344$)



Results

M



399 hypotheses, 75 considered novel by experts; Lead users are best with need-intensive problems

Personal Insights provide Novel Hypotheses

Does consuming probiotics reduce your sugar cravings?

How often do you consume bone broth? Do you have better bowel movements?

Is yogurt better for your gut at room temperature?

Most Questions contained Known Facts

Does eating more plants change my bowel movements?

Do antibiotics lead to GI issues?

Common themes



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](#)

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[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](#)

by [phenylalanine](#) 14 days ago

0 Upvotes | 0 Downvotes

How much popcorn are you eating? How salty is it? Do you drink enough water with it to stay hydrated? I rarely have issues with constipation/BMs and I've never noticed any food-related changes except if I do something extreme such as eating an entire jar of hot peppers or drinking a jar of pickle juice (just a bad idea. don't do it.)

by [Cangussumicrobiome](#) 18 days ago

0 Upvotes | 0 Downvotes

I believe the problem here is the type or quantity of fiber in popcorn.

Receive feedback to learn about relevant science

Feedback from scientific material (?)



Updated 24 days ago Edit

Hi DND, intriguing question! The topic video about gut-brain-axis might provide some basic information about how our microbiome state might be linked - gutinstinct.ucsd.edu/topics Please keep sharing your gut instincts, these are helpful!

Add follow-on questions³⁷

Discuss questions and responses

Share scientific feedback

People contributed in different ways

Diversity in roles: Technical interventions are scalable, social interventions are powerful

Role and Actions

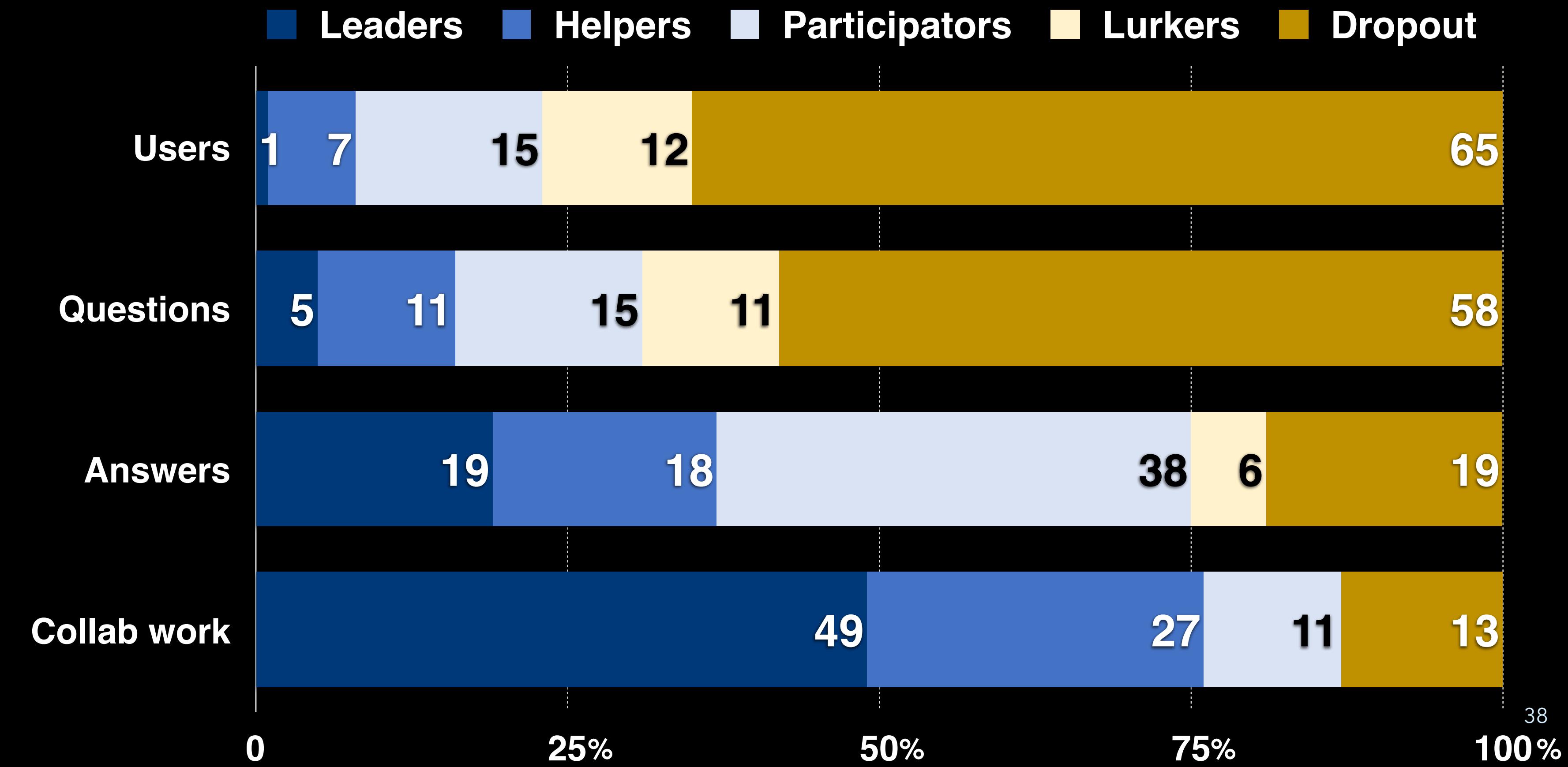
Leader: Add questions, answer & edit others' questions, add follow-ups, discuss

Helper: Add & answer questions, add follow-ups

Participant: Answer questions

Lurker: Add questions but no collaborative work

Dropout: Add a question; never returned



Activity 3:
Do these results remind you of concepts from your previous reading(s)?

Activity 3:

Do these results remind you of concepts from your previous reading(s)?

1. "Situated learning theory explains apprenticeship as legitimate peripheral participation in a community of practice"
- Chapman, Upgrade your cargo cult for the win
2. "technical systems of various kinds are deeply interwoven in the conditions of modern politics."
- Langdon Winner, Do Artifacts Have Politics?
3. ...

**Two lessons from collaborative hypotheses-generation:
Procedural training (know-how) helps and people take roles**

How might citizens design and run experiments?



Kombucha bacteria: a gut probiotic?



Adriana: Kombucha producer from Rio

Experimentation requires making many choices

“Kombucha helps the gut” - what does this mean?

Do people just drink kombucha and report its effects?

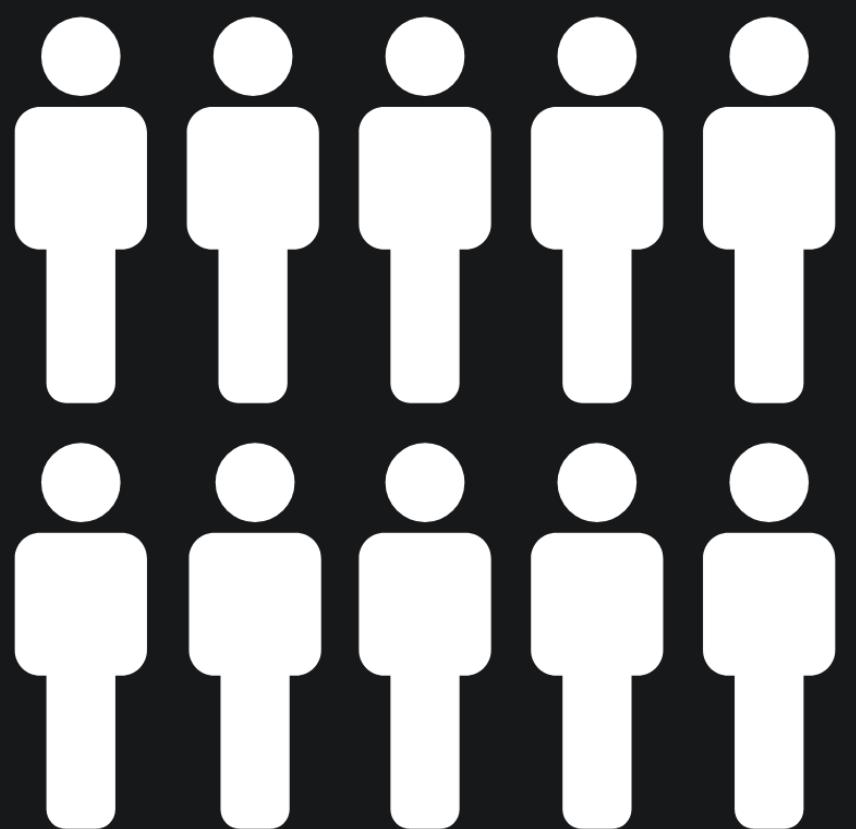
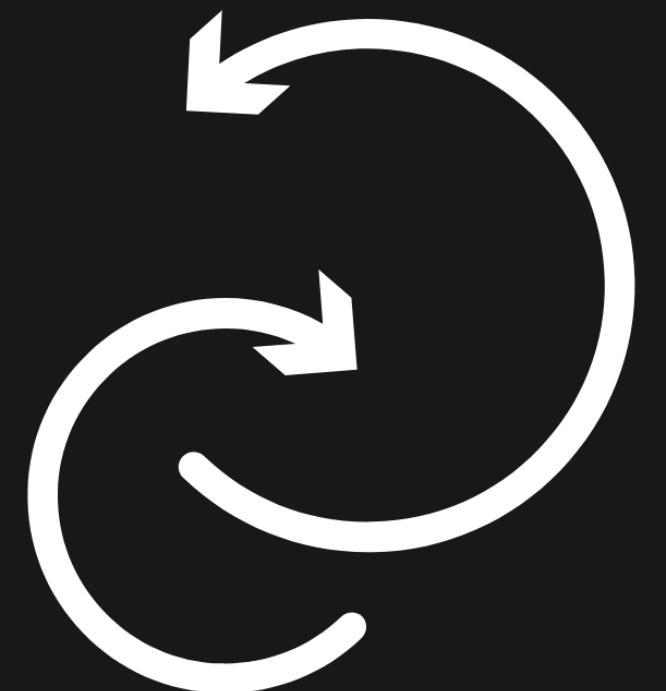
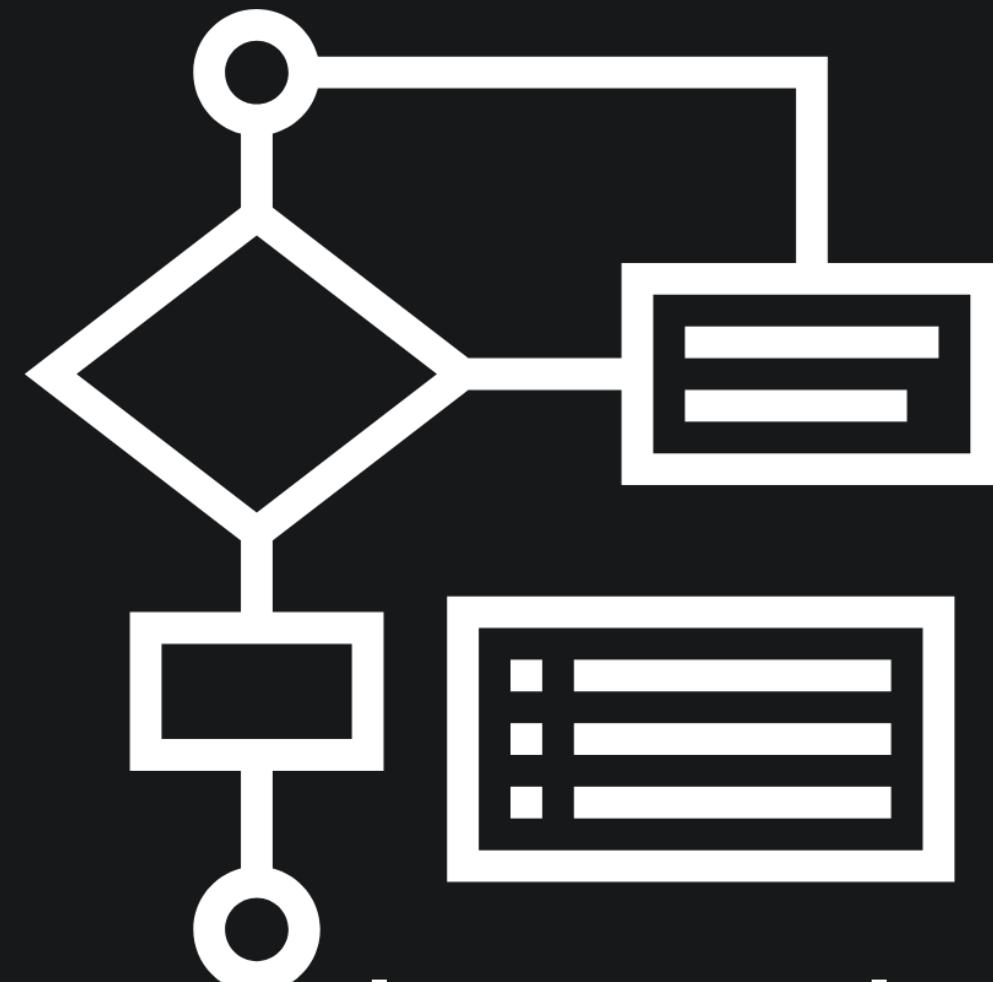
How might participants provide their data?

Which is the right set of participants?

Where do I find them?

Can I place my friend in experimental condition?

Experimentation is hard

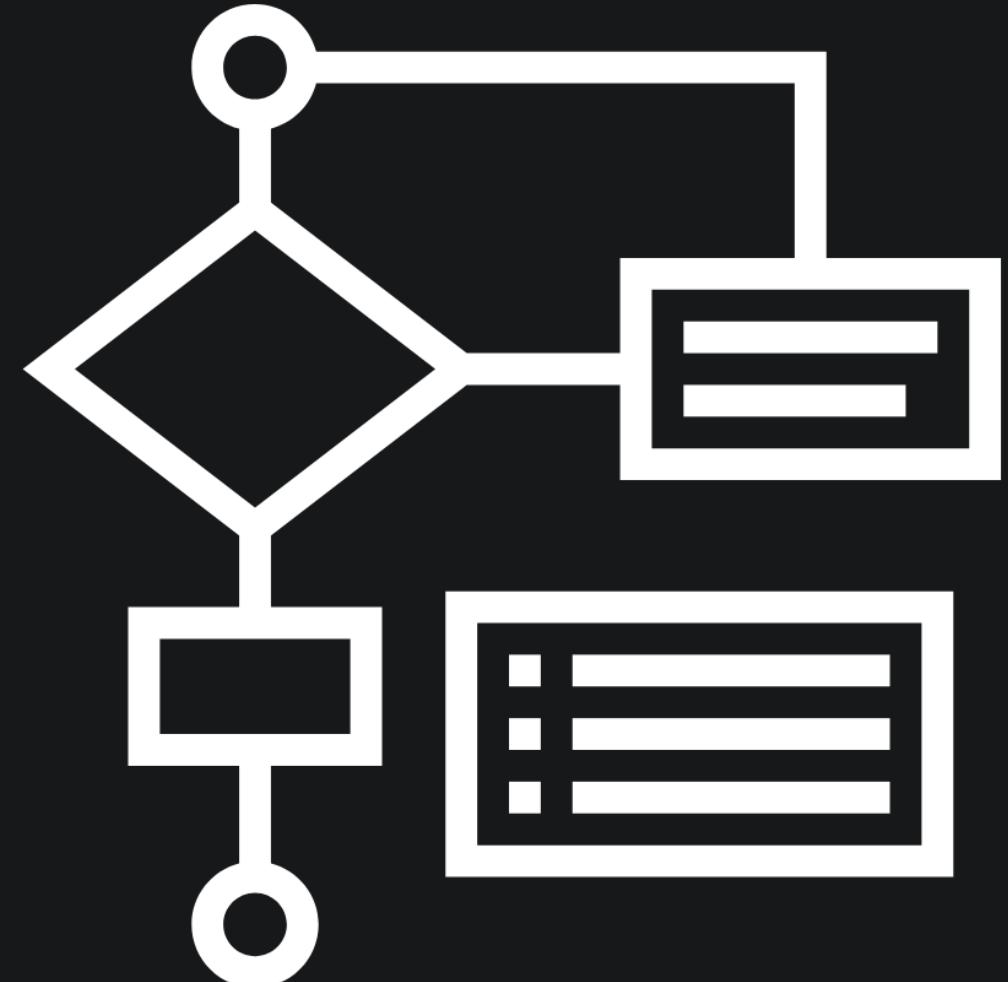


Know what makes
for an experiment
+ get the individual
elements right

Iterate to improve
the design

Run it correctly
(without adding
biases)

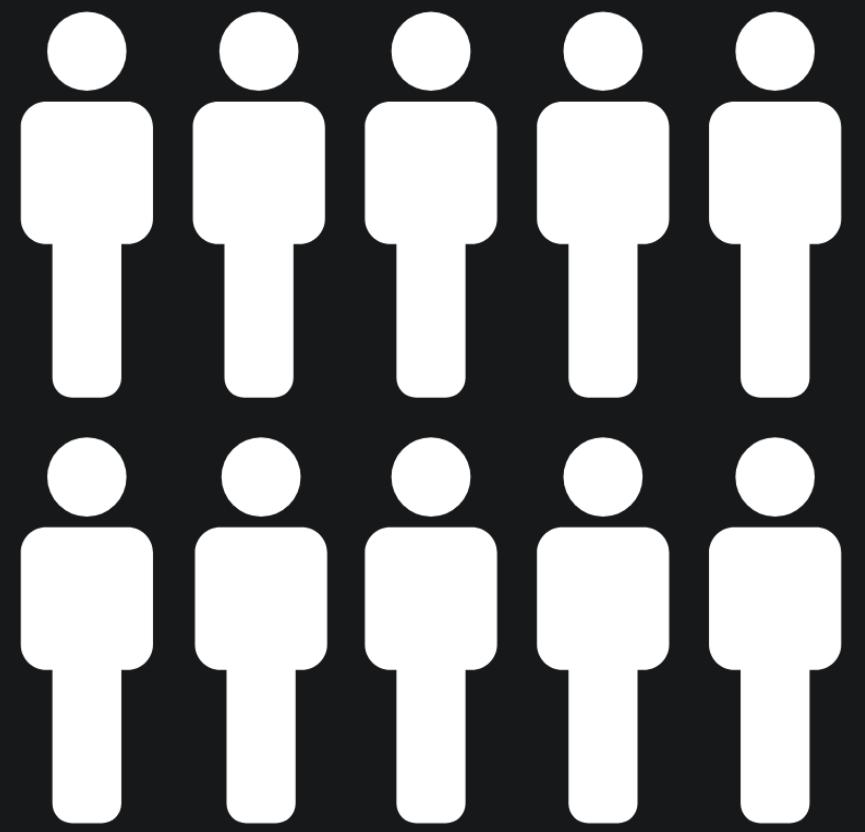
Experimentation is hard because it requires multiple kinds of knowledge and skills



Conceptual +
Procedural training

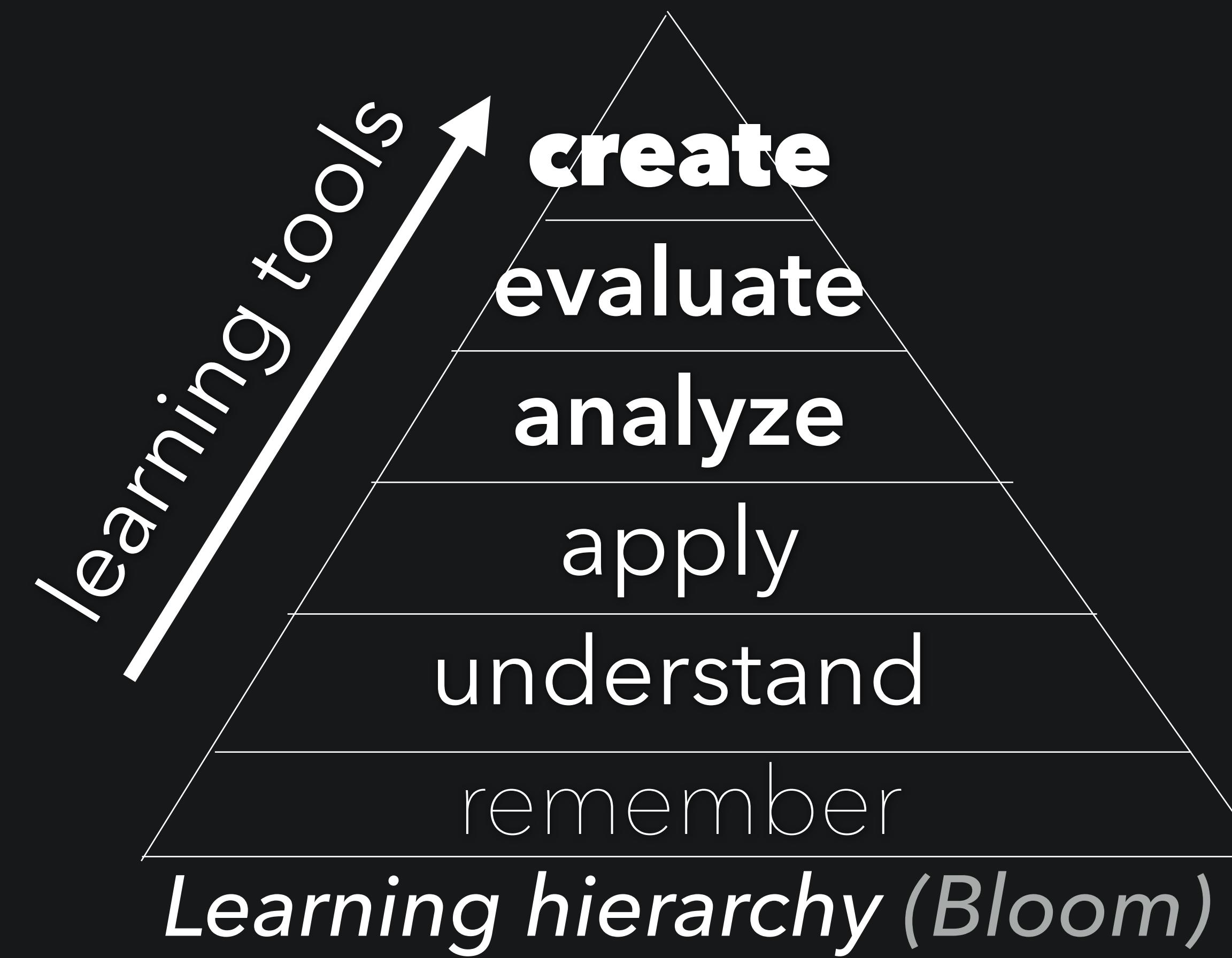


Structured
collaboration

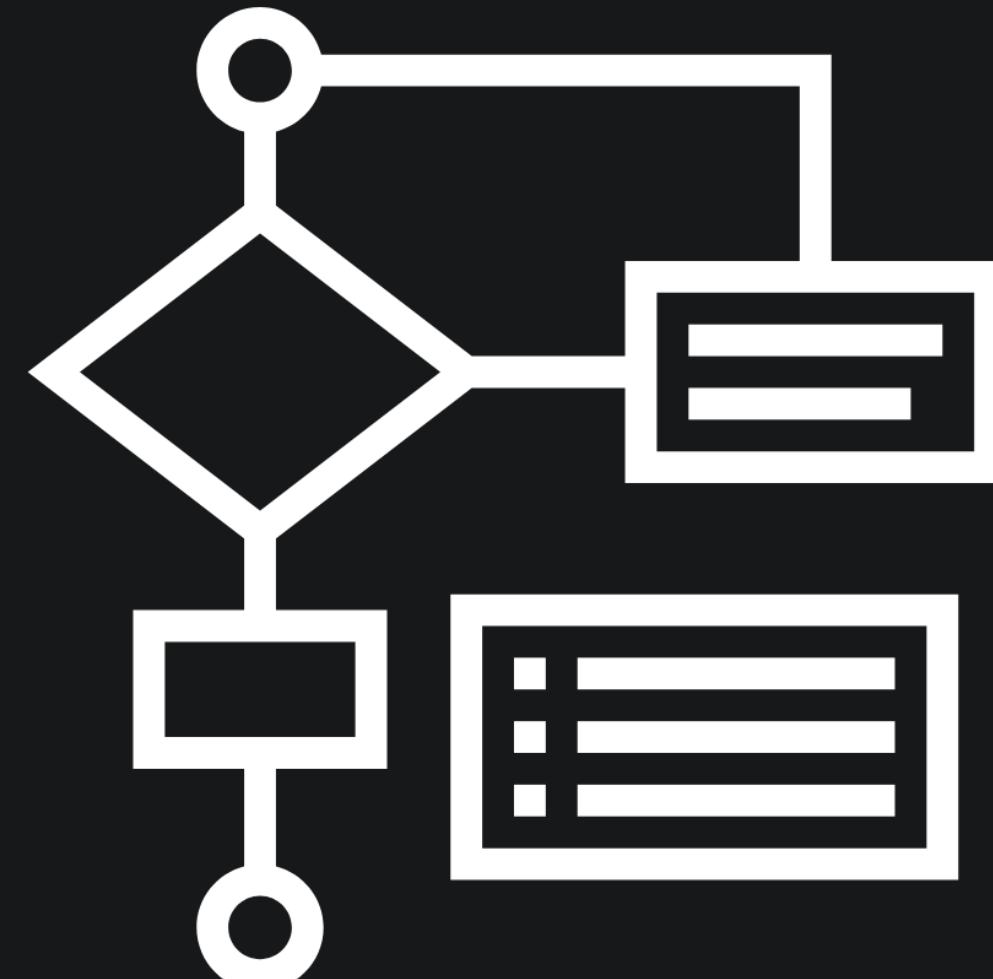


Consistent
implementation

Complex work: learning & collaboration



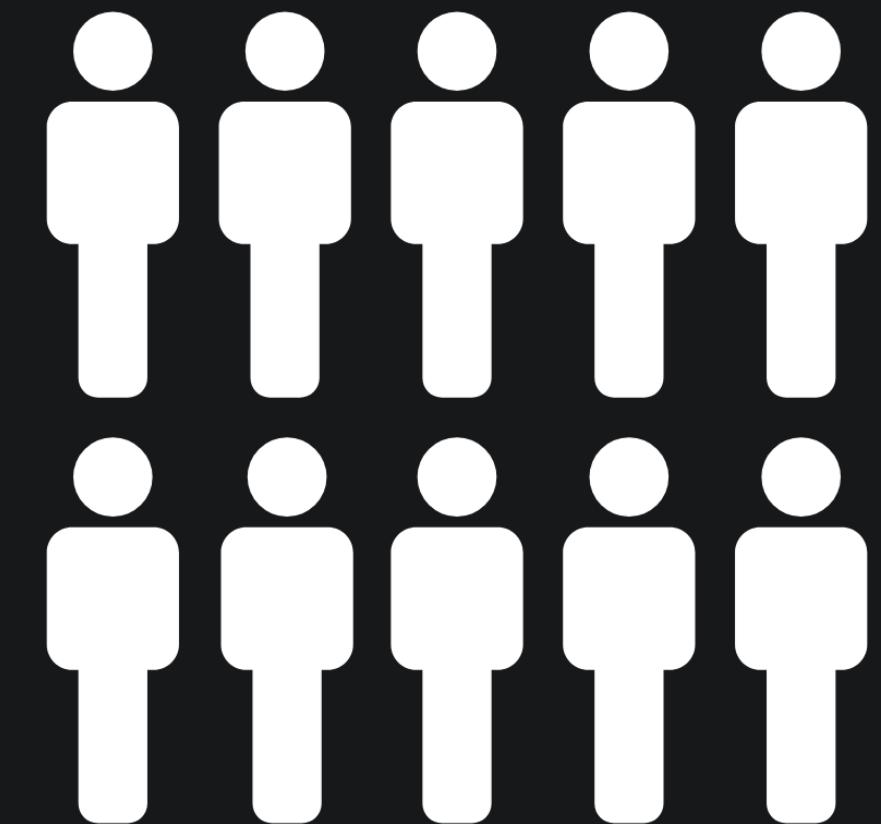
Support for learning: just-in-time procedural help



Reify experimentation
+ Integrate
procedural learning



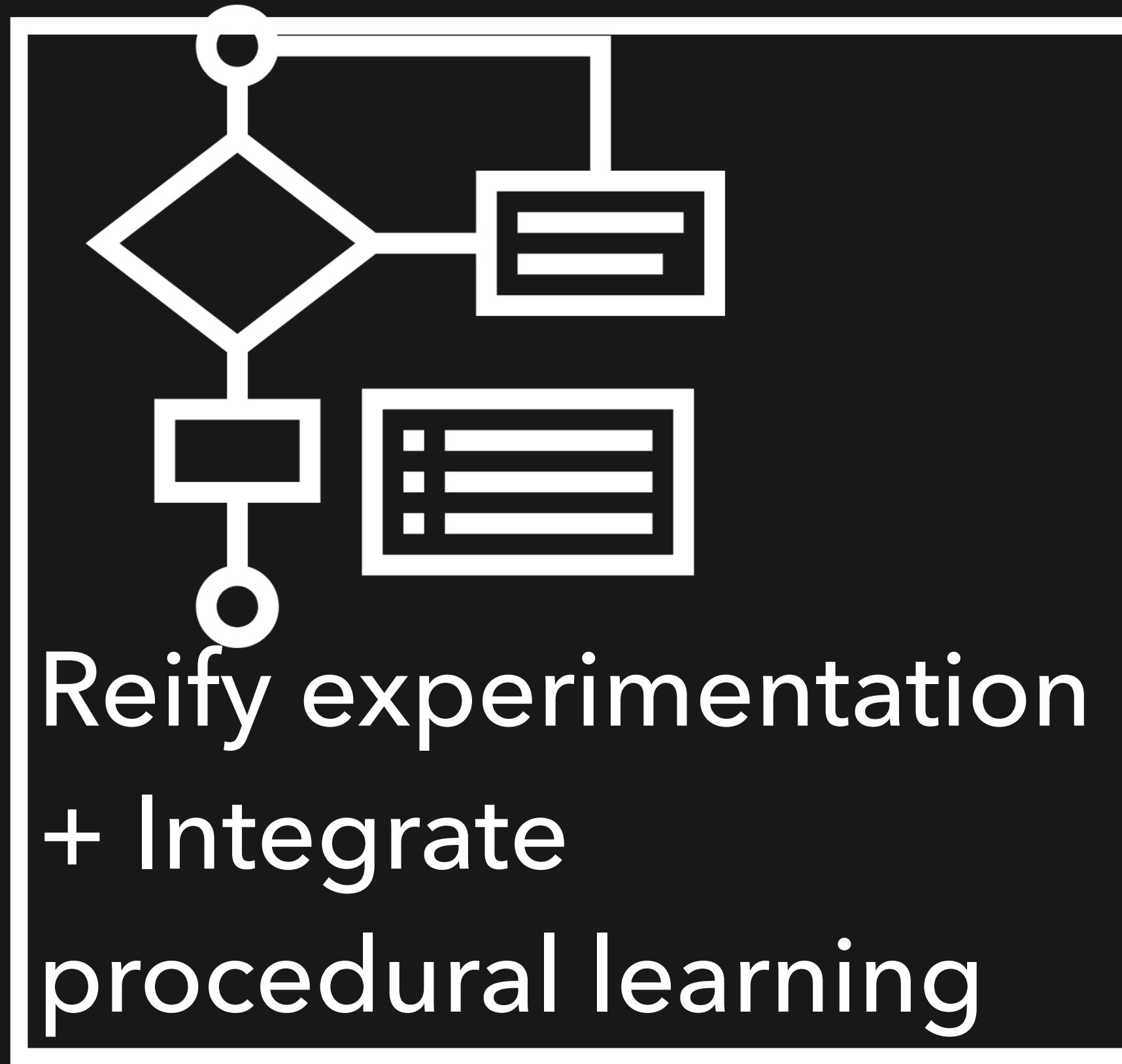
Scaffolded
Community
Review



Automate this

Support for collaboration: Provide concrete roles

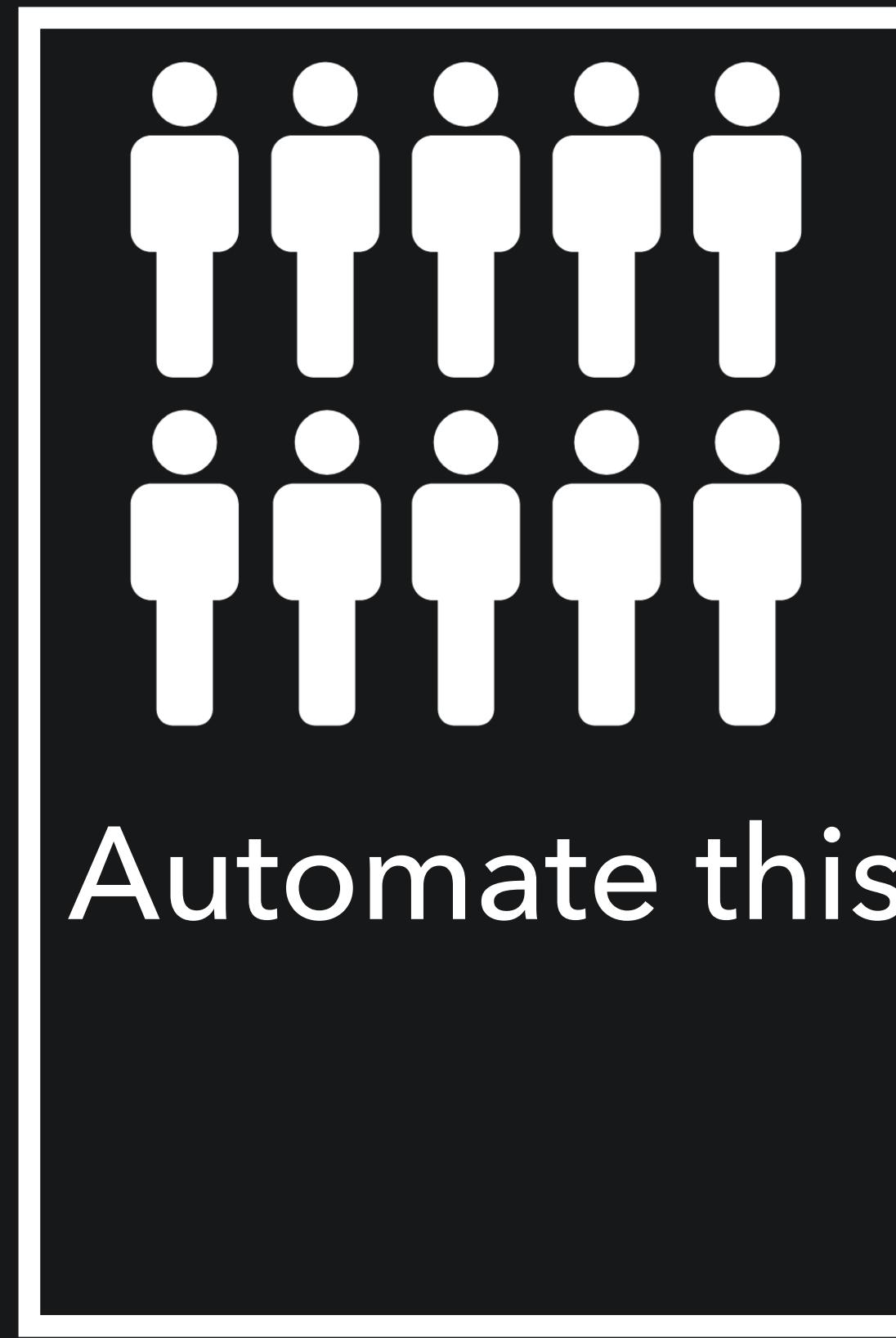
Design



Review



Run



Design using procedural training cues baked into the interface

1 Start with an intuition

Drinking kombucha makes me less bloated

These examples might help:

Cause	Relation	Effect
Drinking coffee	increases	alertness
Eating raisins every day	decreases	number of bowel movements
Not brushing teeth	results in	bad breath

Cause **Relation** **Effect**

Drinking kombucha improves stool consistency

2 Measure the cause

Drinking kombucha improves stool consistency

To conduct an experiment, you need to

1. change the cause (called manipulation) and then
2. record the effect.

How will you manipulate **Drinking kombucha** in your experiment?

(To keep your experiment simple, choose **one** option)

Absence or Presence

E.g. Milk in your diet could be present or absent

E.g. Exercise in your day could be present or absent



EXAMPLES



number of bowel movements
bad breath

stool consistency

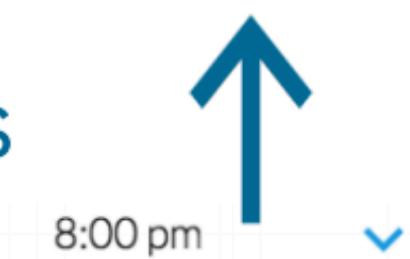


TEMPLATE

3 Set up data collection messages

Send all participants a reminder to provide **Bristol Scale Value** of **stool consistency** at

edit the content for the reminder text message to track **stool consistency** at **8:00 pm**



8:00 pm

Hello from Galileo! This is your 8:00 pm reminder to measure "stool consistency" today.

How would you classify stool consistency on the Bristol Stool Chart? Please refer to the chart (https://en.wikipedia.org/wiki/Bristol_stool_scale) and reply with a value between 1 to 7.

4 Set up exp/control conditions

Your **Hypothesis**: **Drinking kombucha improves stool consistency**

Your **Experimental Group**:

Drinks Kombucha

Your **Control Group**:

Does not drink Kombucha

Experiment Details

Review

Hypothesis: Drinking Kombucha improve stool consistency

Cause

Drinking Kombucha

Relation

improve

Effect

stool consistency

Mechanism:

kombucha has beneficial probiotics to help keeping a normal stool consistency

Related Work:

There are papers about Kombucha benefits but they do not look specifically at stool consistency. Dufresne and Farnworth (Tea, Kombucha, and health: a review) gives an overview of kombucha benefits (mostly from drinker's testimony) and indicates the need to investigate it with a more scientific approach. This is an old paper, though (from 2000). We have more recent papers, but I could not find one specifically related to stool consistency. There are some related to diabetes, for example.

How is Drinking Kombucha manipulated?

- Participants measure Absence/Presence of Drinking Kombucha
- Reminder sent every day at 6 pm with the following message:

"Hello from Austin! This is your 6:00 pm reminder to measure "Drinking Kombucha" 🍃 today. Was Drinking Kombucha absent or present in your day today? Reply Yes for present, No for absent."

How is stool consistency measured?

- Participants measure Bristol Scale value of stool consistency

The Bristol Stool Chart

	Looks like	Consistency	Indicates
Type 1		Separate hard lumps	Very constipated
Type 2		Lumpy and sausage like	Slightly constipated
Type 3		Sausage shaped with cracks in the surface	Normal
Type 4		A smooth, soft sausage or snake	Normal
Type 5		Soft blobs with clear-cut edges	Lacking fibre

Feedback request from the creator of the experiment:
none

People's review of the hypothesis

Is the cause specific?

Yes 1 | No 0

Is the effect specific?

Yes 1 | No 0

Is the relation between cause and effect clear?

Yes 1 | No 0

Is the hypothesis concrete i.e. it either holds or it does not hold?

Yes 1 | No 0

Is this mechanism the most plausible explanation?

Yes 0 | No 0

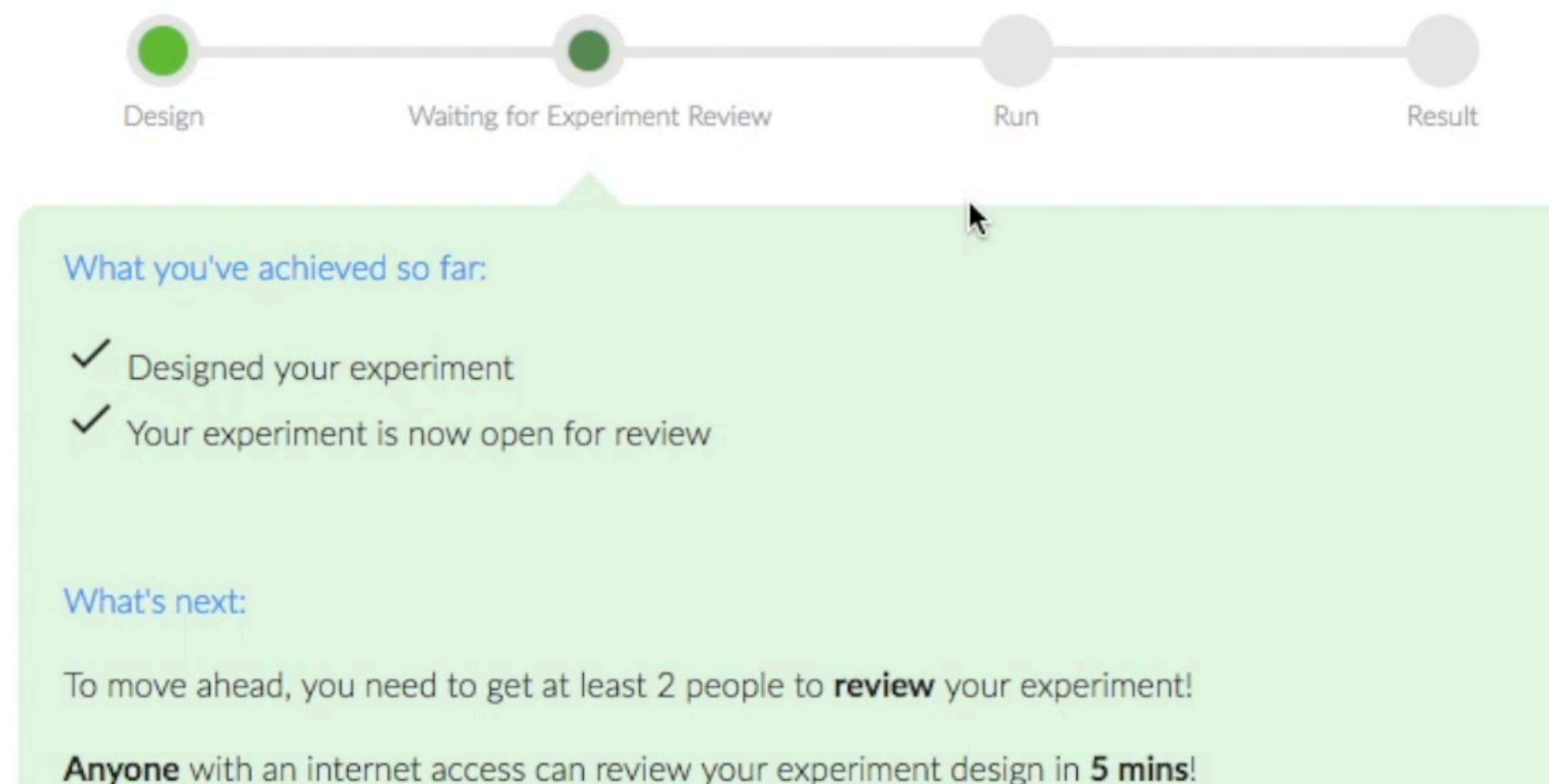
Is the related works description comprehensive?

Yes 0 | No 0

NEXT SECTION

Improve using community reviews; Reviewers use a scaffolded interface that enables boolean and open-ended comments

Experiment Status



Is this choice of measurement appropriate for the effect?

Yes 0 | No 1

Structural

user As previously stated, quality of sleep could mean different things
sleep, feelings of tiredness upon waking up, etc.

Can the experiment participants correctly measure the effect?

Yes 1 | No 0

Pragmatic

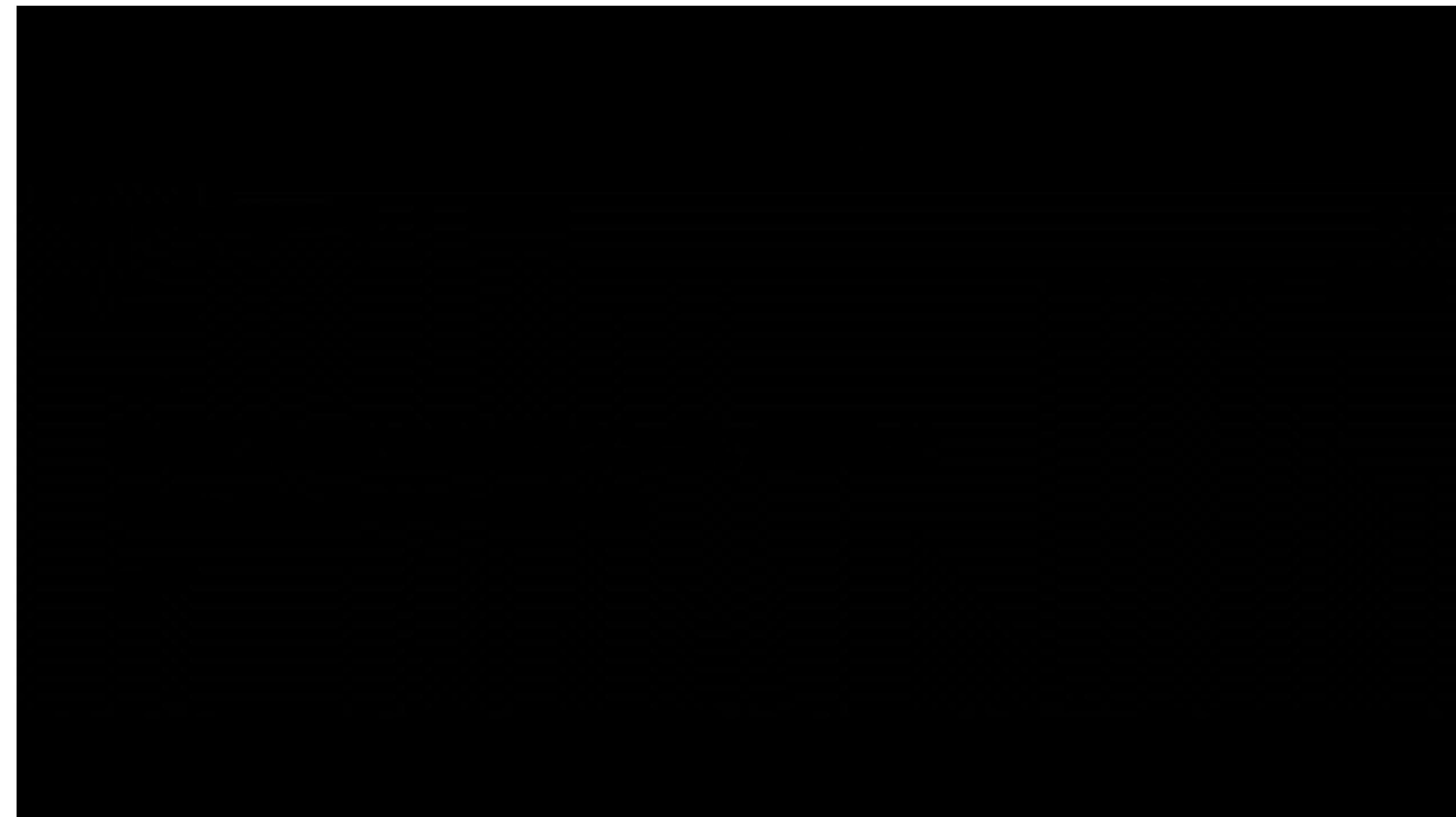
Is the time of reminder convenient for the participants?

Yes 1 | No 0

Experience

Community reviews

Participants join online and provide data via text reminders



People join

Galileo | Beta x +

← → C <https://galileo-ucsd.org/galileo/entrance> 🔍 ☆ ✖ ↑ m ✉ ↑ ✖

Select the appropriate community below to design your own experiments and to view others' experiments

Knight Lab

Experiments: 10



If you are affiliated with the Knight Lab,
click here to design, review, and
participate in experiments.

Diet (including Coffee)

Experiments: 6



If you are interested in Diet (incl Coffee),
click here to design, review and
participate in experiments [\(?\)](#)

American Gut Project

Experiments: 7



Join the American Gut Project
community to design, review, and
participate in experiments! [\(?\)](#)

Coursera Gut Check

Experiments: 7



Join the Coursera Gut Check
community to design, review, and
participate in experiments! [\(?\)](#)

Open Humans

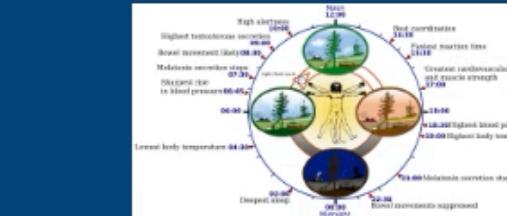
Experiments: 5



If you are interested in Open Humans,
click here to design, review and
participate in experiments [\(?\)](#)

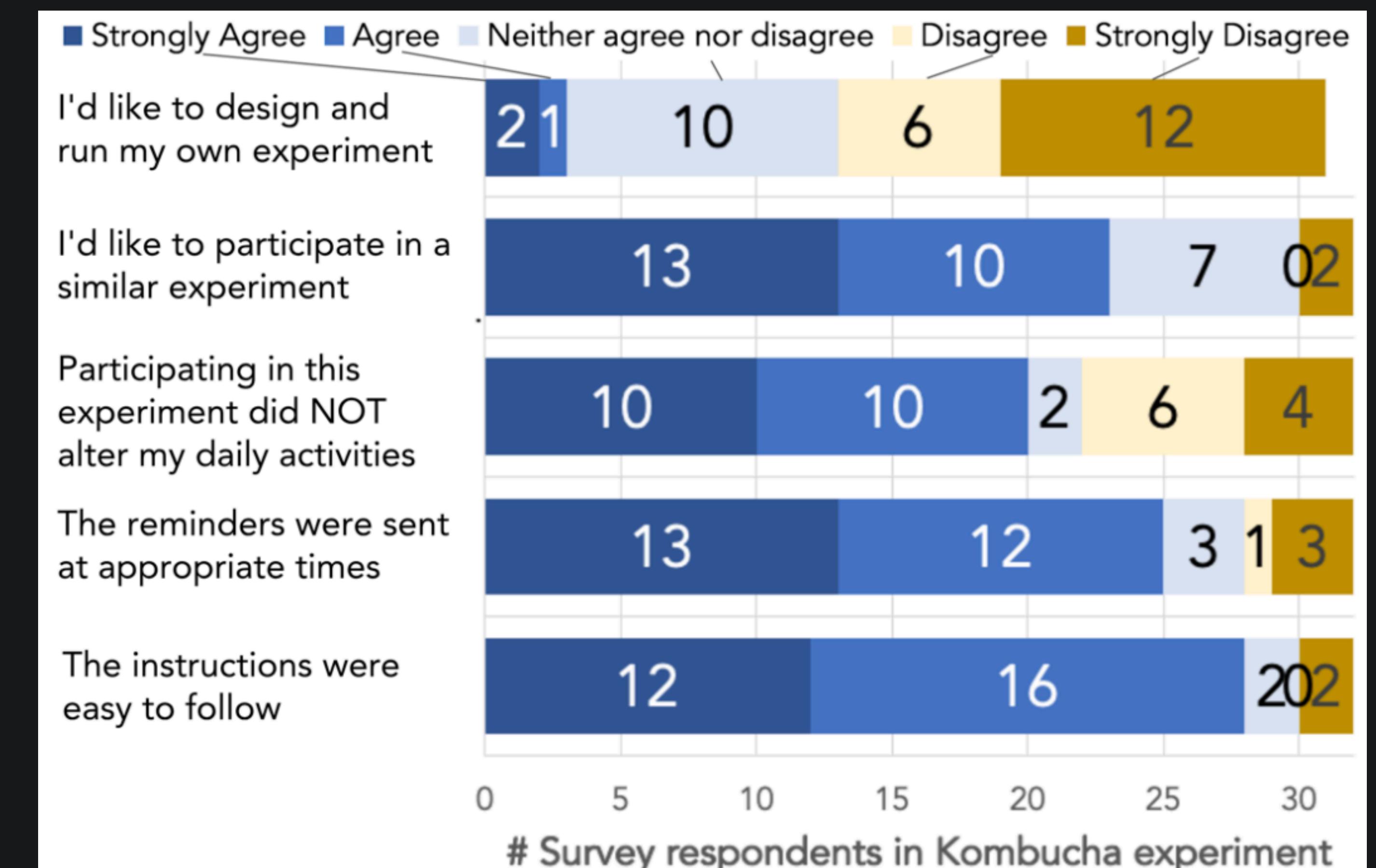
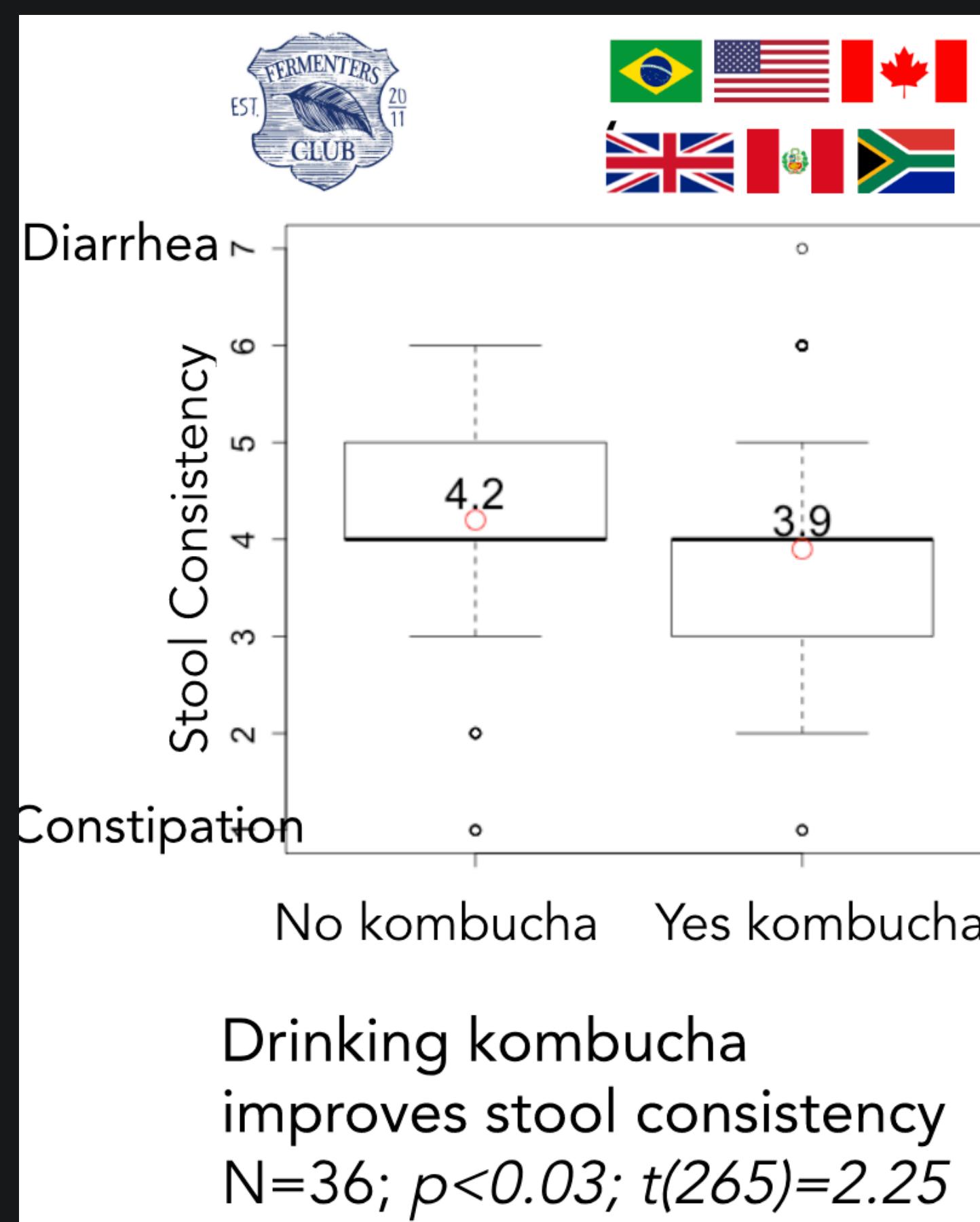
Circadian Rhythms

Experiments: 4



Join the Circadian Rhythm community
to design, review, and participate in
experiments! [\(?\)](#)

Kombucha community: Does drinking kombucha improve your stool consistency? (N=36)



Activity 4:

Only 3/31 participants wanted to design and run own experiments

Why?

How might you improve this situation?

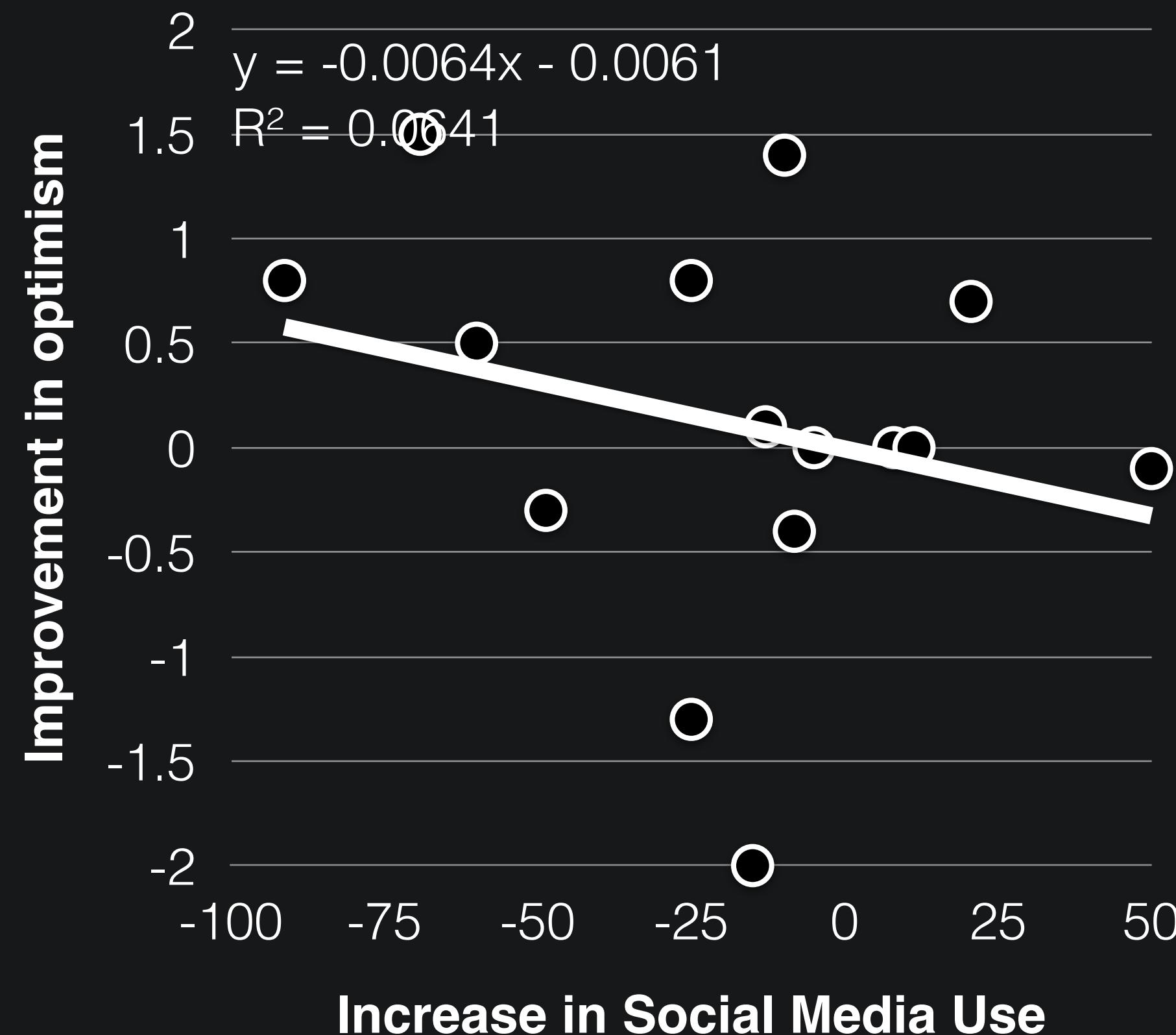
Activity 4: Only 3/31 participants wanted to design and run own experiments

Why?
How might you improve
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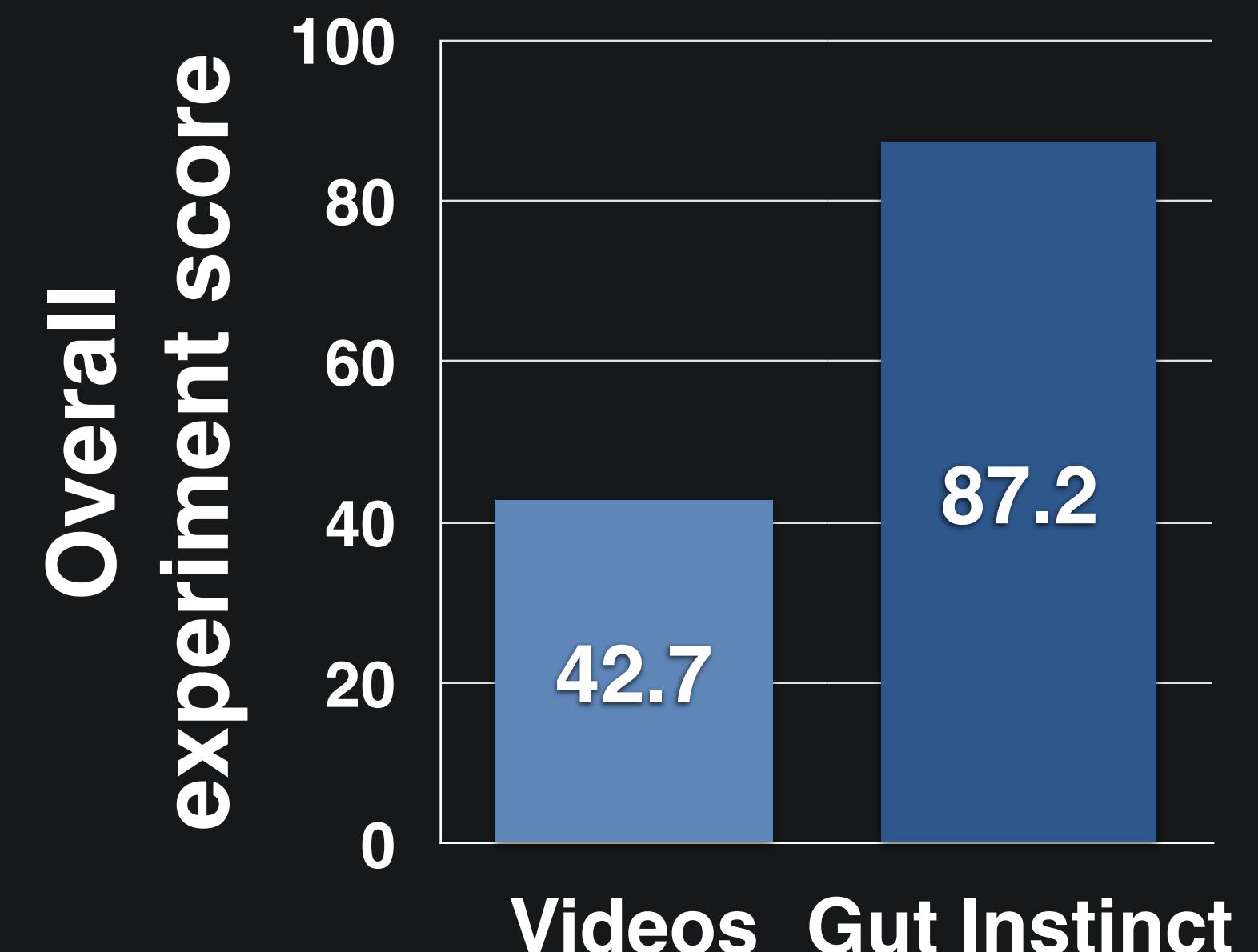
Places to Intervene in a System
(in increasing order of effectiveness)

9. Constants, parameters, numbers (subsidies, taxes, standards)
8. Regulating negative feedback loops
7. Driving positive feedback loops
6. Material flows and nodes of material intersection
5. Information flows
4. The rules of the system (incentives, punishments, constraints)
3. The distribution of power over the rules of the system
2. The goals of the system
1. The mindset or paradigm out of which the system—its goals, power structure, rules, its culture—arises.

Communities can design and run experiments!



Open Humans community studied the effect of social media on optimism ($N=68$)



People design structurally-sound experiments ($N=54$)

People design better with procedural training ($N=72$)

Activity 3 continued:

Do these results remind you of concepts from your previous reading(s)?

1. "Situated learning theory explains apprenticeship as legitimate peripheral participation in a community of practice"
- Chapman, Upgrade your cargo cult for the win
2. "[T]echnical systems of various kinds are deeply interwoven in the conditions of modern politics."
- Langdon Winner, Do Artifacts Have Politics?
3. "Places to intervene in a system"
- Donella Meadows, Leverage points

Okay, so people benefit from accessing papers and other resources. Does science benefit from this?

Science can benefit from

1. Creative insights -> New ideas
2. Real-world reports -> External validity

2 Real-world reports -> External validity

Do people with disorders need to go to
the clinic to know how they're doing?

In-clinic assessments suffer from many challenges related to visiting a clinic

1. Physical (working with kids)
2. mental (stress)
3. Financial resources
4. Scheduling concerns
5. More concerns - e.g. Traveling with immunocompromised patients

Wouldn't it be great to perform remote health assessments from the comfort of one's home?

Benefits people: <points mentioned above>

Benefits clinicians:

1. Track individual progression using longitudinal data
2. Understand variability

Home as TheClinic2: The Gift and the Curse

1. Less motivation to provide scores
2. No clinical expertise/authority
3. Mistakes in providing scores

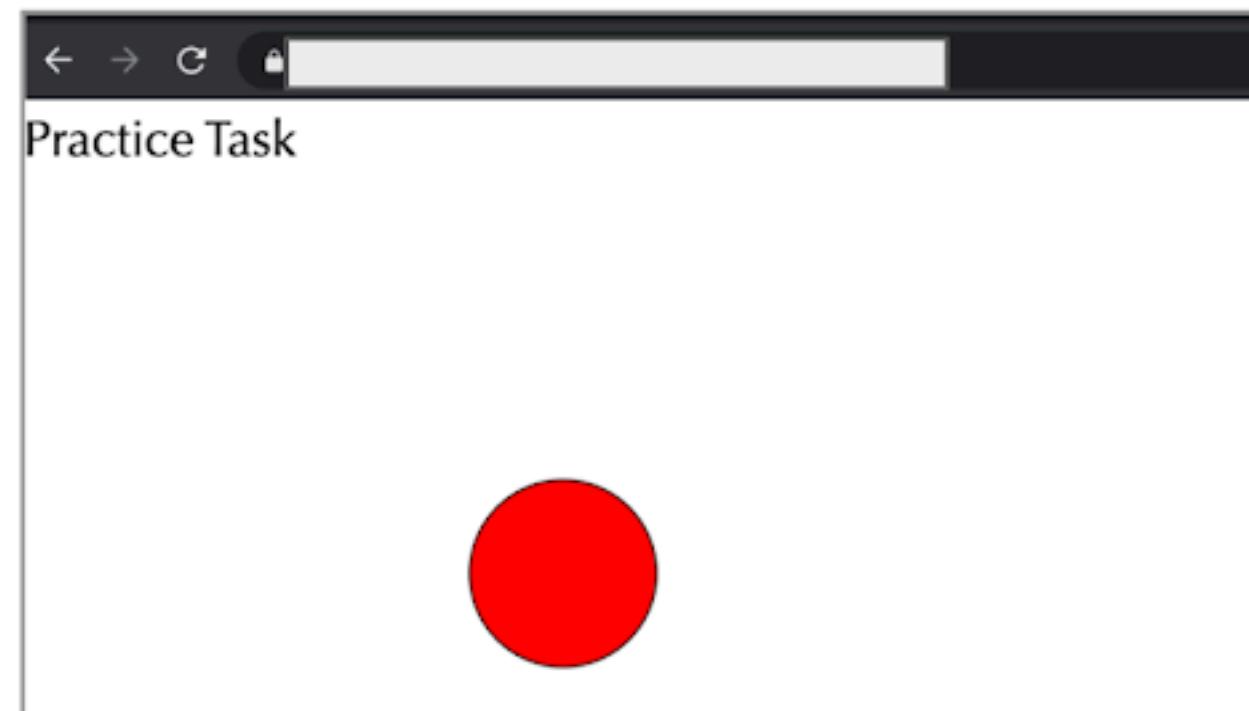
Also

1. Less anxiety at home?
2. Not trying harder than usual?

Setup: Collaborating with a neurological rare disorder community

1. A tool that tracks fine motor performance
2. Social processes that support people in providing at home assessments

1. Participant clicks on dots



2. Javascript captures mouse trajectory and events

```
[{"type": "click", "x": 959, "y": 459, "time": 1585063668787, "in": 0},  
 {"type": "mousemove", "x": 960, "y": 464, "time": 1585063668792, "in": 0},  
 {"type": "mousemove", "x": 958, "y": 464, "time": 1585063669384, "in": 0},  
 {"type": "mousemove", "x": 949, "y": 464, "time": 1585063669395, "in": 0}]
```



4. Scripts generate age-specific z-scores

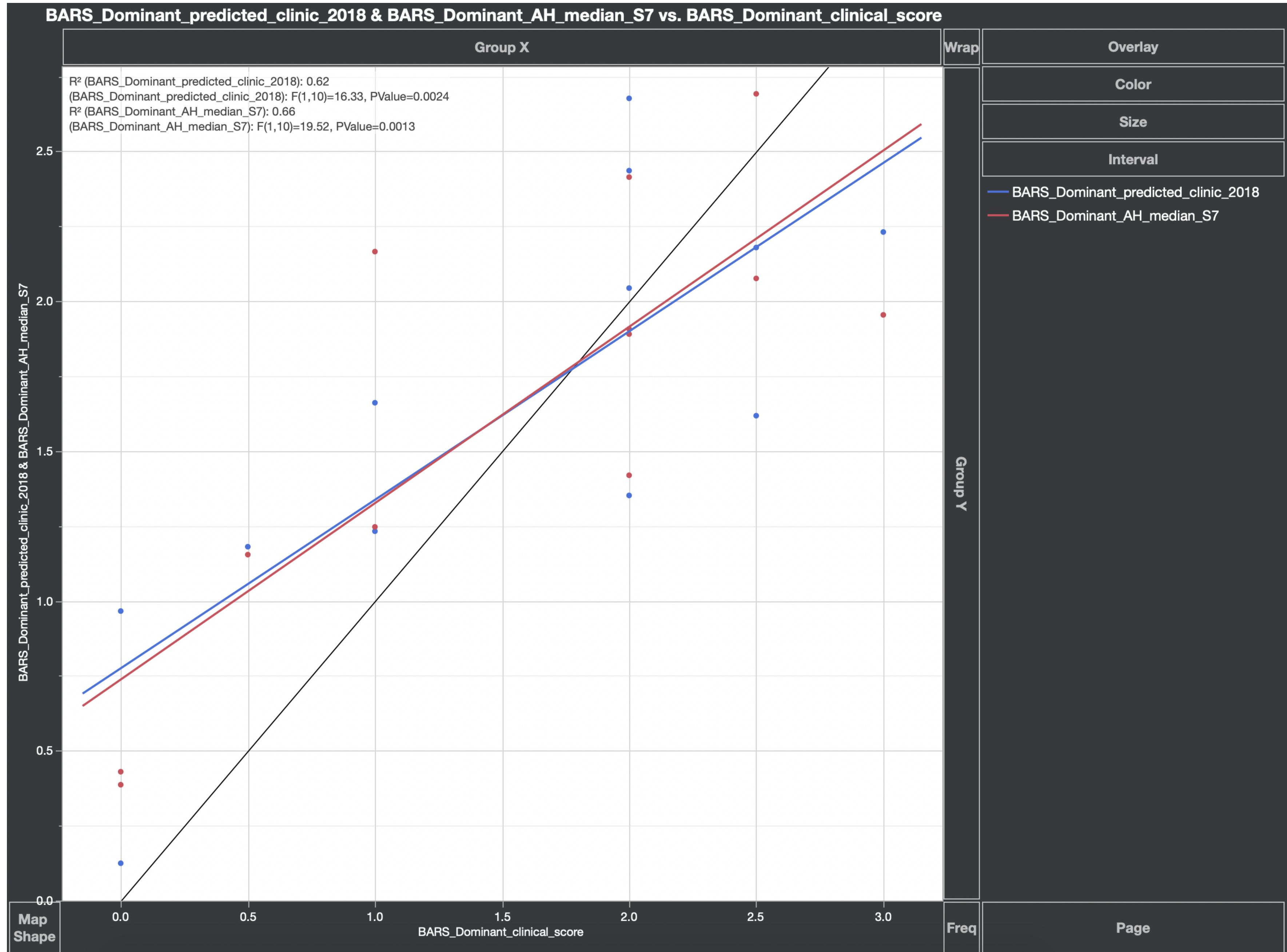
```
movement_time: 2.4  
executiom_time: 3.57  
num_pauses: 5.03
```



3. Batch processing scripts generate 32 features

```
movement_time: 4084 msec  
executiom_time: 2100 msec  
num_pauses: 6
```





N=12, 2C

$\text{corr}(\text{in-clinic}, \text{clinical}) = 0.78$
 $\text{corr}(\text{median}(S1-7), \text{clinical}) = 0.81$

Activity 5: How might this tool be useful for people?

Bringing the two systems together

Building expertise - using roles and procedural guidance (know how)

Accessing expertise - A tool that encodes features of interest and provides a severity score

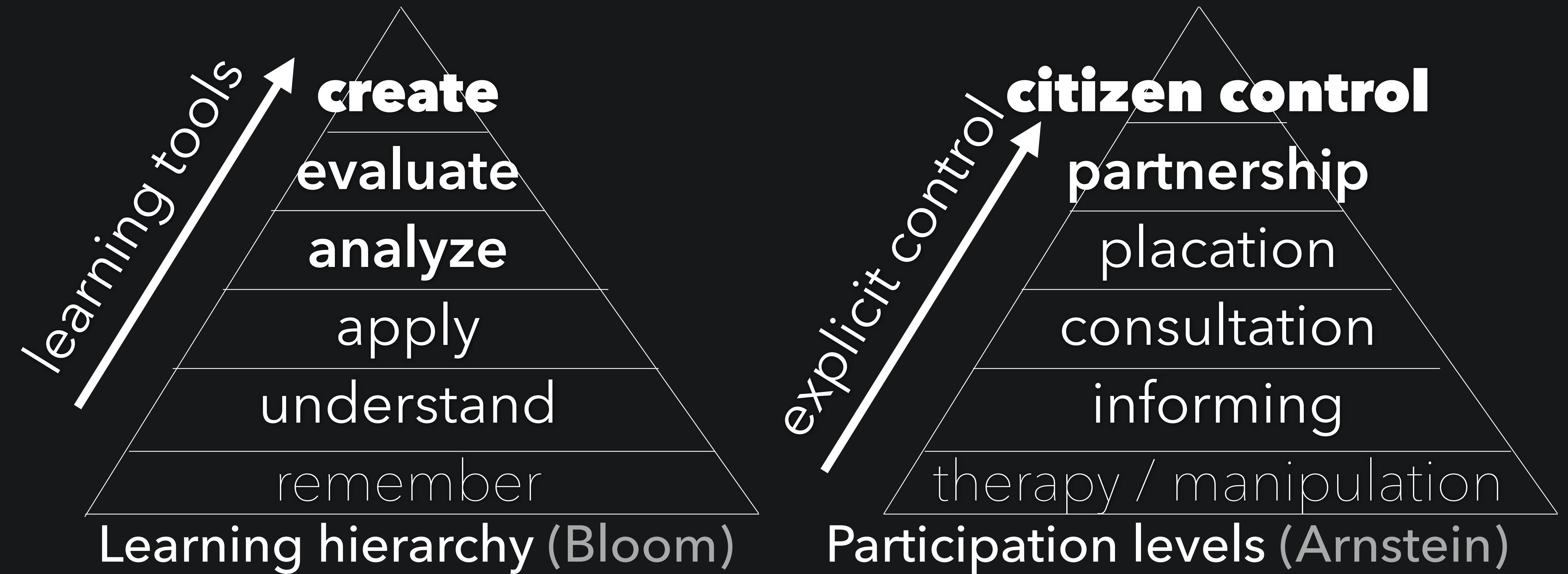
Okay, so people benefit from accessing papers and other resources. Does science benefit from this?

Science can benefit from

1. Creative insights -> New ideas
2. Real-world reports -> External validity

Learning in Social Computing:

Doing big things, together!



Todos

Survey - <https://bit.ly/2vkwyen>