Remote laboratories

Student experience

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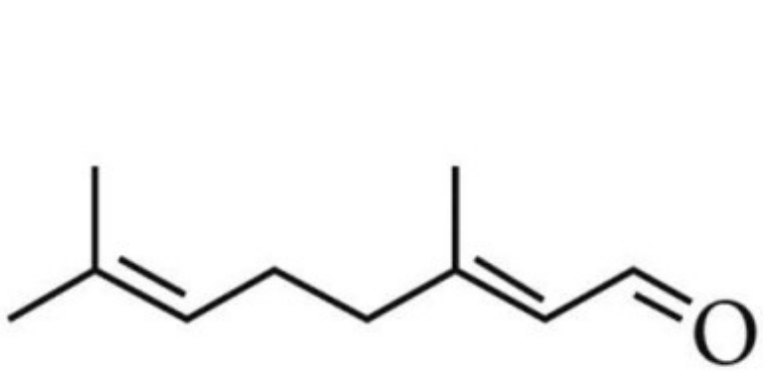
What *is* (an) experience?

similar citrus smell

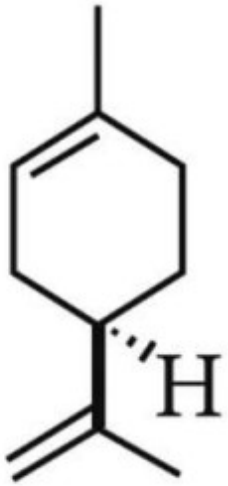
citrus smell

minty smell

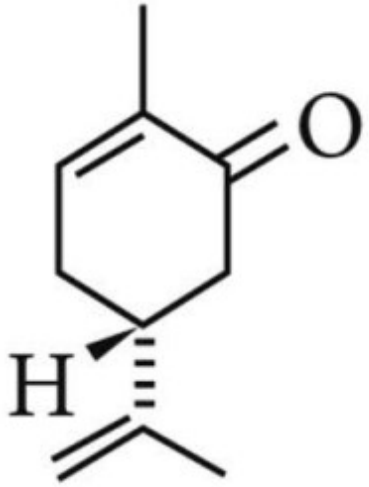
neural pattern



citral



R-limonene



R-carvone

bit.ly/pautz21

Should we frame

educational experience

as

experiential learning?

“The study reveals that **individuals roam freely, rapidly, and extensively** across learning style categories.

Thus, the categorical differences measured by the KLSI **lack meaningful purpose**.

Whether or not learning styles are a neuromyth, this study indicates that the act of learning, as an act of agency, is **fluid with potentiality and choice**.

- Newton & Wang 2021”

KLSI Engineering/Architecture

[1] Abdulwahed & Nagy 2009

[2] Bernold et al. 2000

[3] Cagiltay 2008

[4] Sharp 2001

[5] Demirbas & Demirkan 2003

[6] Kvan & Yunyan 2005

[7] Tucker 2008

[8] Ictenbas & Eryilmaz 2011

[9] Jamali & Mohamad 2018

[10] Kowalski & Kowalski 2012

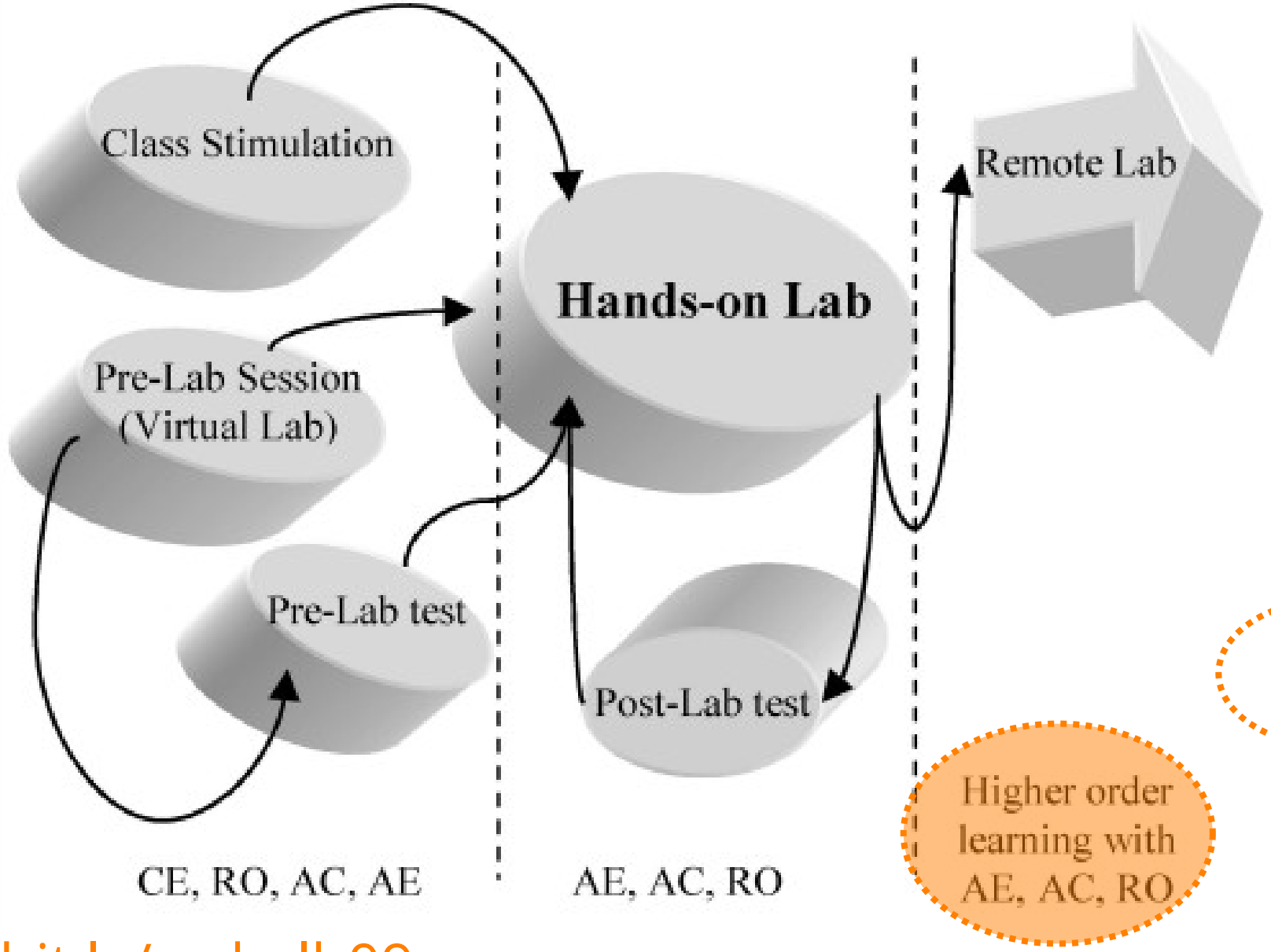
[11] Li, Han & Fu 2019

[12] Mansor & Ismail 2012

[13] Tawil et al. 2012

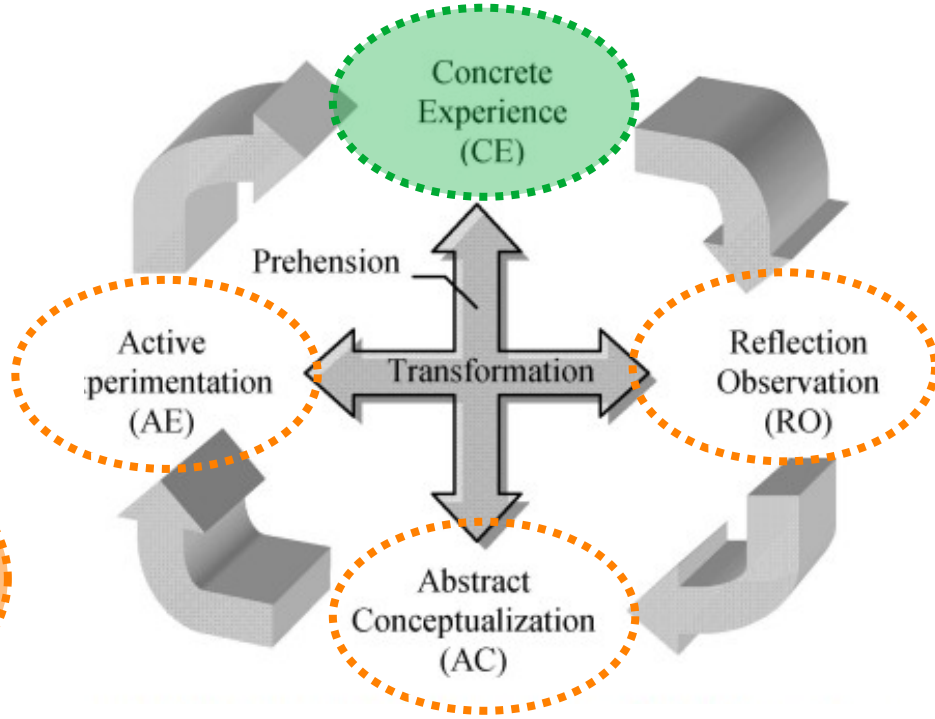
[14] Tulsi, Poonia, & Priya 2016

bit.ly/newang21



How relevant is the aspect of "concreteness"?

Whose "concreteness" is it?



bit.ly/awkolb09

Online *complements*; does not replace in-person

Repartition to make best use of each mode

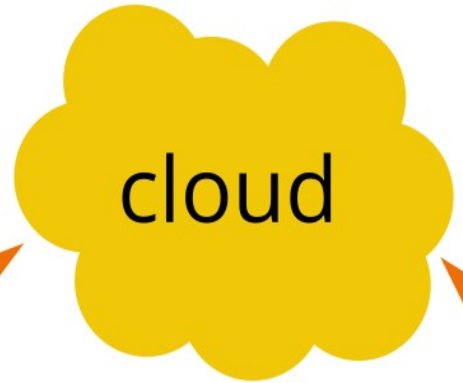
For both: adopt critical post-humanist approach mixing both humanity & technology to achieve

- a sum greater than the parts,
- not bound by the limits of either

bit.ly/tdd135

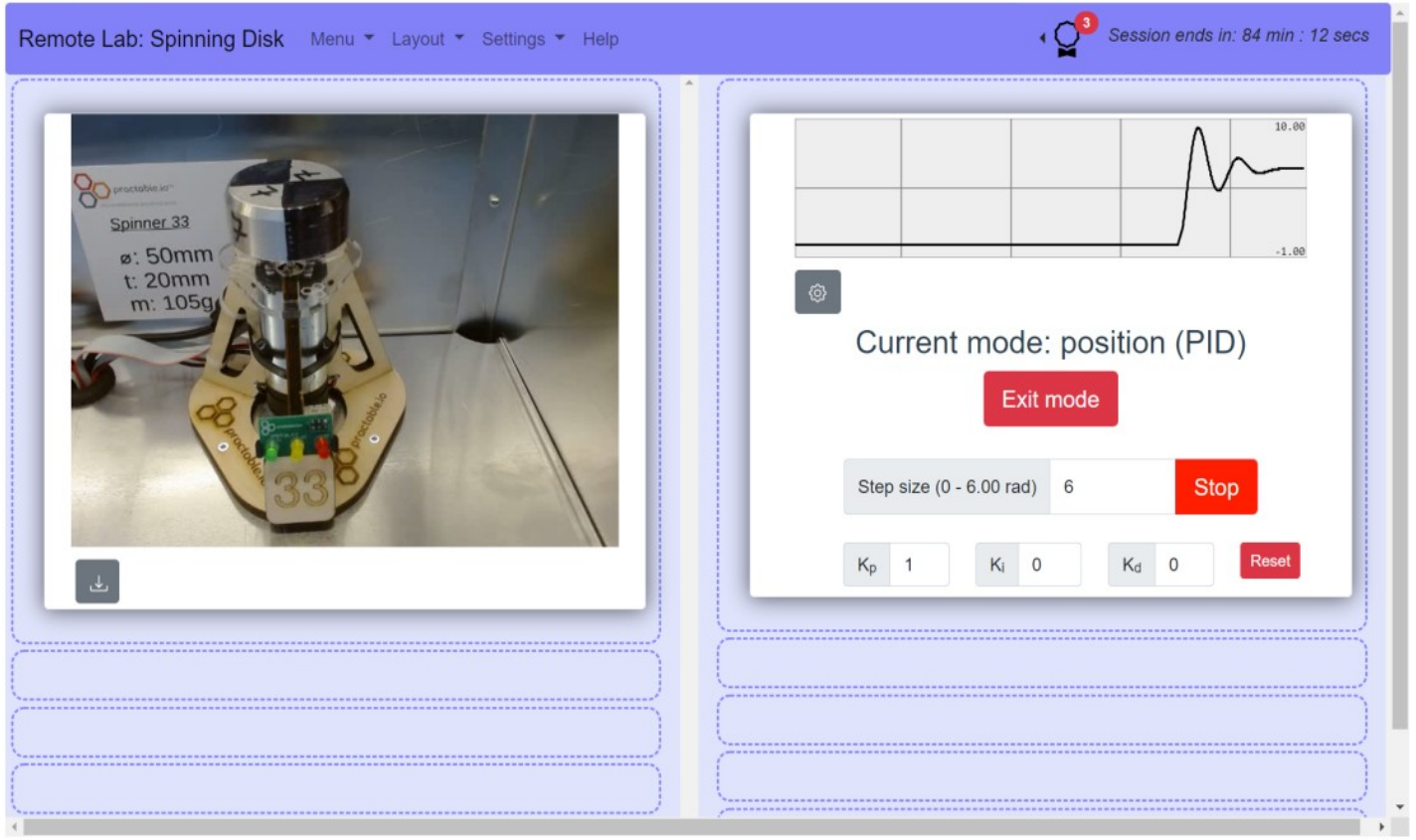
We're not using technology,
we're *collaborating* with it:
co-development with pedagogy becomes natural

bit.ly/tdd212



experiment

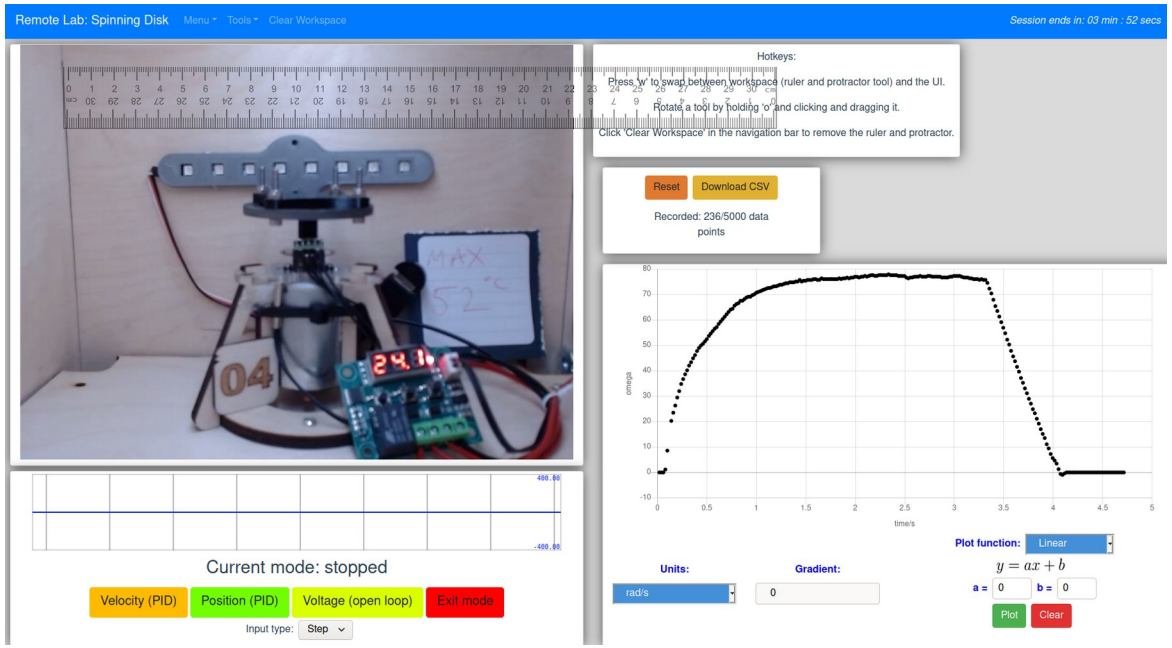
browser



David Reid, Andrew Brown, Calum Melrose, Doug Halley, Iain Gold, Alasdair Christie, Imogen Heard, Sally Morgan, Chris Sturgeon, Fraser Miller, Bruce Duncan, Pawel Sokolowski, Matt Tasker, Eck Kirkland, Central Estates, Aristides Kiprakis, Symon Podilchak, Maksim Kuznetvoc; Funded by School of Engineering (Gareth Harrison, Conchúr Ó Brádaigh)

2021 Controls class

- 250 students
- 12 remote lab boxes
- Accessible 24 hrs/day for ~3 months
- Range of disk inertias

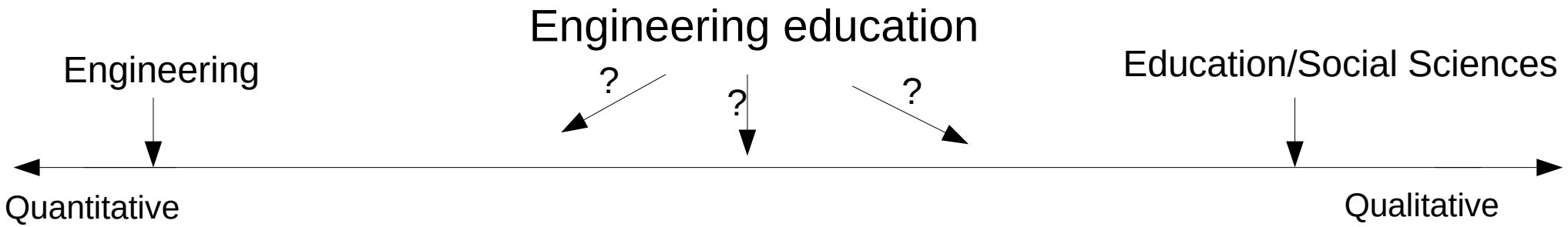


Course organiser: Dr Aristides Kiprakis

Mechanical design/build: Andrew Brown / Calum Melrose

- N=21 responses → selection bias
- Mixed methods approach

bit.ly/borre13



User Experience

- Range usually +/-2 (max +/-3), >0.8 considered a significant positive result.

1.13

Attractiveness

Overall impression of the product. Do users like or dislike it?

1.51

Perspicuity

Is it easy to get familiar with the product and to learn how to use it?

1.08

Efficiency

Can users solve their tasks without unnecessary effort? Does it react fast?

Dependability

Does the user feel in control of the interaction? Is it secure and predictable?

0.76*

Stimulation

Is it exciting and motivating to use the product? Is it fun to use?

0.88

Novelty

Is the design of the product creative? Does it catch the interest of users?

1.17

*1.06 if outliers removed

User Experience

1.13

Attractiveness

I enjoyed the remote lab practical work

I am satisfied that I learned what I should have

1.51

Perspicuity

It was easy to navigate the user interface

1.08

Efficiency

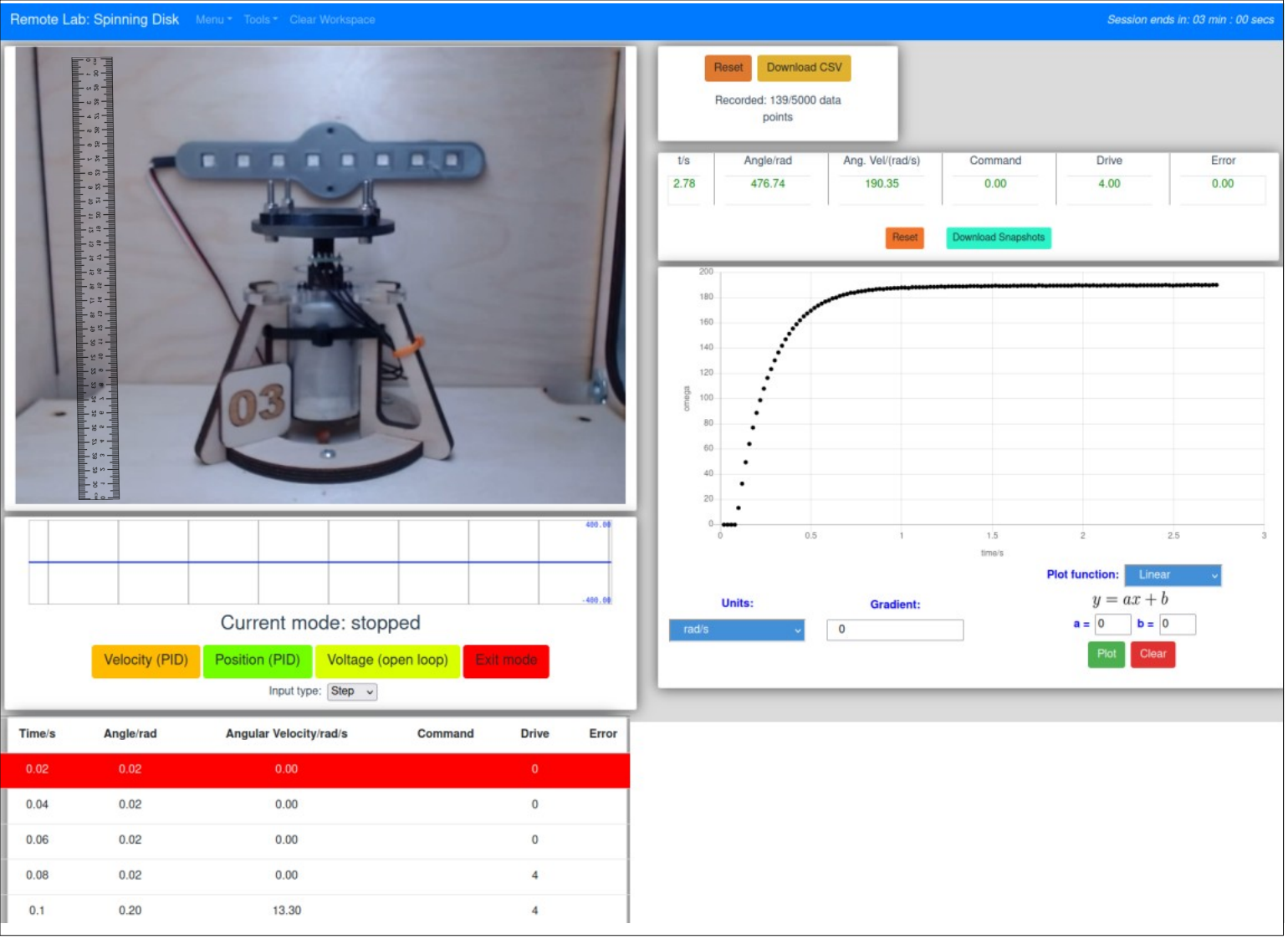
It was easy to collect the appropriate data

I believe the results of my experiment are accurate

0.76*

Dependability

I felt like I was in control of the hardware



UI ratings

	Rating		
UI Component	Easy to use	Useful	Feel in control
Webcam			
Live graph			
Controls			
Table			
Download			
Snapshot			
Graph			
Gradient			
Functions			
Measuring tools			

Positive rating, large effect size

Positive rating, medium effect size

Not statistically different from neutral response

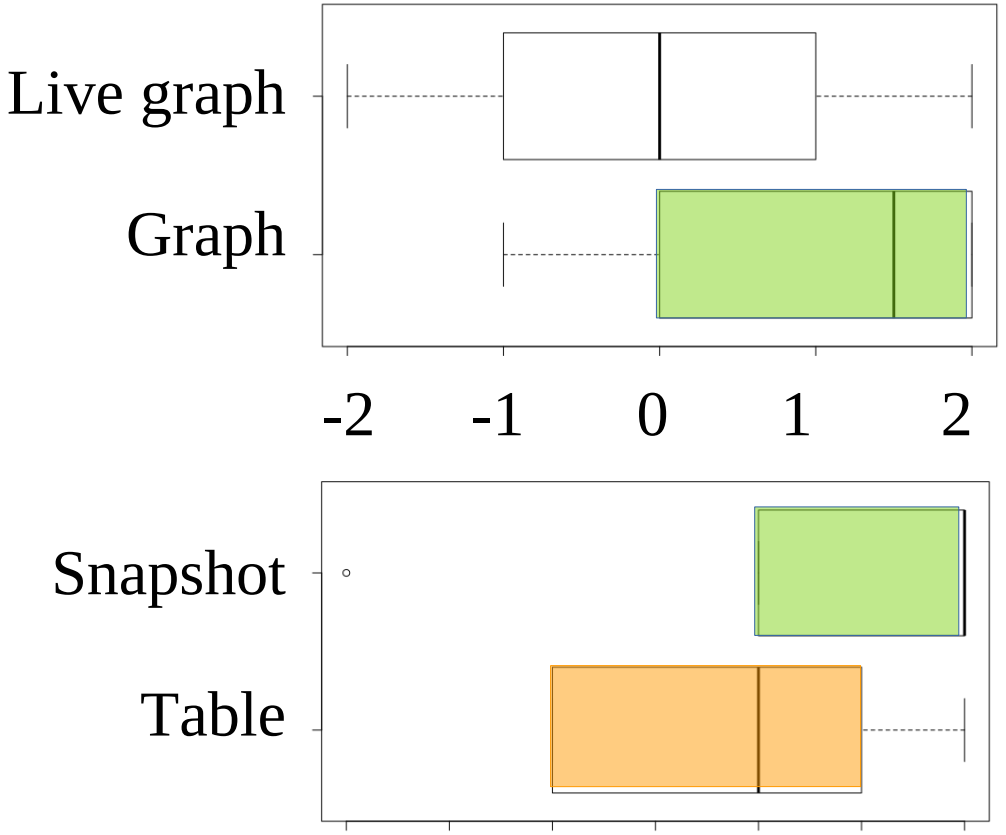
‘Feeling in control’

Attractiveness ∝ Dependability

Attractiveness ∝ ‘I felt in control of the hardware’

‘I am satisfied I learned the content’ ∝ ‘I felt in control of the hardware’

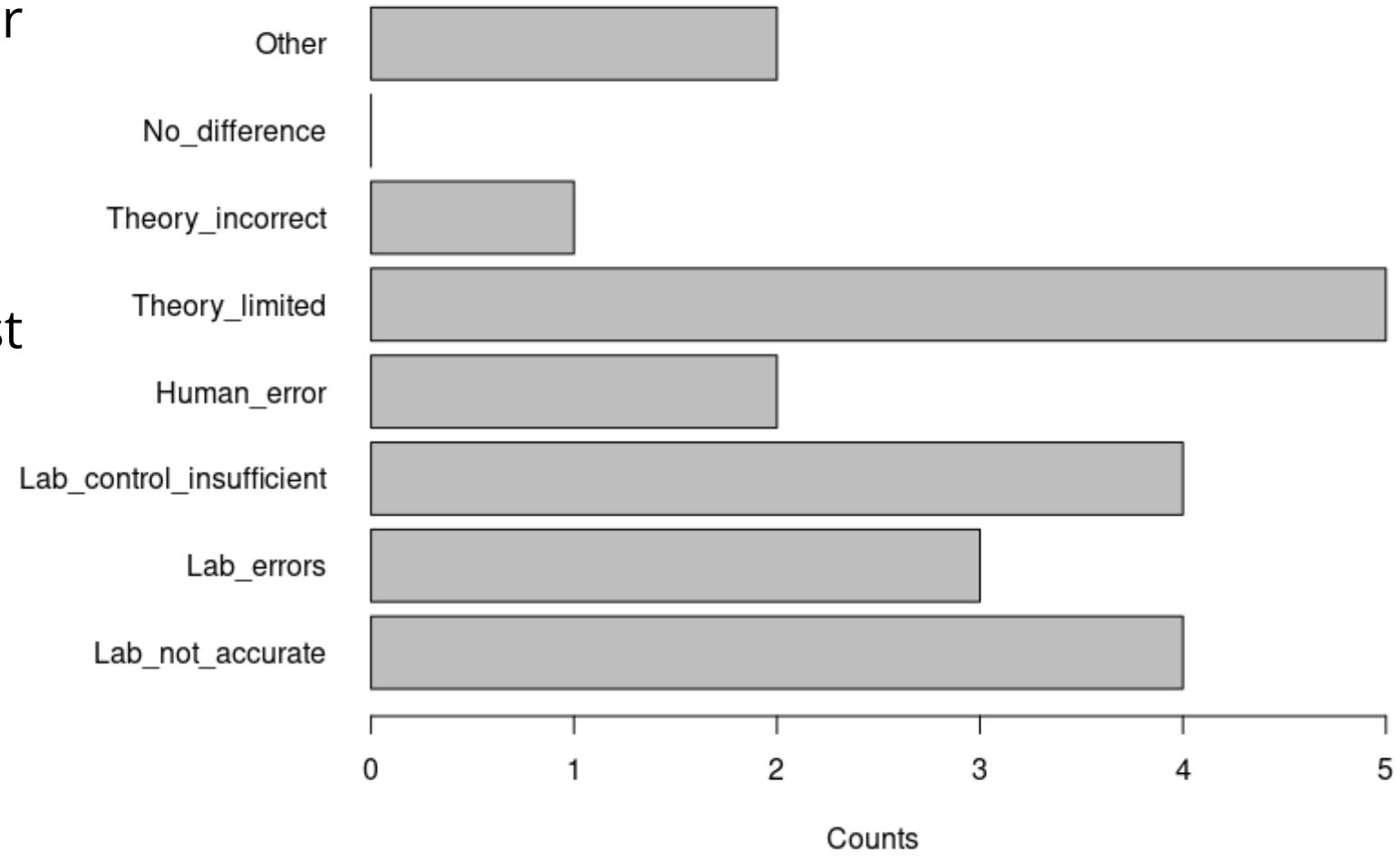
Positive emotional response ∝ Dependability



Whose “concreteness” is it?

On experimental results vs textbook

- No correlation between ‘user experience’ and belief in cause of data discrepancies
- Tech/design issues do **not** strongly impact student trust in remote lab.
- Neutral response to statement: ‘*Remote labs are not real practical work*’



How relevant is the aspect of “concreteness”?

Perception of skills practice

Easier with REMOTE
Collecting data
Managing lab time
Comparing to theoretical models
Setting up equipment
Presenting data
Working safely

No significant difference
Analysing data
Investigating unknown quantities
Exploring beyond the lab book
Measuring accurately
Controlling variables

Easier with PROXIMAL
Designing my own experiment
Working with others
Using multiple senses

Q25. Any other thoughts or feelings?

Both theory not completely representative and errors in remote lab were reason results not completely match theory

Although not required, it would have been nice to **tell us about the other details of the system** too, like the motor and driver used.

The lab was impressively reliable and worked well. However I feel at least one in-person session would have aided understanding.

It seemed that **recorded data changed slightly the longer a disk was in use**. This may be due to increased temperature. I was not sure how to deal with this, so I did not use data obtained when disk temperature was high.

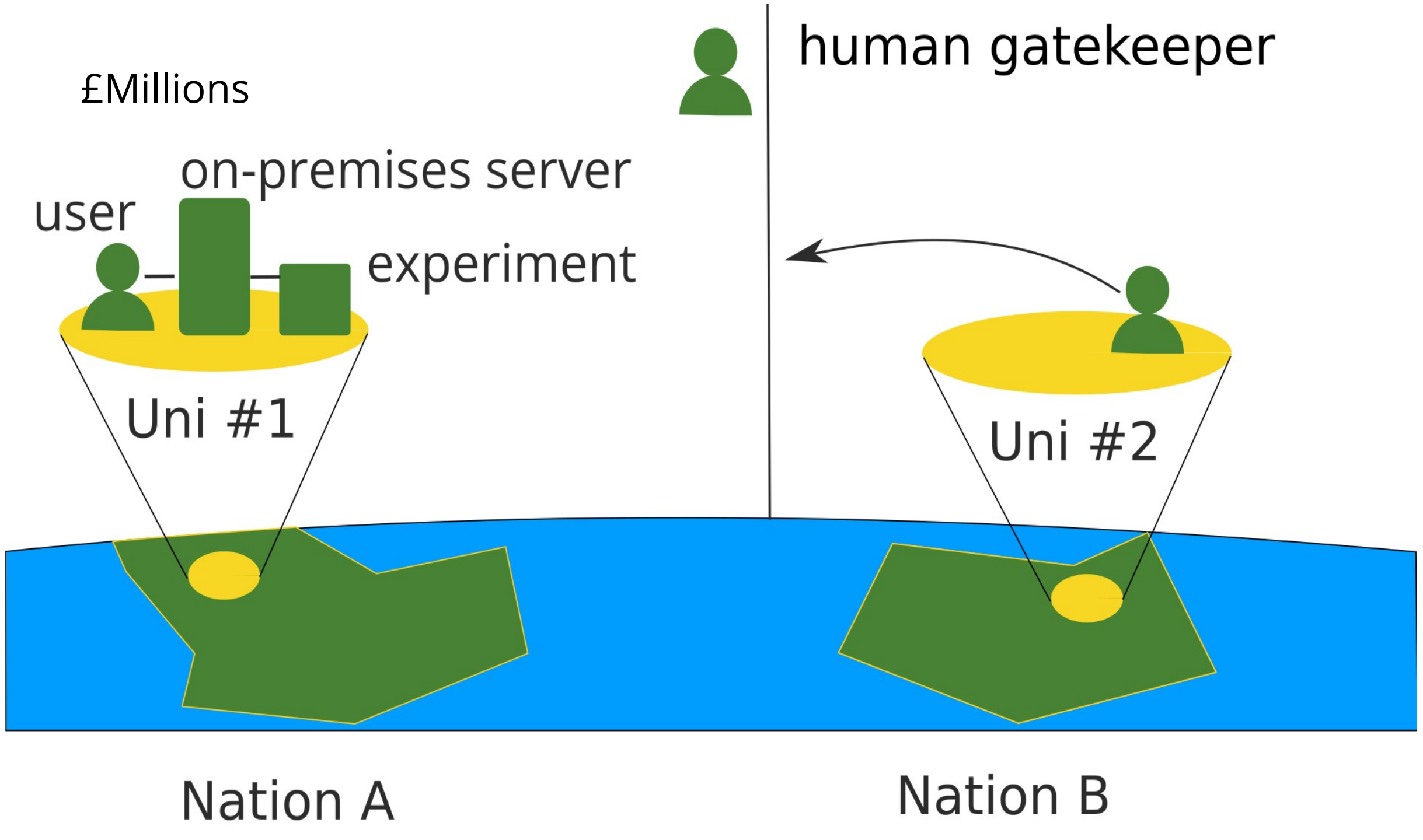
Would be nice if there were **more spinners available** to be used and if you could **cancel your time slot** when you were finished to allow others to be able to use the lab. Could also work better if spinner weights had been assigned to us to **evenly distribute** the number of students allocated to a spinner.

Remote allows for convenience and redoing of experiments if your data is out of range of expected values. Physical allows more discussion between students on what is happening and why. Getting others views helps expand your own

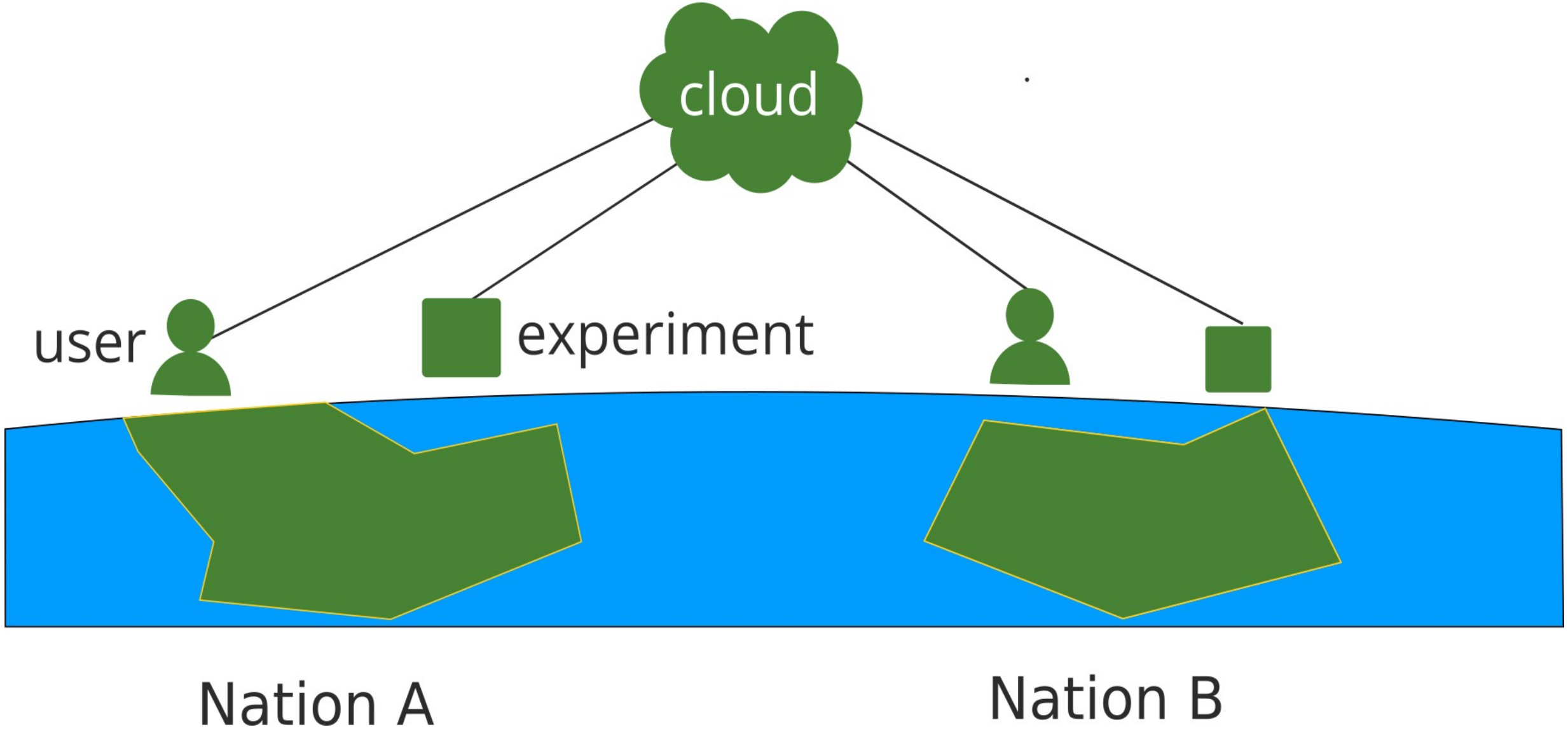
It is a great tool, and made me feel more motivated than a purely simulated one would have. I would be happy to have it as an option in other courses alongside the physical lab, so that I don't always have to travel for a quick measurement.

Whose "concreteness" is it?

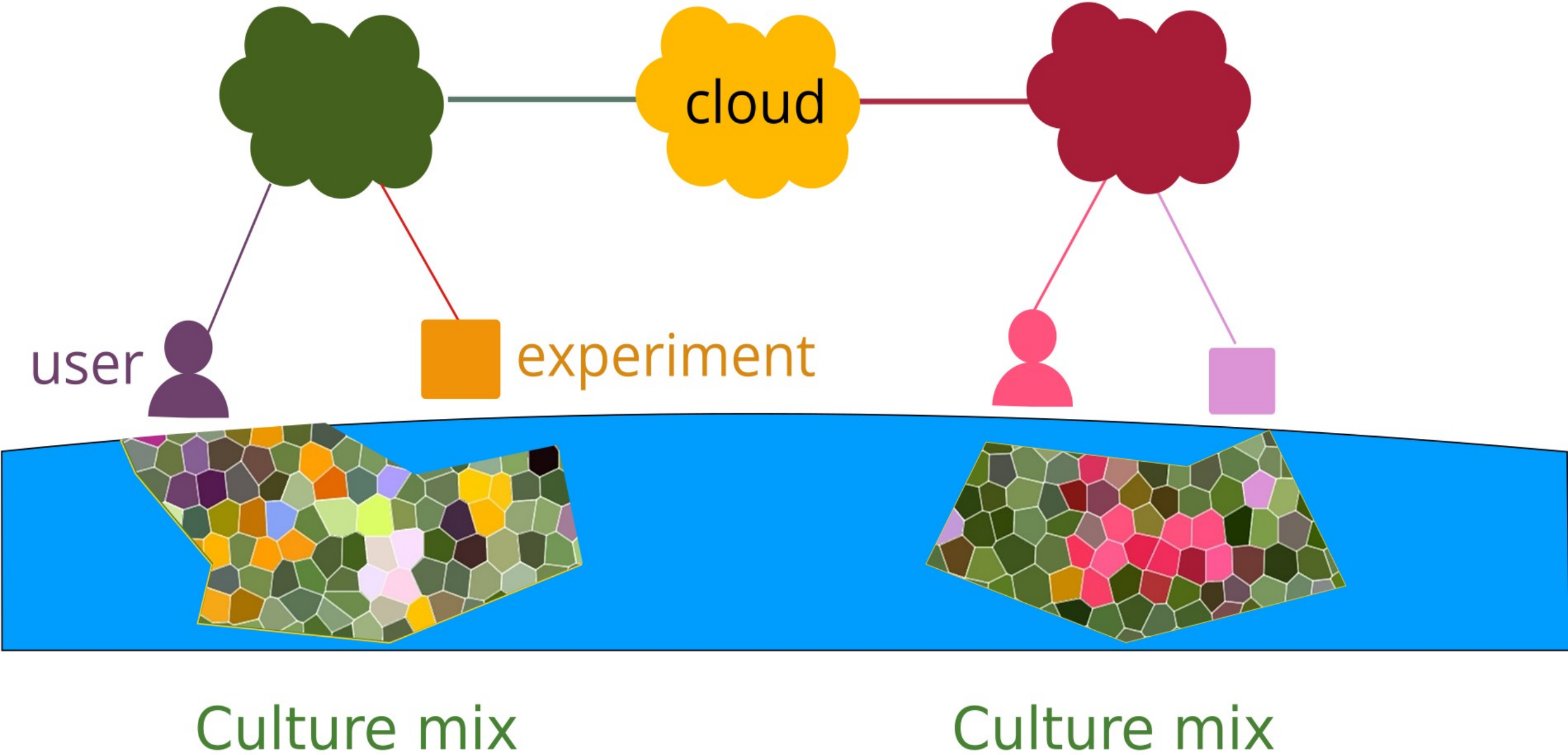
Part 2 → staff experience?


£Millions
human gatekeeper
on-premises server
user
experiment
Uni #1
Uni #2
Nation A
Nation B

One size fits no-one (but a good start?)



Openly share & modify (respect values, locality)



(e) **States should invest in free and public digital platforms and infrastructure for education, grant adequate funding to public institutions to develop alternative free digital solutions and tools that do not involve the private personal data market, and support the development of non-proprietary data tools, platforms and services that are based around values of openness, transparency and common stewardship (rather than individual ownership) of data. They should prioritize the production and use of content in the form of open educational resources and provide a professional, systematic and personal guiding service to individual users;**

A/HRC/50/32: Impact of the digitalization of education on the right to education

Educational delivery

- Co-develop pedagogy & technology
- Create, deploy & manage experiments
- Extend core system & documentation
- Build developer & user communities
- Federate between institutions

Educational research

Automated feedback

Authentic assessment

Speculative methods

Student co-creation

Benefits

Improve experience & outcomes

- for students, staff, and institution

Do social good at all levels

- local, national, and international

Call to action

Identify opportunities for adoption

Identify barriers to adoption

Let us know about both!