The Augmented Human: How Computers Can Make Us Smarter (and Dumber)

Miguel A. Nacenta

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Brief Personal Introduction

Territorial acknowledgement

- I *acknowledge* with respect the Lekwungen peoples on whose traditional *territory* the *University of Victoria* stands, and the Songhees, Esquimalt and W̱SÁNEĆ peoples whose historical relationships with the *land* continue to this day.
- I feel grateful for working and living in this beautiful place full of history.

Victoria Interactive eXperiences with Information

Sowmya Somanath

Charles Perin

Regan Mandryk

Miguel Nacenta

My Research

- Human-Computer Interaction
- Information Visualization
- Machine Learning

My Goals Today

- Give you an understanding of what keeps me busy
- Give you an impression of why I think it is important
- Show you something that you did not know about
- Show you something that surprises you
- Make you a little bit smarter
- Learn a bit from you

Let’s start with an ice-breaker

- What super-power would you want to have?
- Share in the chat if you are on zoom

Superpowers I'm interested in…

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Cognitive Augmentation

- Tools and methods that improve human's cognition in some way
- Focussing on computer-based tools and methods

What is Cognition?

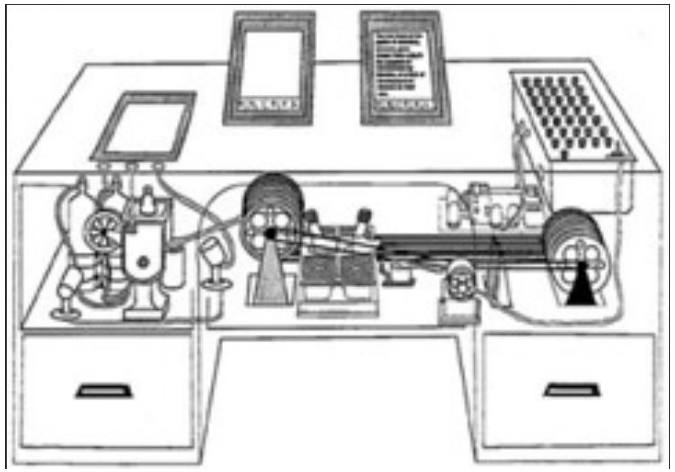
Calculation
Pattern Recognition
Memory
Perception
Emotion
Attention
Argumentation
Decision Making
Creativity
Communication

Vannevar Bush

Born 1890

US Science administrator
(Director of the Office of Scientific Research and Development)

V. Bush, ‘As we may think’, *The Atlantic Monthly*,
vol. 176, no. 1, pp. 101–108, 1945.



J.C.R. Licklider

Born 1915

Harvard, MIT

J. C. R. Licklider, ‘Man-Computer Symbiosis’, *IRE Transactions on Human Factors in Electronics*, vol. HFE-1, no. 1, pp. 4–11, Mar. 1960, doi: 10.1109/THFE2.1960.4503259.

Planted seeds of:

- Point-and-click interface
- Human-Computer Interaction
- The personal computer
- Information Visualization
- The internet

U.S. National Library of Medicine's "Once and Future Web" online exhibition under the NLM Copyright Information page.

Doug Engelbart

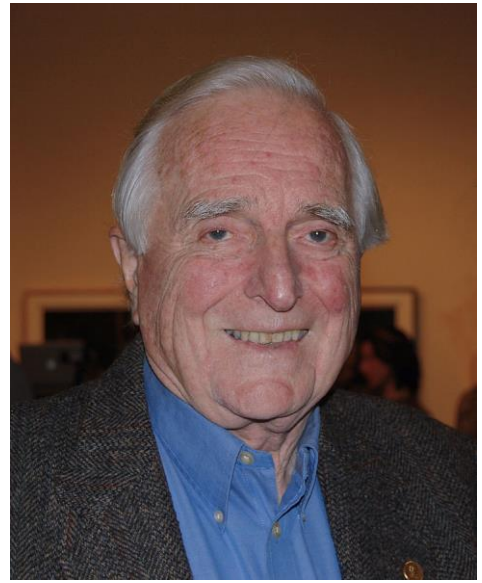
Born 1925

Stanford Research International

“The mother of all demos”

D. C. Engelbart,
‘Augmenting human intellect: A conceptual framework’, *Menlo Park, CA*, 1962.

https://www.youtube.com/watch?v=yJDv-zdhzMY



Alex Handy

“ Founder of Human-Computer Interaction”

- The computer mouse
- Graphical Computing
- Internet, video-conferencing

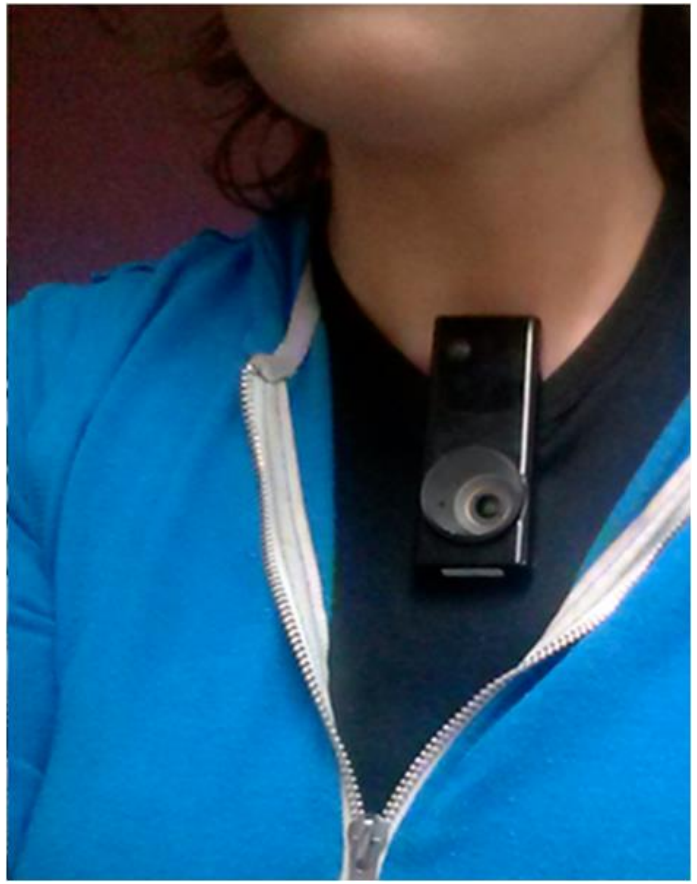
A Remarkable Legacy from "Cognitive Augmentation":

- The Personal Computer
- The Computer Mouse
- The Internet / the Web

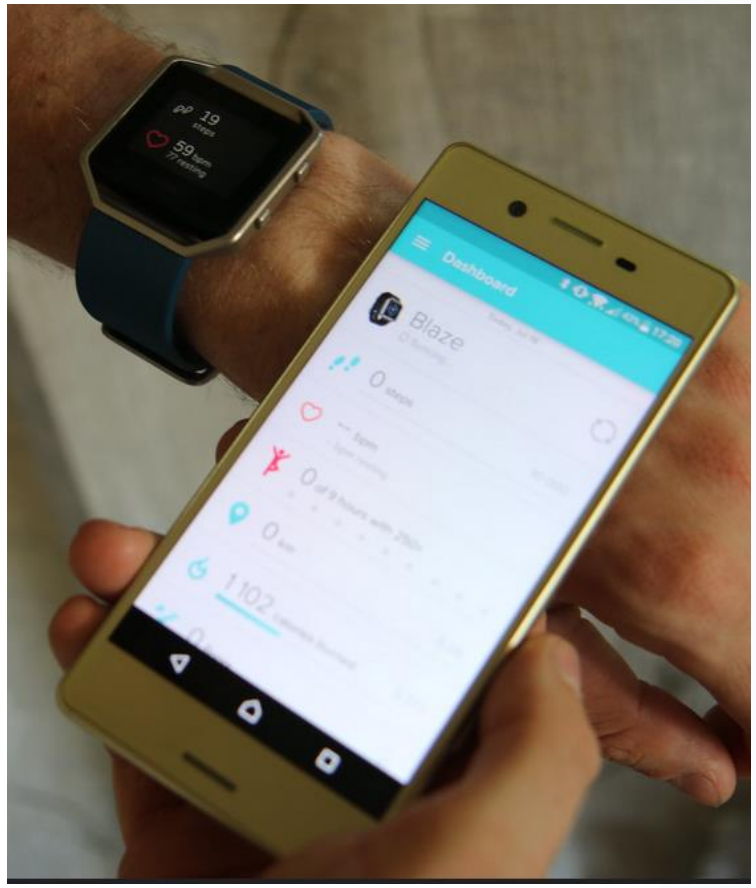
What will come next?

Memory

Lifelogging



Katarzyna Sila-Nowicka and Piyushimita Thakuriah, CC BY 4.0 <https://creativecommons.org/licenses/by/4.0>, via Wikimedia Commons



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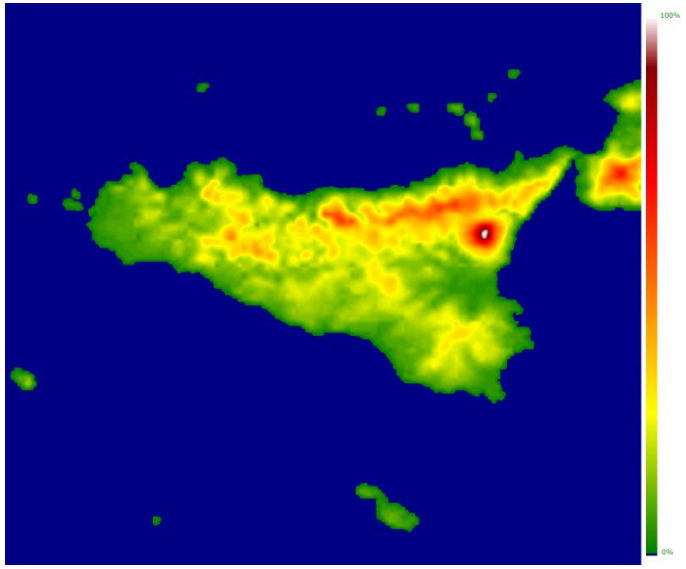
Tim.Reckmann, CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0>, via Wikimedia Commons

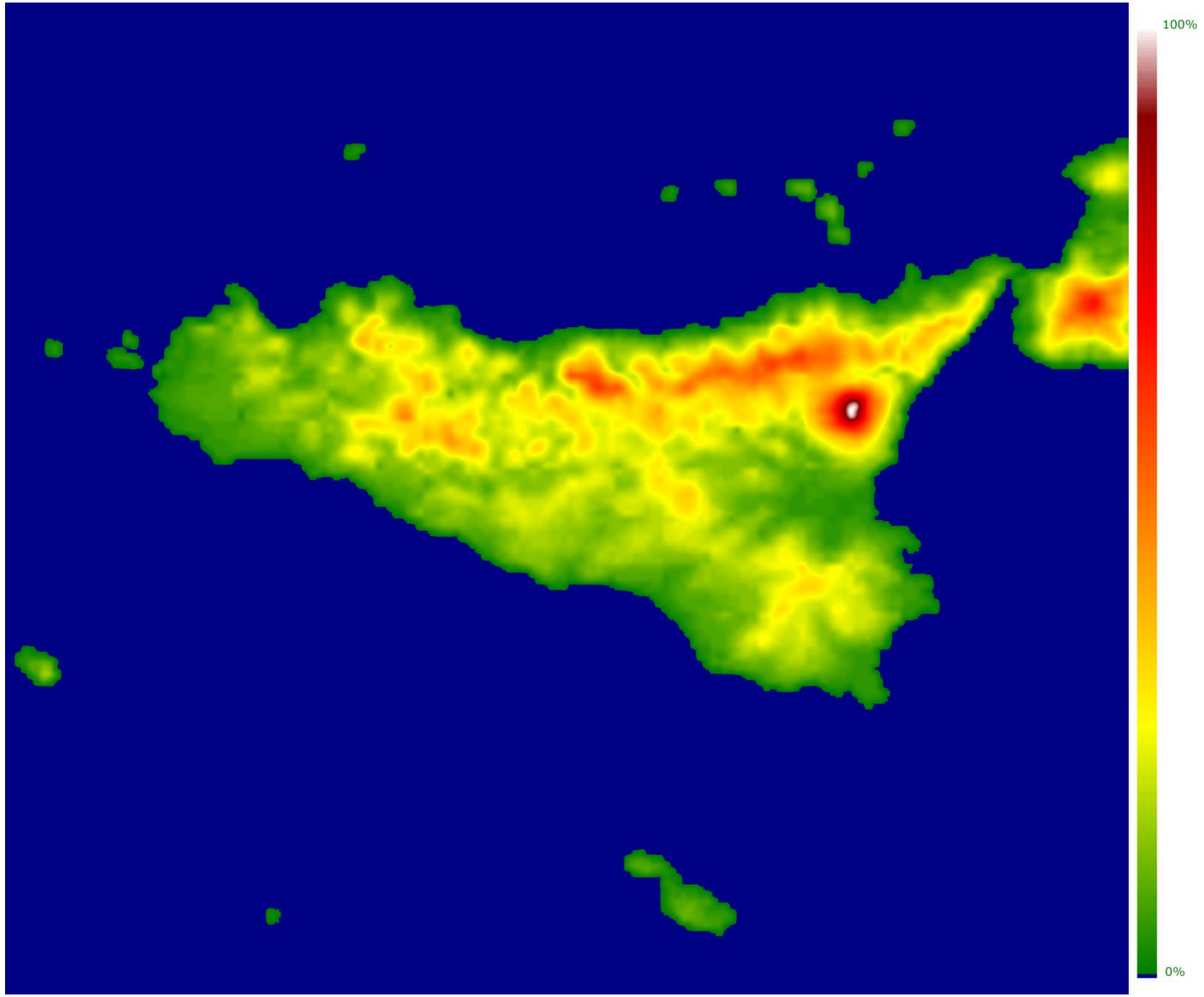
Neuralink (and other BCI)

Perception

Representation in Visualization

47	62	74	85	92	94
34	49	64	77	87	93
22	37	53	68	80	90
13	27	43	58	72	83
7	18	33	48	62	74
4	12	24	38	51	63
4	8	17	28	39	50
5	5	11	20	28	37
8	5	8	13	19	25
11	7	7	10	13	16
16	10	9	10	10	10
22	16	14	14	12	9
29	24	22	22	18	13

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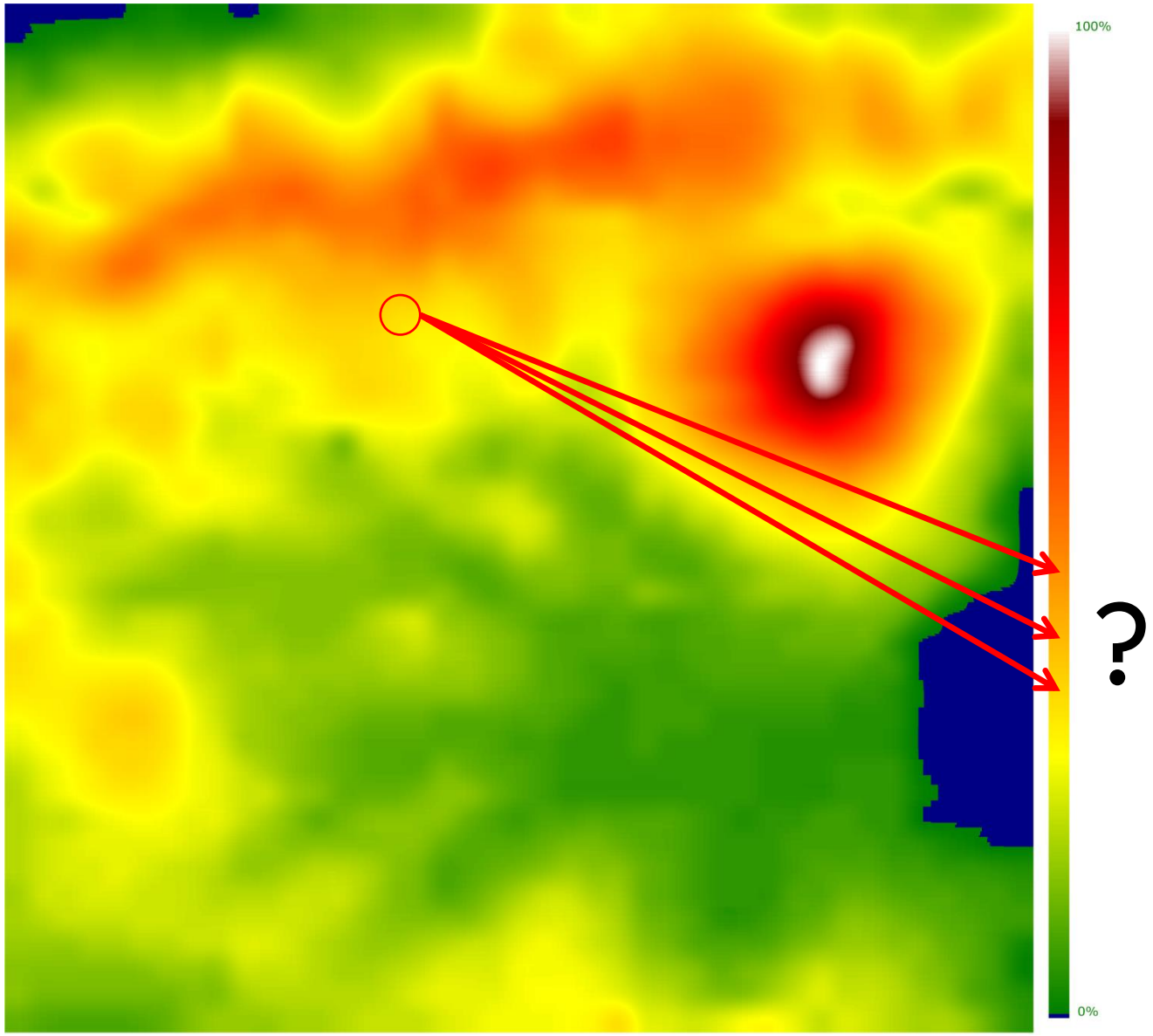
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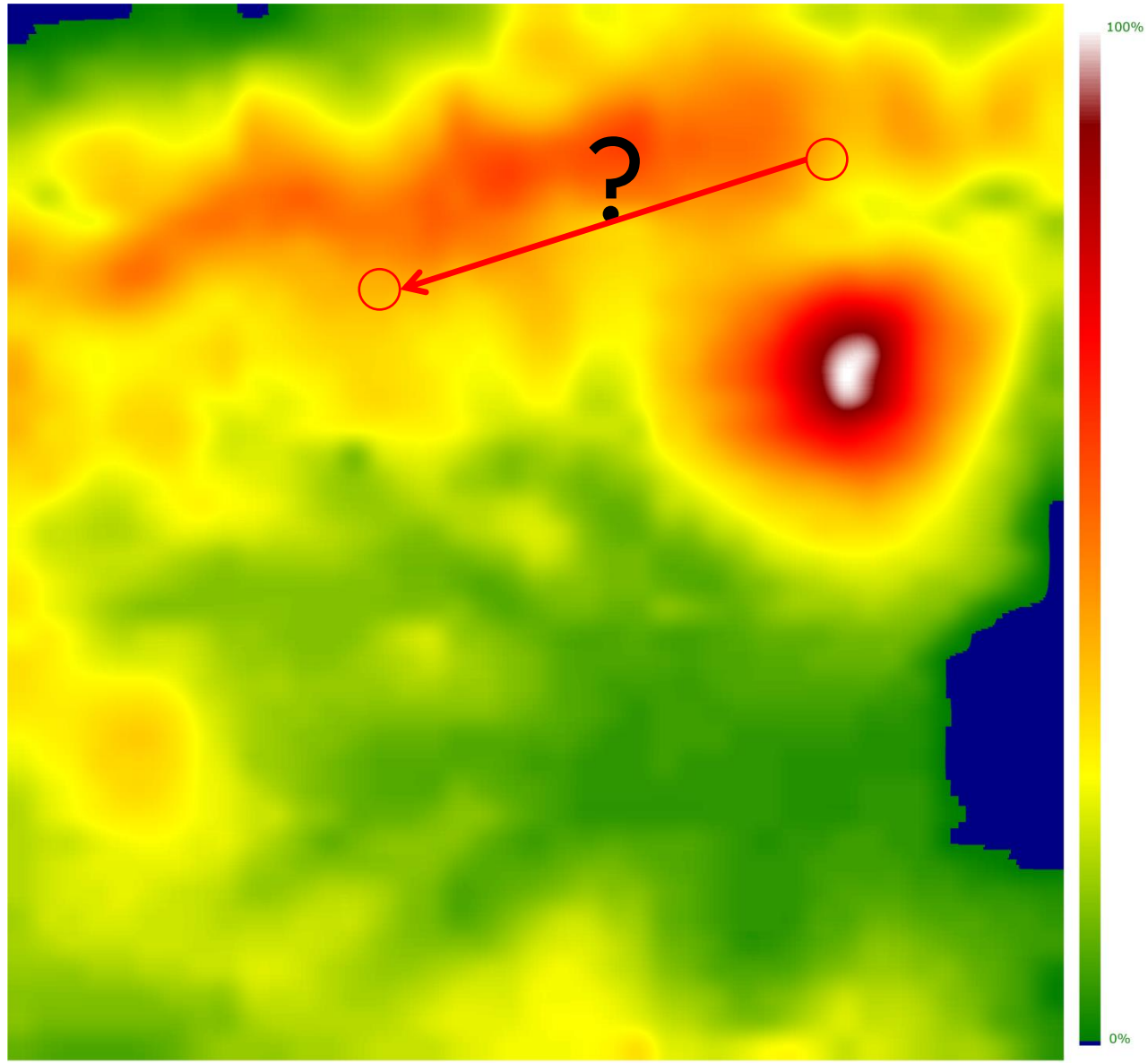
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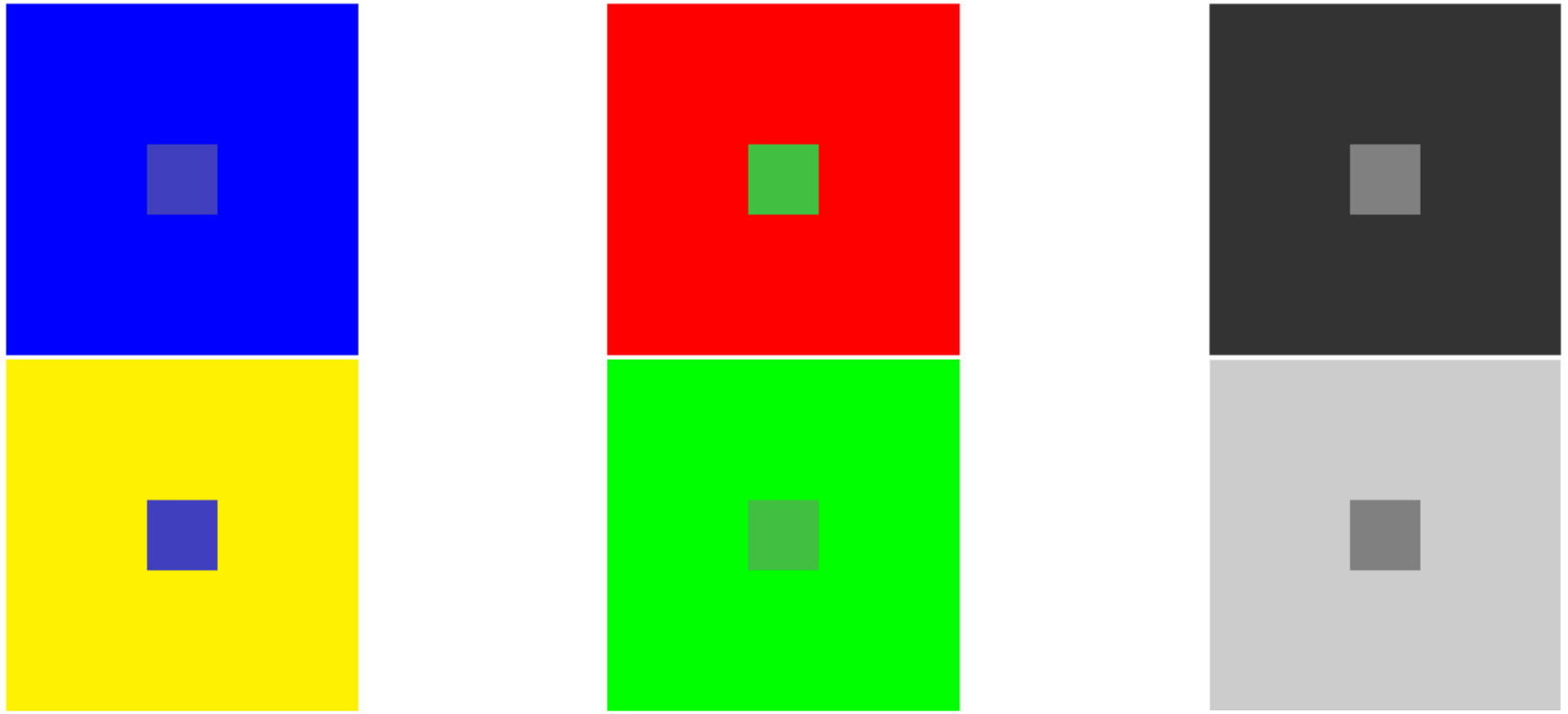
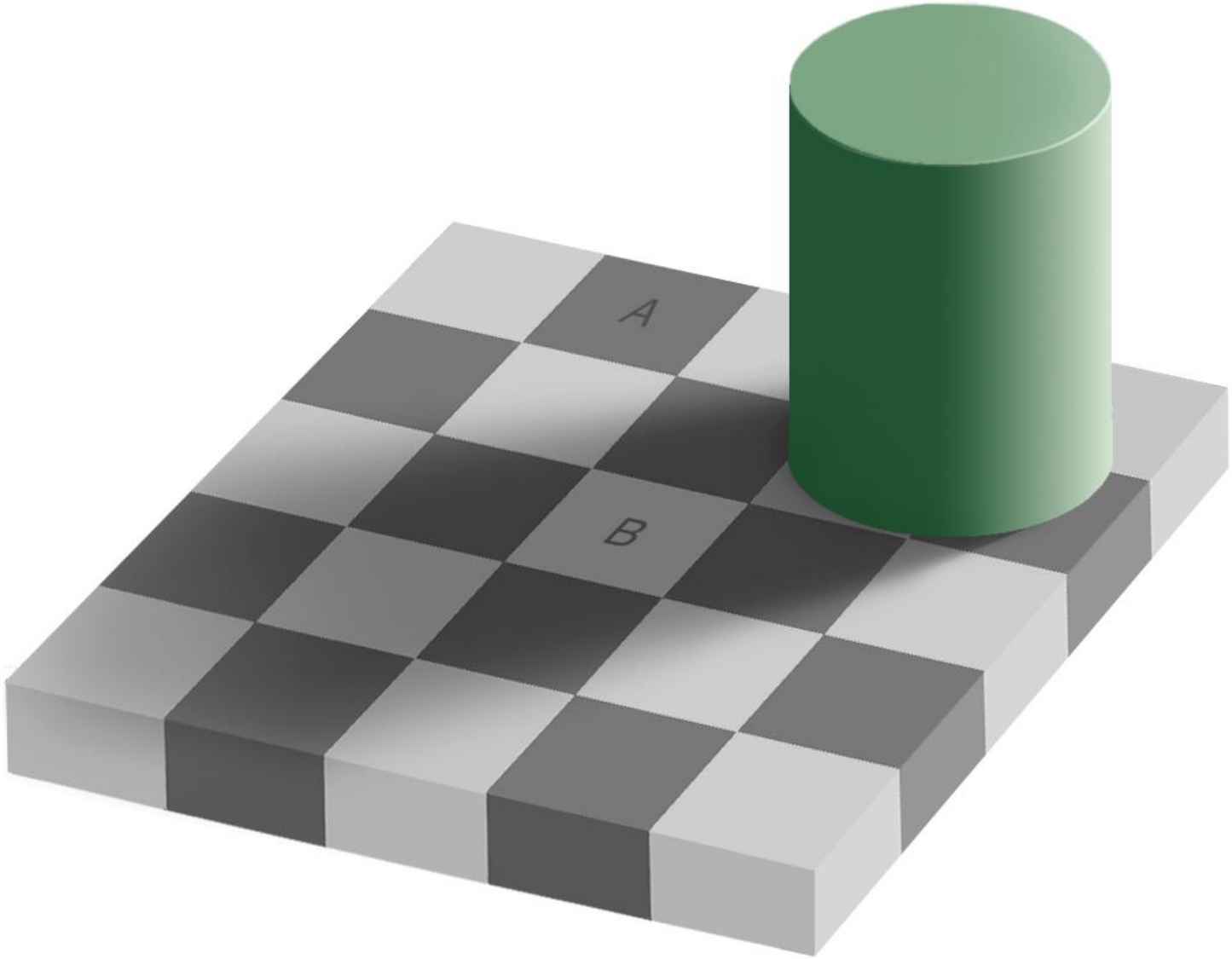
Simultaneous Contrast





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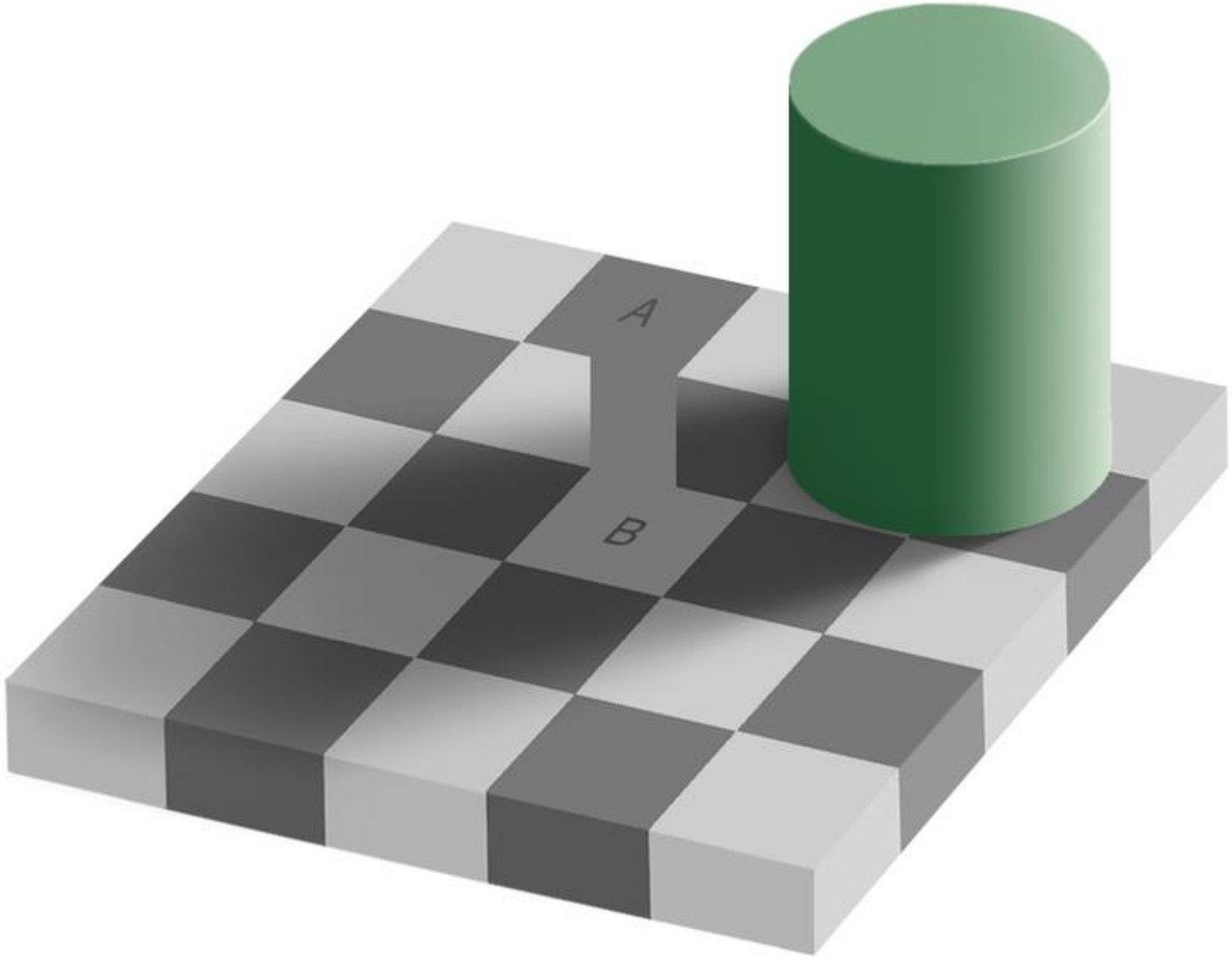
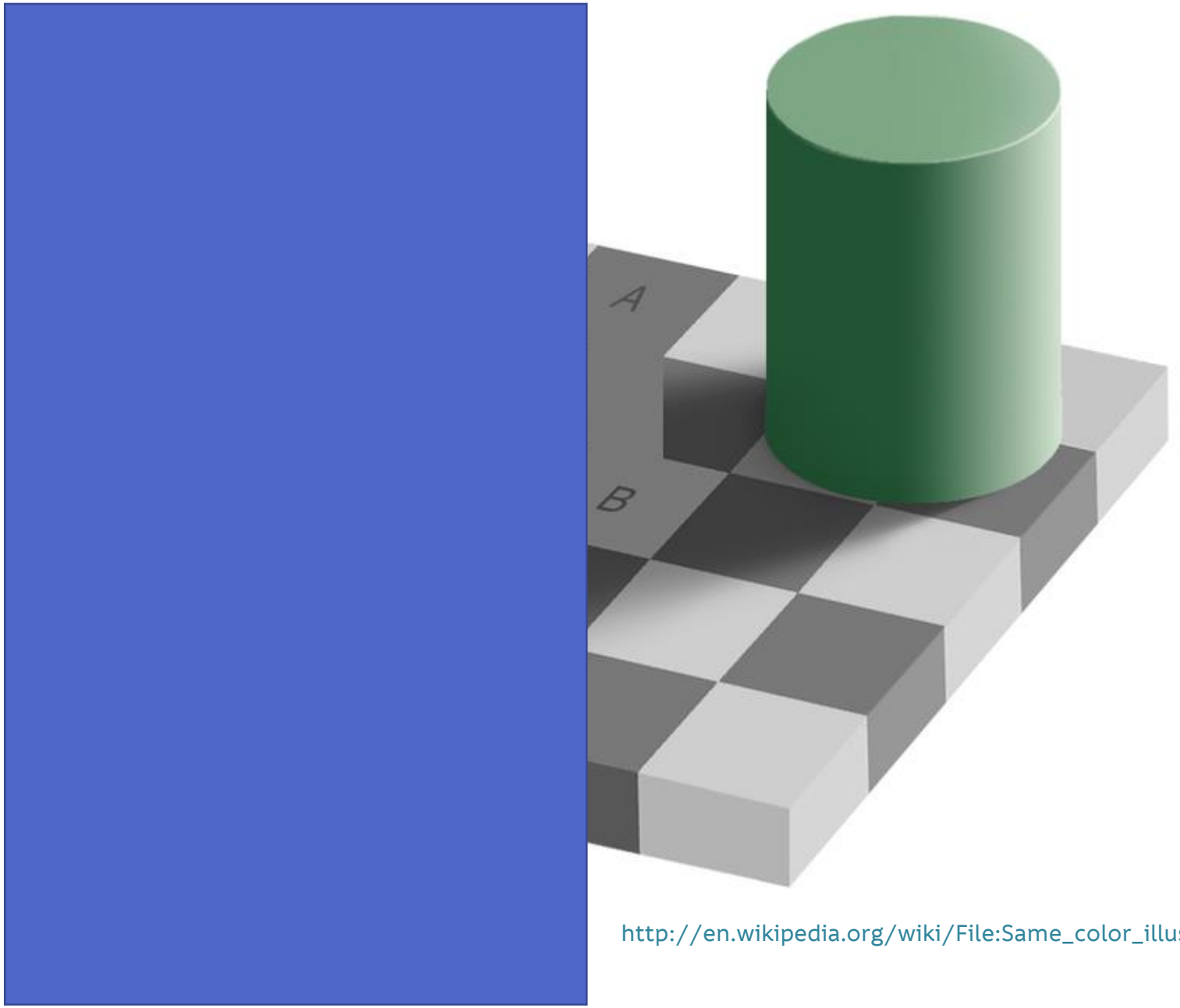


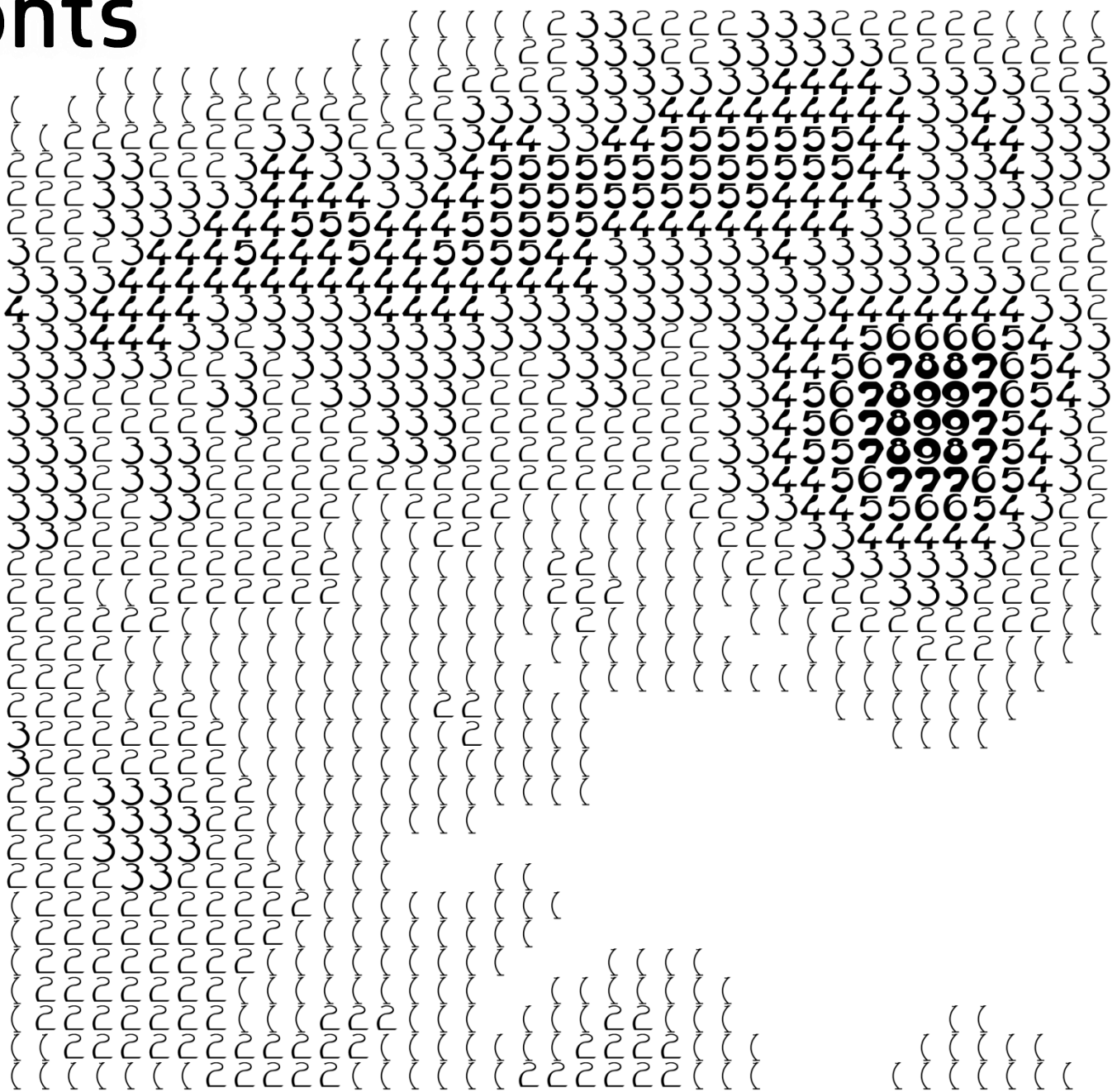
http://en.wikipedia.org/wiki/File:Same_color_illusion_proof2.png



http://en.wikipedia.org/wiki/File:Same_color_illusion_proof2.png

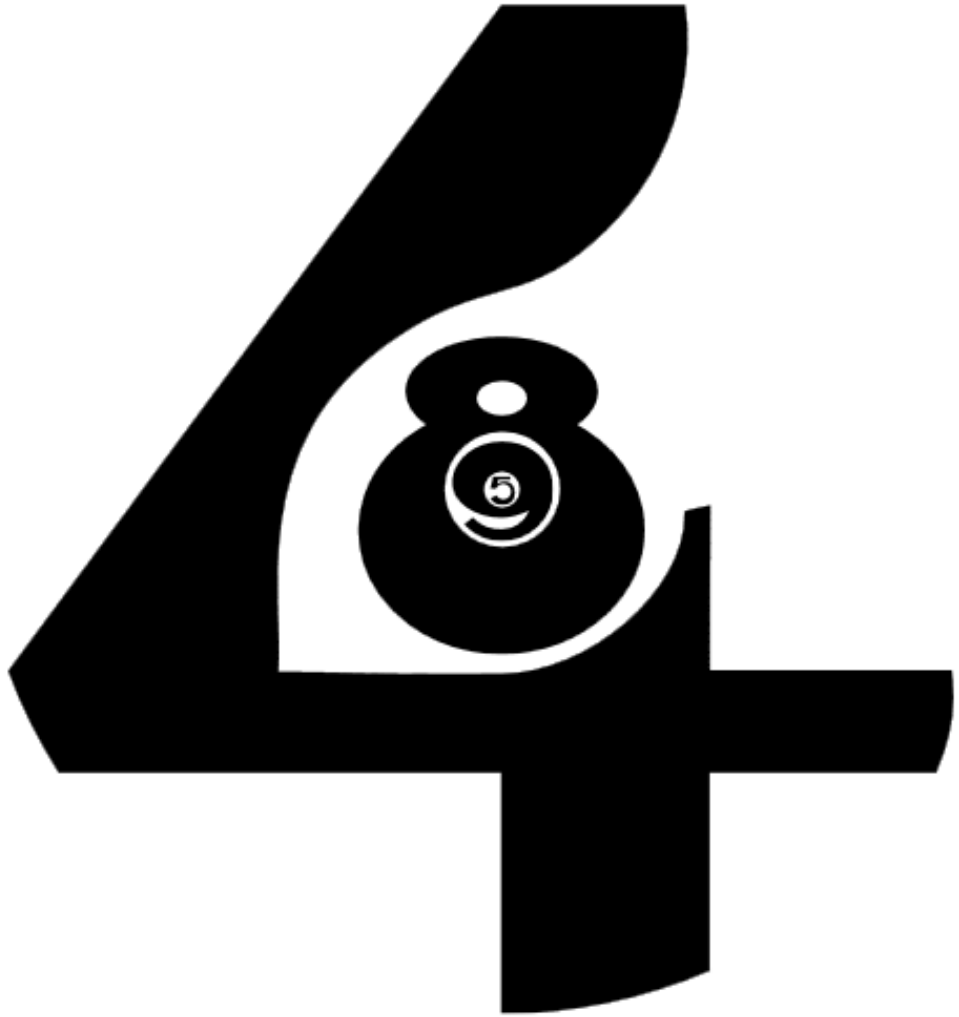
What are FatFonts?

FatFonts



FatFonts: How They Work

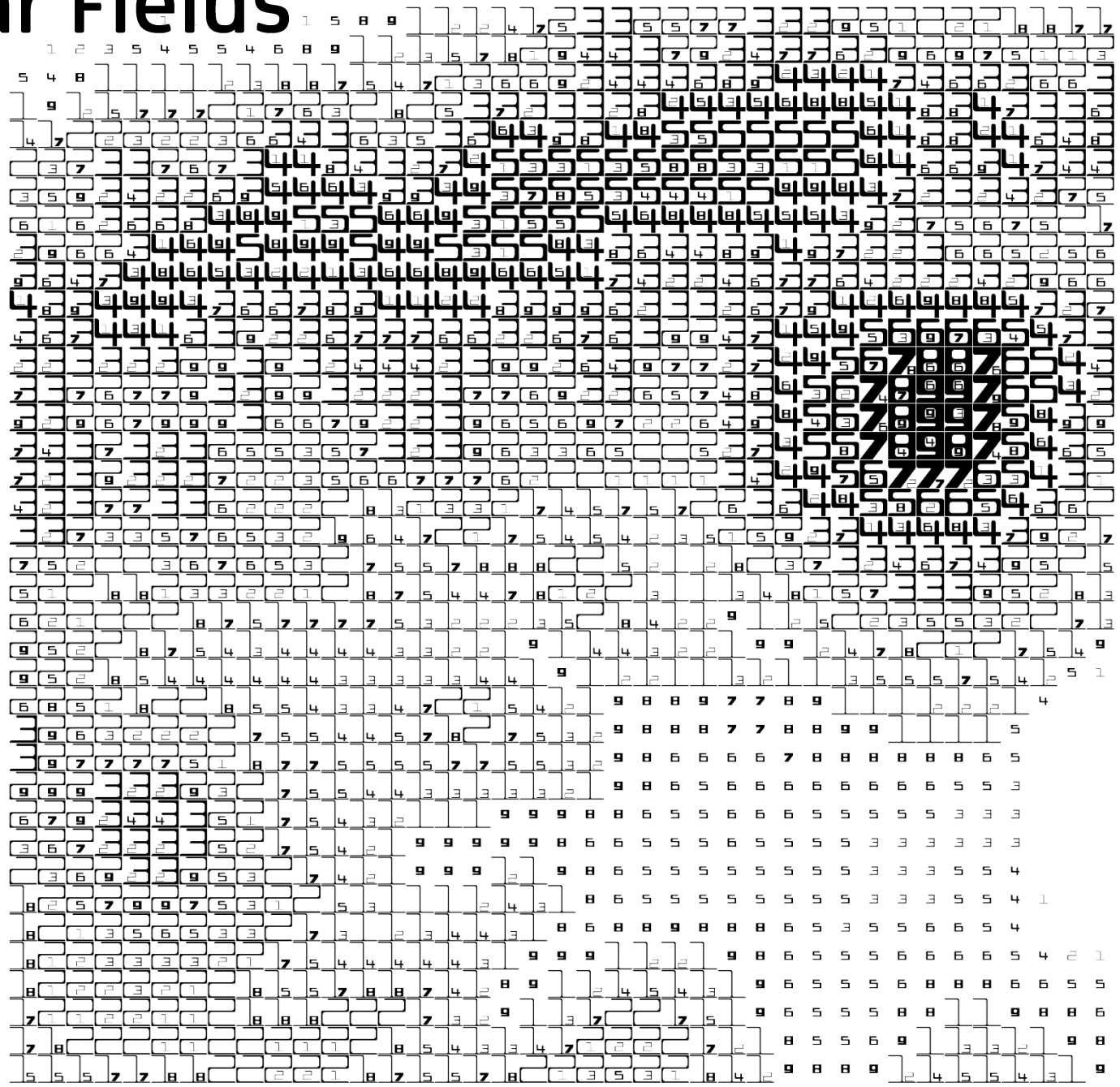
Nesting



FatFonts: How They Work

Nesting

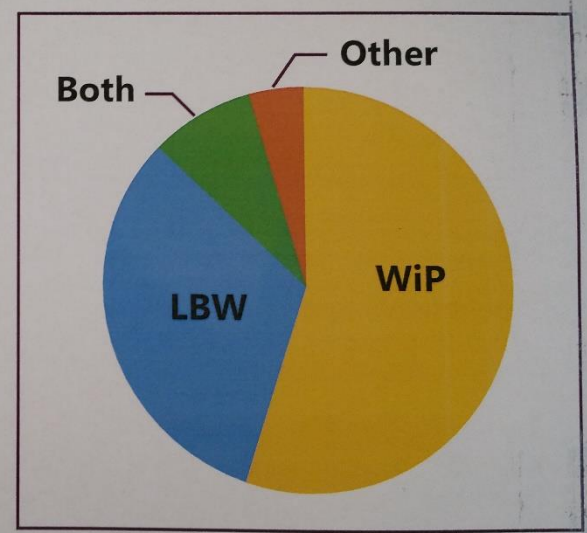
Scalar Fields



Submissions and Reviewing?

ow that the submission and review process is complete, is interesting to take a look at the numbers. This year, er the review process, we asked the ACs to characterize e papers as either a WiP, LBW, or Other (they could en add a comment as to why they deemed it an Other). ey could also choose more than one option. In total, Ws had 647 submissions. Of the 647 submitted, 281 %) were accepted. Table 1 is the breakdown of those missions by type and Table 2 is the breakdown of type Accept/Reject.

submissions we received clearly tended to favor k-in-progress, but we also had a substantial number of -breaking work as well. There does seem to be a clear d that work-in-progress were more likely to be reject



LBW Submissions by AC-described Type

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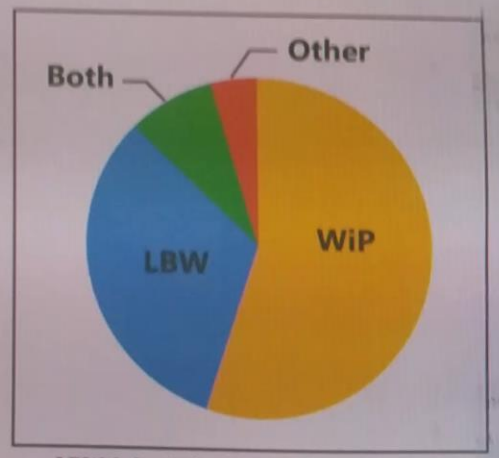

LBW Submissions by AC-described Type

Extractors

Marks

Values

Operators

Collections

Functions

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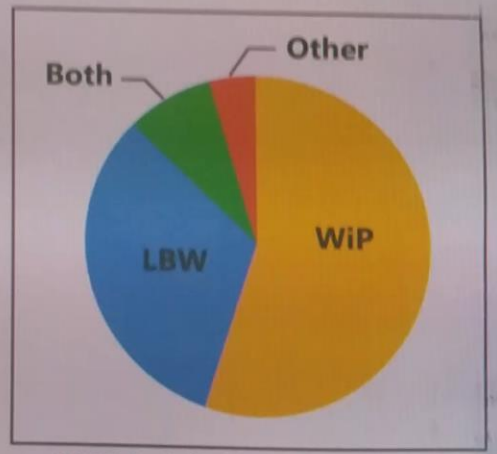
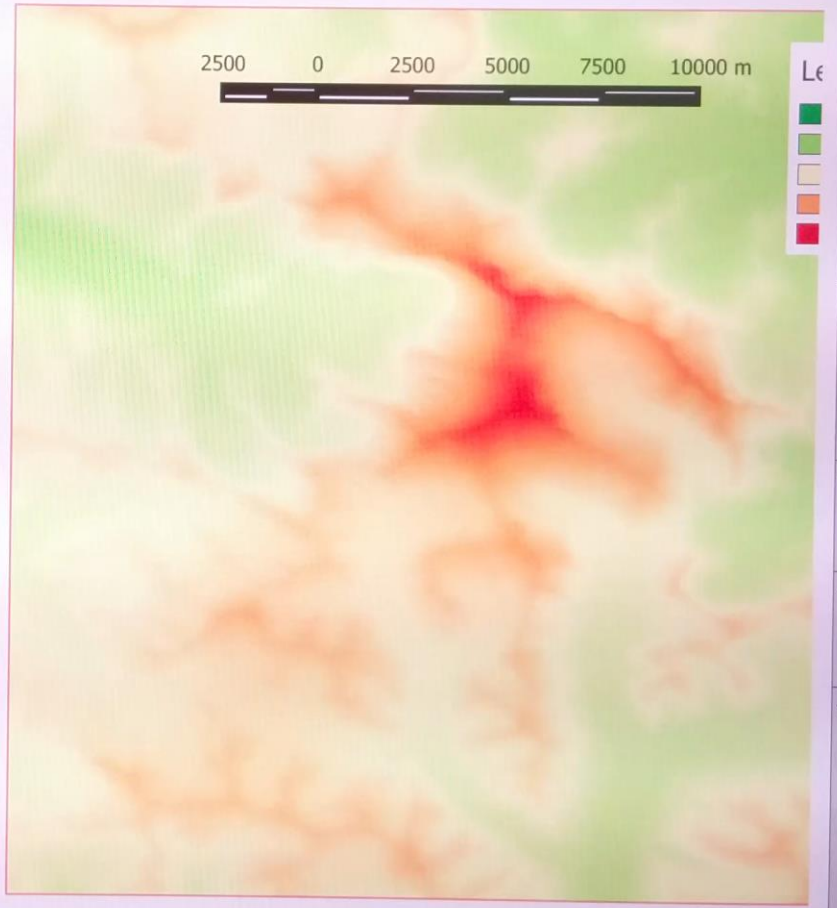
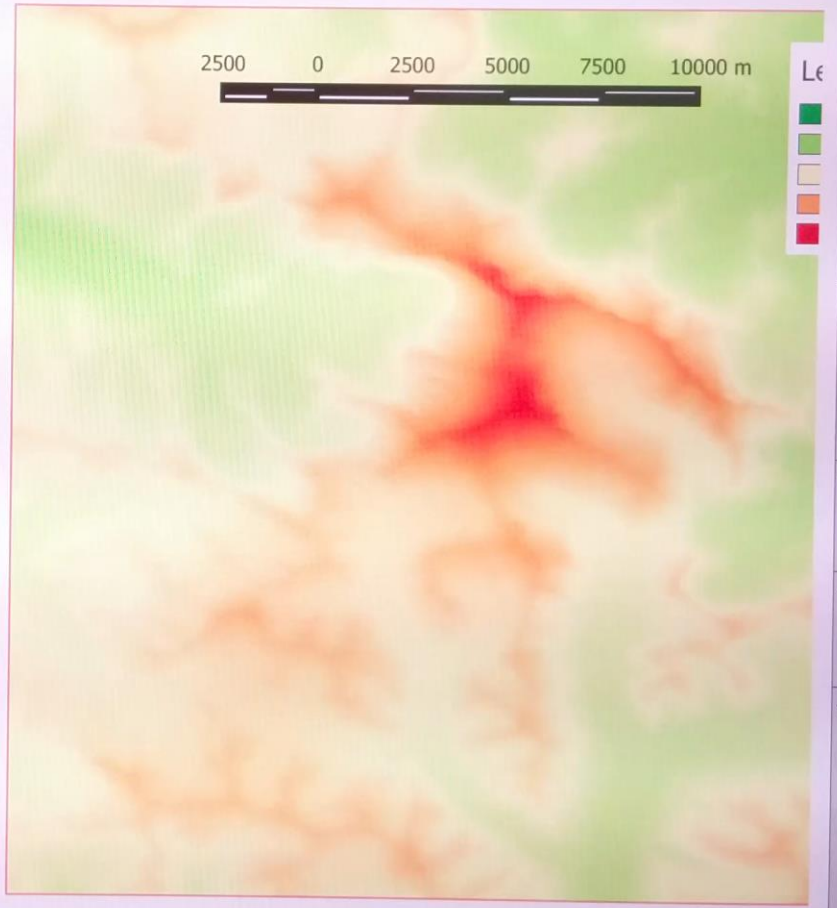


LBW Submissions by AC-described Type

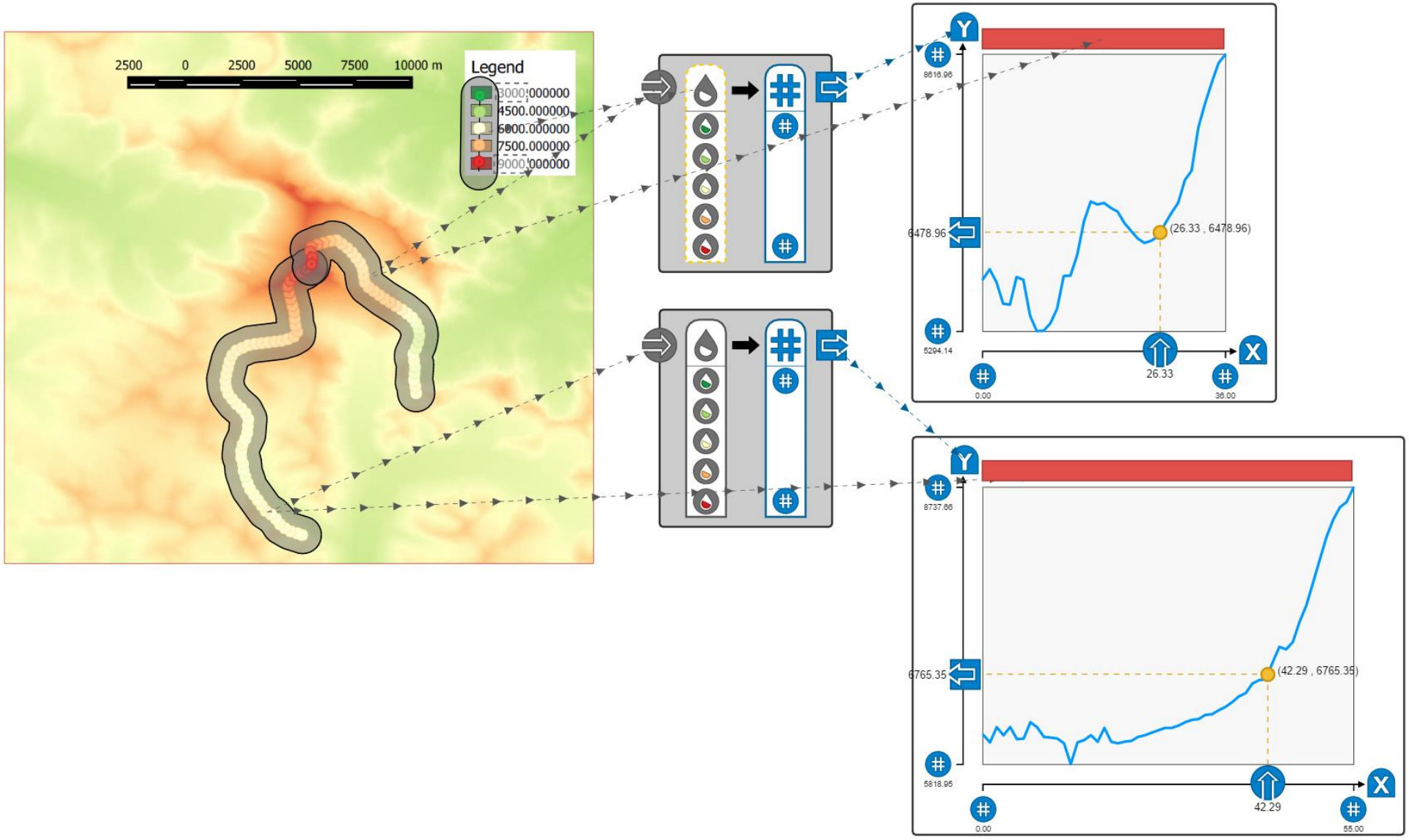


Extractors
Marks
Values
Operators
Collections
Functions



Extractors
Marks
Values
Operators
Collections
Functions

Final construction



Motion Amplification

Hao-Yu Wu, Michael Rubinstein, Eugene Shih, John Guttag, Frédo Durand, William T. Freeman
Eulerian Video Magnification for Revealing Subtle Changes in the World
ACM Transactions on Graphics, Volume 31, Number 4 (Proc. SIGGRAPH), 2012

Neil Harbisson

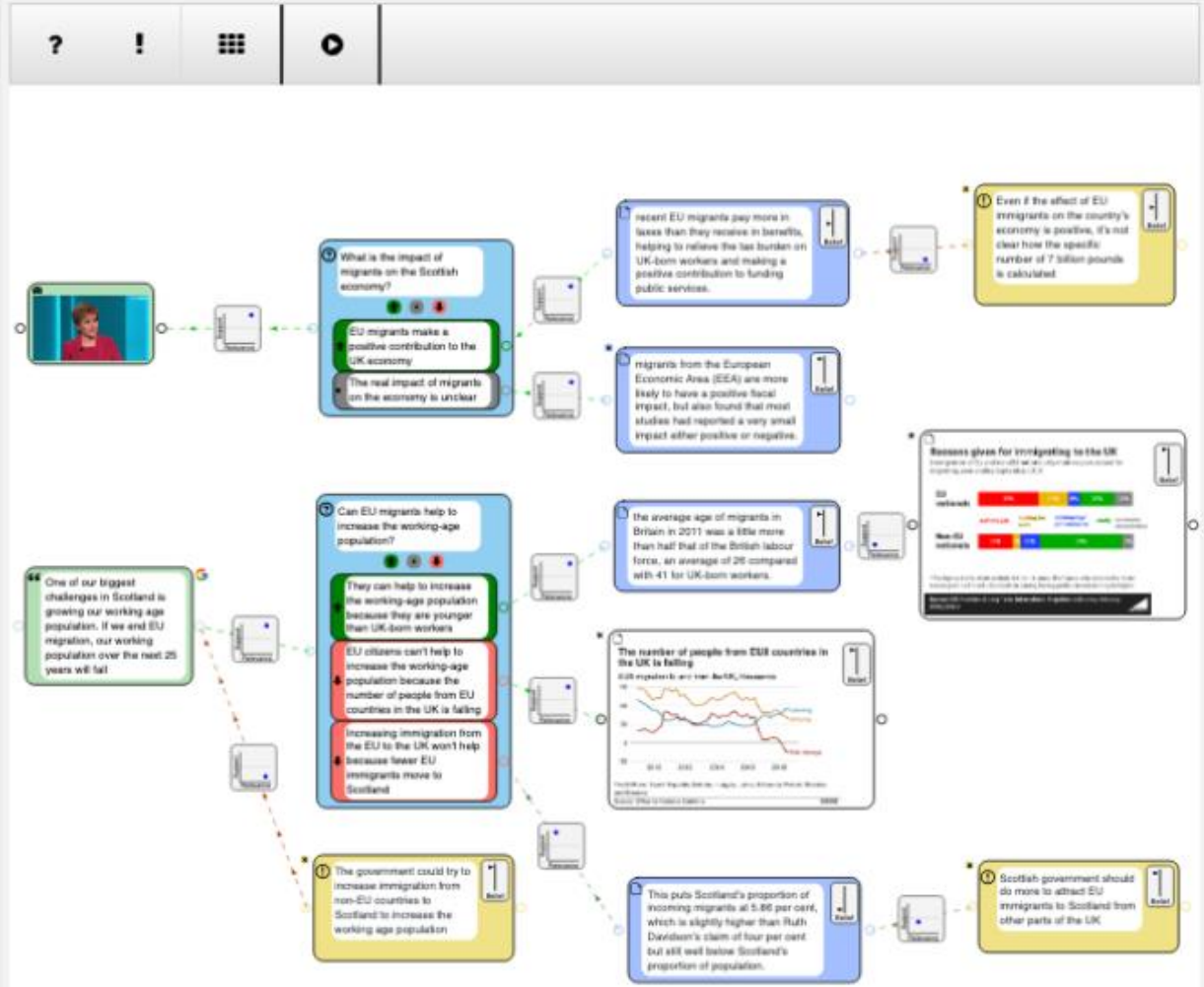
Argumentation / Text Creation

and the hard reality is our economy needs migration
from the European Union. I mean,
Scotland alone, EU migrants contribute 7
billion pounds every year. They are more
likely to be in work. They are less
likely to be claiming benefits. They are
more likely to be university educated
than the population as a whole. One of
our biggest challenges in Scotland is
growing our working age population. If we
end EU migration, our working
population over the next 25 years will
fall while our pension at each
population [thank you] going up by 50
percent. One last point. [I need to go to]
Public services are under pressure.
But that's not the fault of
migrants. That is the fault of the
austerity agenda pursued by the Tories
and and banking politicians like that.

Tue, 31 Mar 2020 13:05:08 GMT — Tue, 17 Nov 2020 21:24:49 GMT

Time

Relevance | Support | Belief



https://www.bbc.co.uk/news/

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UK migration: Rise in net migration from outside EU

28 February 2019

Net migration to the UK from

Should greater regulatory control be exerted over genetic biohacking?

Over the last two decades, the scientific movement of "biohacking" has exploded. As a consequence of the easy access to scientific knowledge in the digital age, and the development of biohacking-related communities caused by it, genetic research and testing is no longer confined to traditional laboratories.

The "democratisation" of genetic research, however, prompts a multitude of questions over its merits, its safety, and - most controversially - its risks. But is genetic biohacking, in its current and largely unregulated form, a cause for positive change or an oncoming catastrophe?

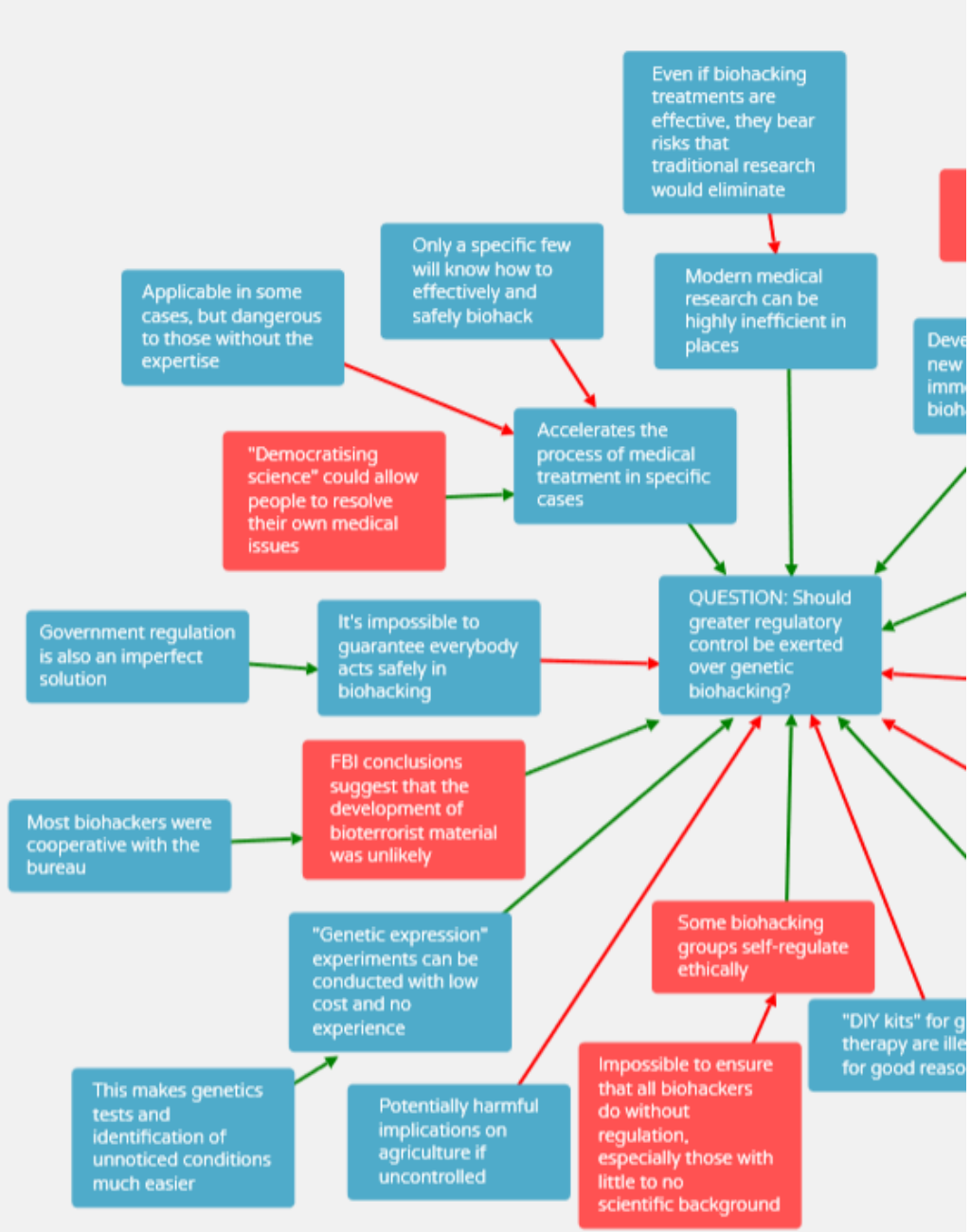
It's safe to say that the majority of biohackers are individuals from qualified backgrounds dissatisfied with the scientific world. Take Josiah Zayner, a shining example; the sluggishness and bureaucracy of traditional medical research led him to try to solve his own health issues through self-experimentation. His treatments were successful, making it hard to doubt his research is a force for good that granted him access to treatments unavailable by any other means. By short-cutting the wait of up to 10 years for drugs to be fully approved, biohacking-produced research such as this can be lifesaving to those with access to it.

A similar success story involves the drug Glybera. This $1-mil-per-treatment gene therapy was recreated in an affordable form by biohackers, albeit a form that has received criticism from experts in gene therapy. Developments such as this, which circumvent the many years of traditional scientific testing, can be gamechanging to those suffering from genetic conditions.

Hearing success stories such as these makes it easy to forget that those slow testing processes have reason to exist. Traditional research channels ensure that genetic therapies have their safety guaranteed, whilst biohacking treatments lack the same reassurance. The case of Thalidomide, a scientific shortcoming now taught in UK schools, is looked at as a prime example of

wrong if a new drug is misunderstood; modern research,

782 words

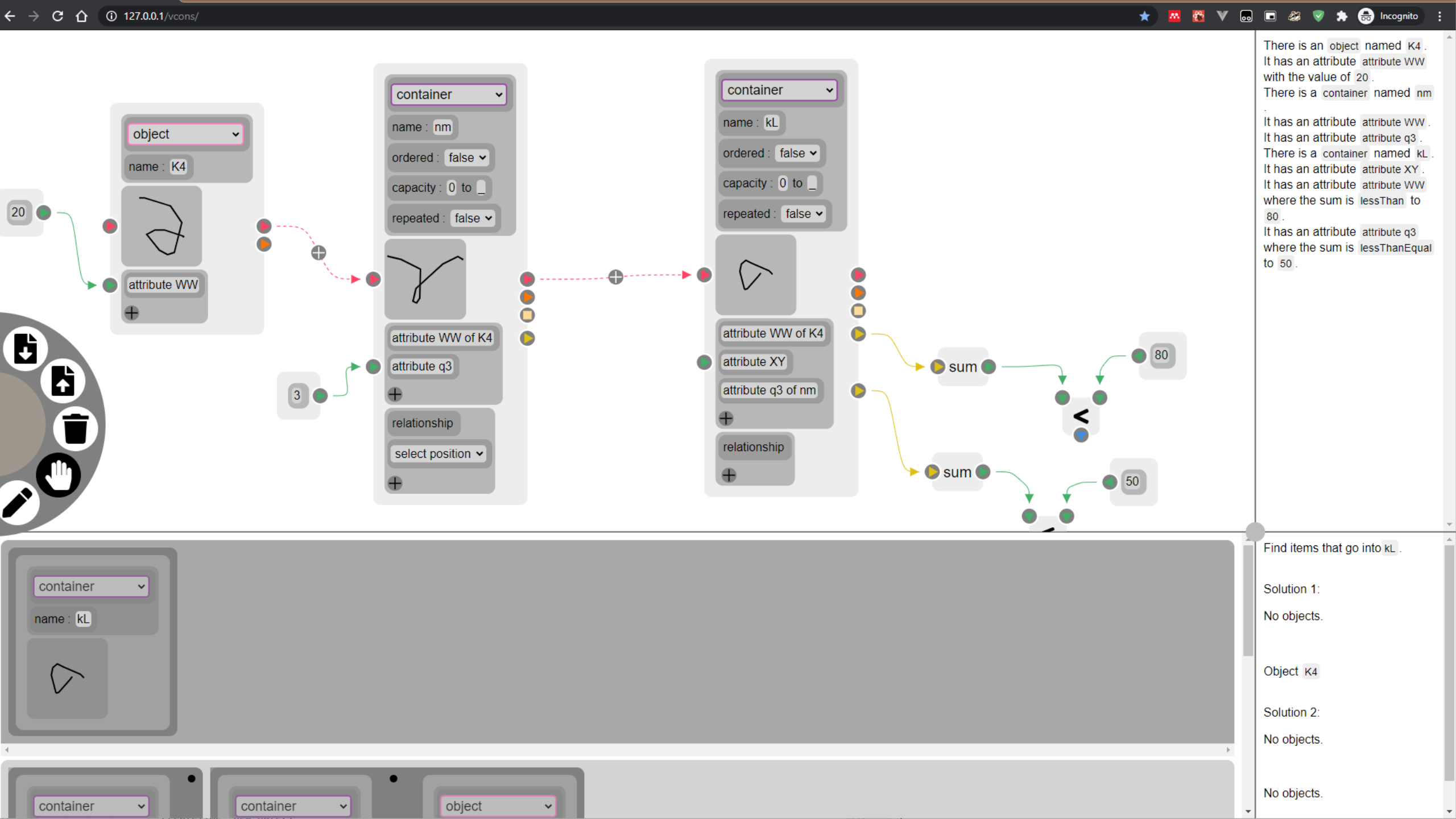


Back | Study participant instructions | View fact sheet | Export PDF | Export logs | Save

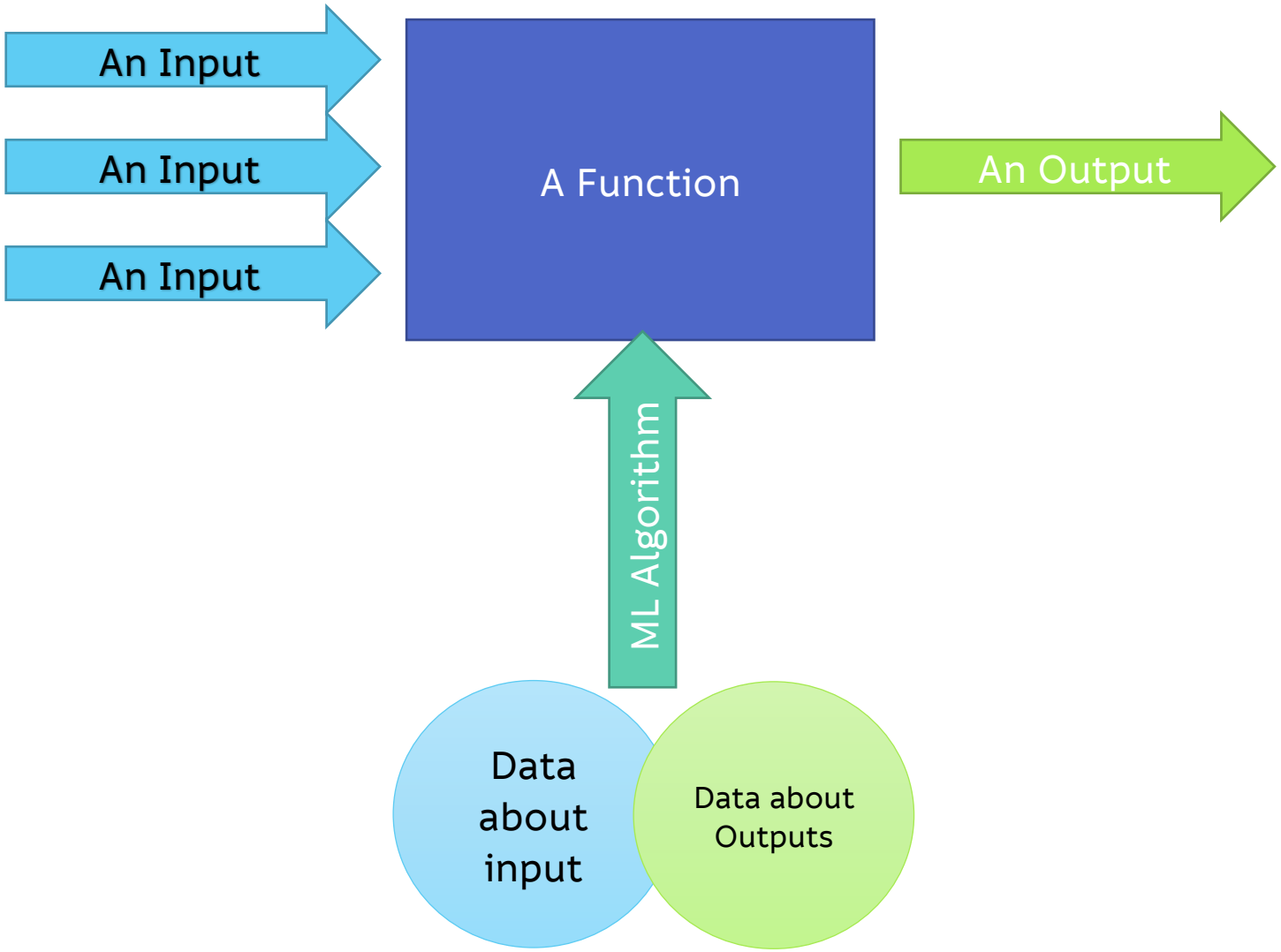
Calculation

A wedding problem

- The hall can hold 200 people
- We have between 20 and 30 tables
- Each table can sit between 5 and 10 people
- We want as many people from the same family together
- But we do not want creepy uncle Don to sit with people < 40yo
- But each table should have a healthy mix of diverse people


127.0.0.1/vcons/
Incognito
object
name : K4
attribute WW
20
container
name : nm
ordered : false
capacity : 0 to _
repeated : false
attribute WW of K4
attribute q3
3
relationship
select position
container
name : kL
ordered : false
capacity : 0 to _
repeated : false
attribute WW of K4
attribute XY
attribute q3 of nm
relationship
sum
80
<
sum
50
There is an object named K4 .
It has an attribute attribute WW with the value of 20 .
There is a container named nm .
It has an attribute attribute WW .
It has an attribute attribute q3 .
There is a container named kL .
It has an attribute attribute XY .
It has an attribute attribute WW where the sum is lessThan to 80 .
It has an attribute attribute q3 where the sum is lessThanEqual to 50 .
container
name : kL
container
container
object
Find items that go into kL .
Solution 1:
No objects.
Object K4
Solution 2:
No objects.
No objects.

Artificial Intelligence / Machine Learning



Machine Learning as Human Augmentation

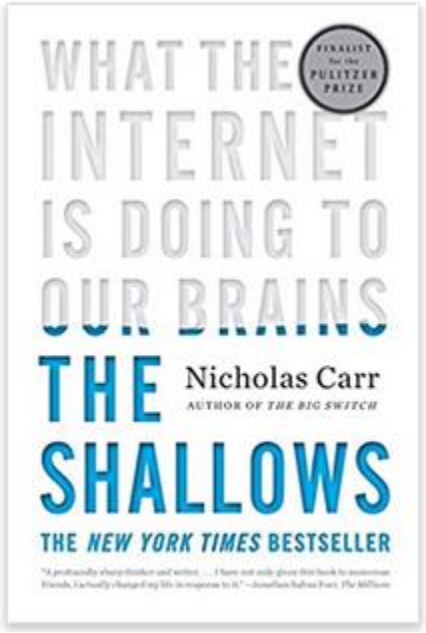
Computer Vision can now classify objects more accurately than humans (for some applications)

We have started to delegate in ML Systems

- Face recognition – crime detection
- Predicting Recidivism
- Writing text (ChatGPT)
- Making Images

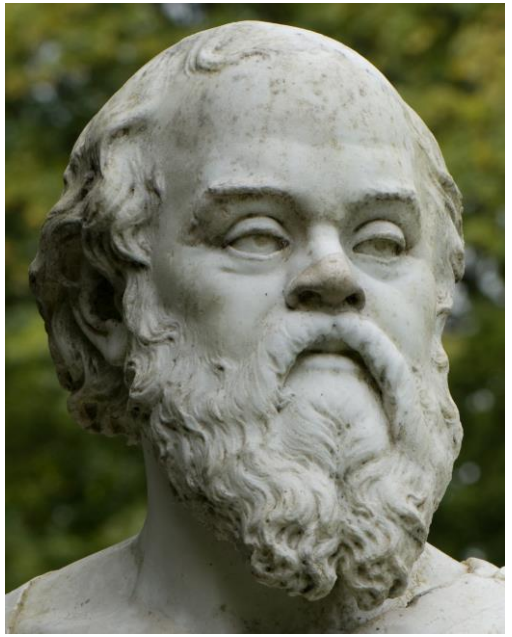
Discussion
(are computers making us dumb?)

If we delegate (or let the machine do their thing all together) are we augmenting cognition? Are we becoming smarter?



I never remember how

to write guarranty, warantee.



Was Socrates Wrong?

- How much of it do we have to do **ourselves**? What does **ourselves** even really mean?

By Gan Khoon Lay
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By HeadsOfBirds, IM
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Conclusions (and my opinions)

Regarding AI / ML for human augmentation God is in the details

- How do we understand what the ML is doing (interpretability)
- How do we communicate what we need, and correct?
- Can we manage the uncertainty?

Conclusions (and my opinions)

In Computer based Cognitive Augmentation the interface is key

- Can we specify the desired outcome fast enough? Precisely enough?
- Can we access the results in context?

Conclusions (and my opinions)

Cognitive Augmentation has been going on for a long, long time

- It’s a long journey of incremental improvement
- Some of the technological acceleration from the last few years might make us smarter, but do not believe the hype too much

Conclusions (and my opinions)

There are important legal and ethical concerns

- When is it not fair that Cognitive Augmentation is used? (e.g., exams)
- Are we increasing inequality based on access / socio-economic status?

Collaborators


Michael Mauderer


Gonzalo Mendez


Julian Petford


Xu Zhu

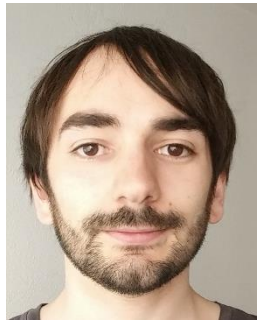

Simone Conte


Sebastien Vandenheste


Alice Lynch


Alexandra Lee


Guilherme Carneiro


Constant Manteau


Sheelagh Carpendale


John Brosz


Ricky Pausch


Uta Hinrichs


Alice Toniolo


Özgür Akgün


Christophe Hurter


Dhanraj Vishwanath


Pete Nightingale


Daniel Archambault


Dave Flatla

My Goals Today

- Give you an understanding of what keeps me busy
- Give you an impression of why I think it is important
- Show you something that you did not know about
- Show you something that surprises you
- Make you a little bit smarter
- Learn a bit from you

The Augmented Human: How Computers Can Make Us Smarter (and Dumber)

Miguel A. Nacenta

Associate Professor, University of Victoria
nacenta@uvic.ca

How does this affect you?

- Have you thought of new computing technologies as cognitive augmentation?
- Do you fear or are hopeful for new applications of ML in your work?