Bill Gardyne
Wholistic Environment

Presentation

It's not real until it's modelled

Biography

Bill has 35 years experience as an environmental practitioner with extensive experience in both natural and built environments. He is a Fellow of the Environmental Institute of Australia, and has been a Director and/or Vice-President of the International Erosion Control Association (Australasian Chapter) for the past thirteen years.

Bill has previously acted as a regulator on four major highway upgrade projects, representing the NSW Department of Planning (DoP):

- Pacific Highway Upgrade: Tintenbar to Ewingsdale
- Pacific Highway Upgrade: Banora Point
- Tugun Bypass, and
- Pacific Highway Upgrade: Brunswick Heads to Yelgun

Bill adopts an wholistic approach to environmental issues, recognising that all issues interact to a greater or lesser extent and that excellence comes from recognising and understanding, both technically and financially, those interactions.

Over the past four years he has been instrumental in improving the rehabilitation strategies being undertaken for the CSG projects for Santos, Origin, and Arrow through intelligent design and thorough auditing. In those projects for which he was the designer, the outcomes have been cheaper implementation, greater levels of compliance, and minimal operational cost through stable landforms.

Bill has undertaken numerous audits of industrial and linear projects. His approach is always to help improve standards through practical, cost-effective measures. This often creates challenges where a change in method is suggested. Often both the contractor and the regulator may be challenged to reconsider their position from a different perspective, or look at a range of alternative measures to achieve a better outcome. Recent examples include being the catalyst behind the use of compost blankets on the Tugun Bypass Project, and the adoption of chemical binders and flocculants to improve water quality outcomes in the construction industry as a whole.

Bill was the key-note speaker at a Highway Technology Conference in New Zealand, where he spoke on the essential role of the soil scientist. He helped organise, and was a speaker at, an EPA-sponsored conference on erosion and sediment control in Cairns. Outcomes from that conference include a submission to the relevant minister, and organising a 5-day training programme on this subject.

Bill has also acted as an Expert Witness for the Commonwealth Department of Environment and Qld EPA in relation to erosion and sediment issues associated with a project proximate to Lamington National Park, the Great Barrier Reef Marine Park at Airlie Beach, and at Ipswich near Brisbane. Historically he acted as an Expert Witness in relation to ecological assessments associated with development applications near Brisbane and Noosa Heads.

Bill is also recognised by the Queensland Department of Environment Resources and Mining (DERM) as a suitably qualified person for contaminated land assessments.

Abstract

We have had a number of instances lately where we have seen wrong answers presented because of a reliance on modeling, and a lack of associated curiosity to look beyond the screen.

These have included modeled data associated with:

- Noise - the models are now giving very accurate predictions of (*e.g.* traffic noise), but that doesn't answer an individual's response to noise (type, timing, and frequency)
- Water quality (MUSIC model data). In a recent teleconference there was a major issue wherein the professionals believed the model over the measured data, and were quite affronted when that was noted.
- Hydrology (three different engineering professions looking at an erosion issue, and coming up with the wrong interpretation (and thus a solution that is deemed to fail)

As the younger professionals, who have been brought up on a diet of technology, come through, this problem is likely to become worse.

Sometimes the wrong answer is a consequence of the wrong question, and thus it is also important to 'Know what you don't know." That is something that only comes with experience (*i.e.* the Dunning-Kruger Effect.)

The answer is supervision and revision by some 'old heads' and /or generalists, a very important, but usually under-valued professional asset.

WHOLISTIC
environment

It’s Not Real

(Until It’s Modelled)

Bill Gardyne

Noise

Logarithmic: dB(A) is a measure of physical sound intensity, not of perceived loudness.

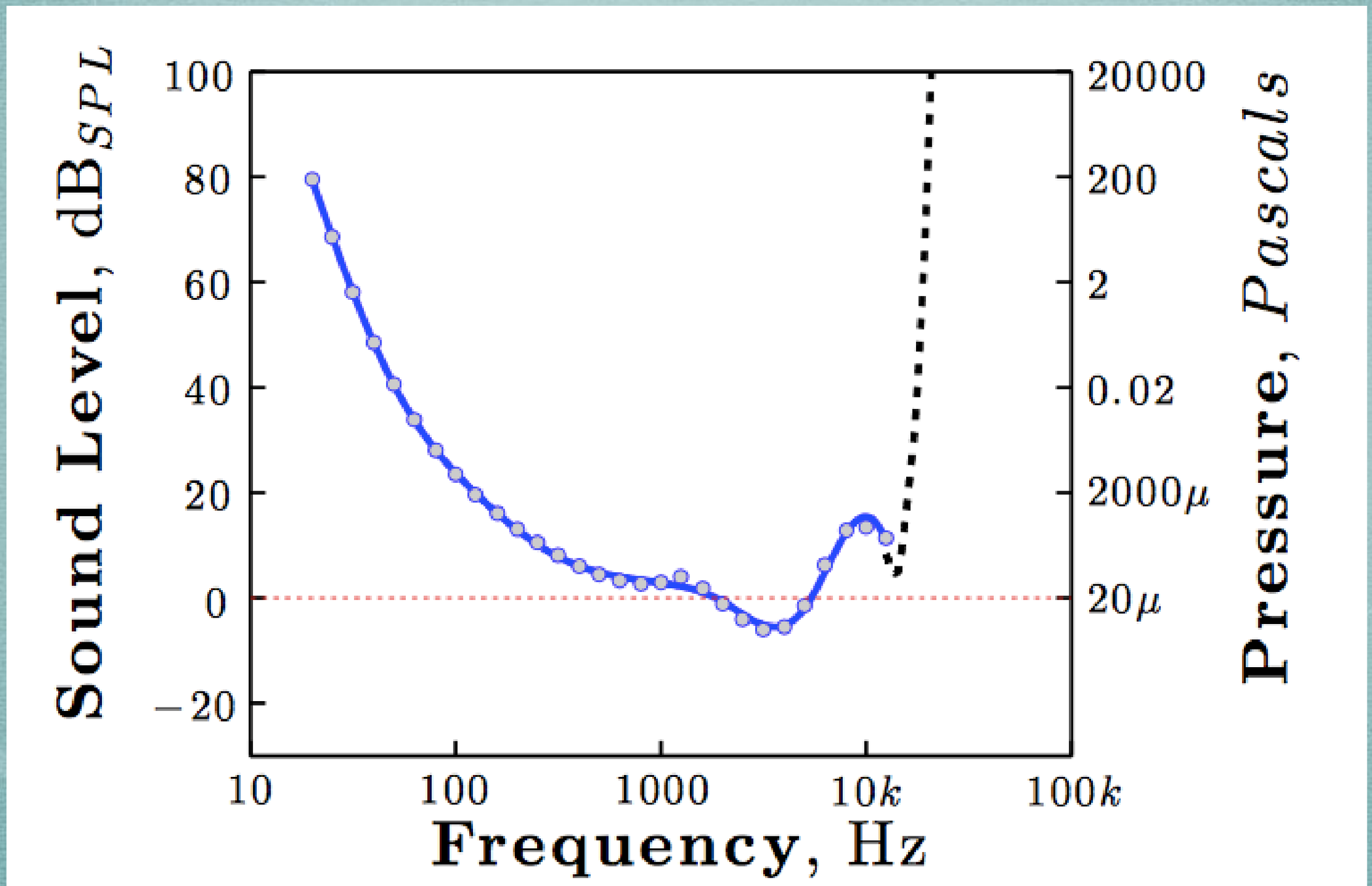
Human Ear:

Lowest: 0 dB ≈ 10^{-8} mm @ 1 kHz

Pain: 140dB(A)

Statistical: L_{A1} ; L_{A10} ;L_{A90} ;L_{Aeq} ; $L_{Aeq\ 18hr(6am-12pm)}$

Noise


Sound Level, dB$_{SPL}$
100
80
60
40
20
0
−20
20000
200
2
0.02
2000μ
20μ
Pressure, Pascals
10
100
1000
10k
100k
Frequency, Hz

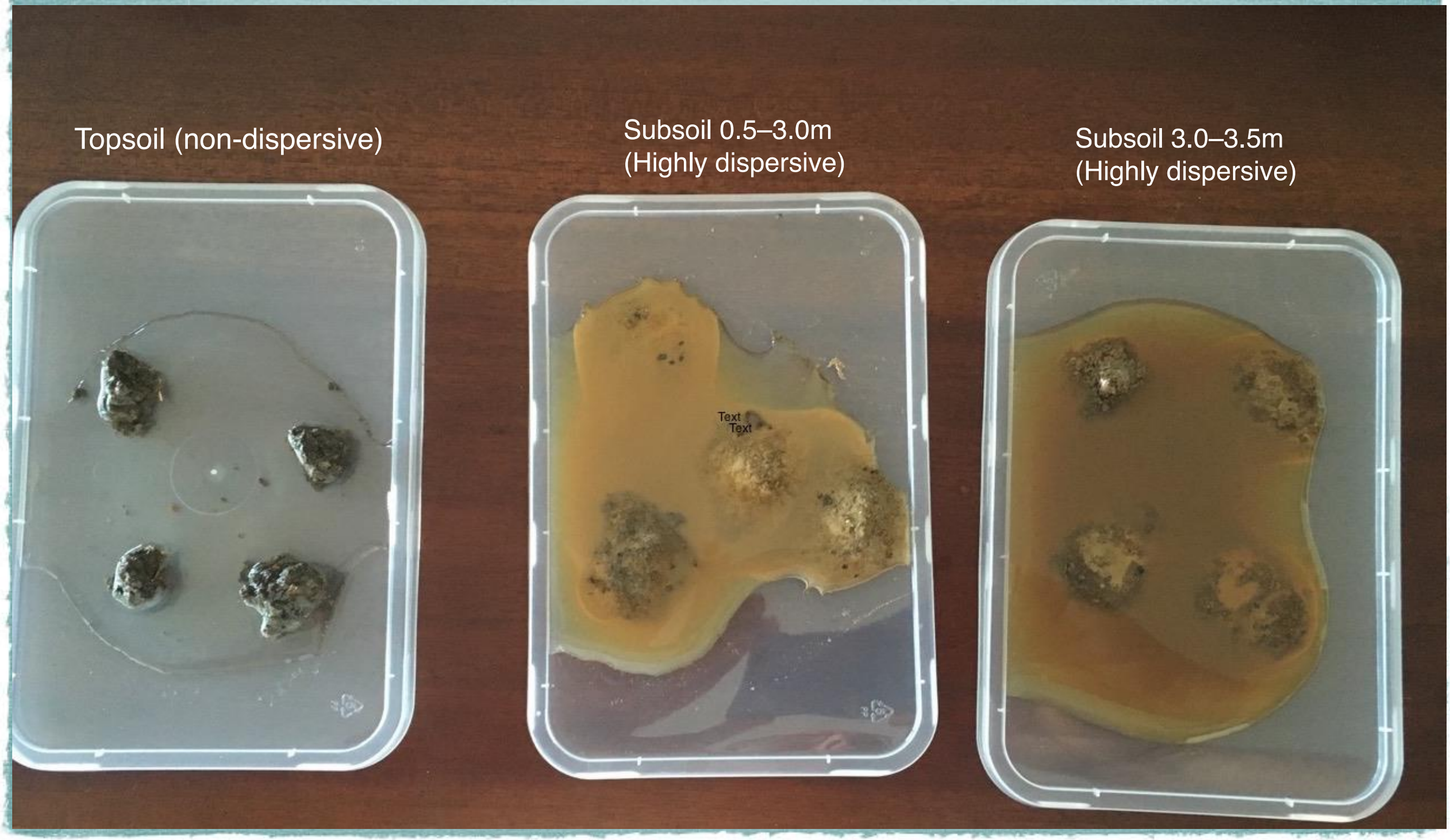
Noise

Recent modelling of highway noise:

All sites measured within 2dB(A) of modelled predictions.

Numbers are absolute, but . . .

Emerson Dispersion Test



Emerson Dispersion Test

Sodic and Magnesic soils (Hard set or Slop)
Saline soils (Stabilise [temporarily?])
High Al (Stabiliser but toxic to plants)

Soil EC and Cations

Analysis	Result
pH [1:5 H2O]	5.1
CEC (meq/100g)	1.82
EC [1:5 H2O] (dS/m)	0.04
Phosphorus [Olsen] (ppm)	3
Potassium[Am. Acet.] (meq/100g)	0.13
Calcium[Am. Acet.] (meq/100g)	0.44
Magnesium[Am. Acet.] (meq/100g)	0.84
Sulphur [MCP] (ppm)	14
Boron[CaCl2] (ppm)	< 0.1
Copper [DTPA] (ppm)	0.2
Iron [DTPA] (ppm)	17
Manganese [DTPA] (ppm)	0.7
Zinc [DTPA] (ppm)	0.7
Sodium[Am. Acet.] (meq/100g)	0.1
Aluminium[KCl] (meq/100g)	0.27
Ca base saturation (%)	24.1
K base saturation (%)	7.2
Mg base saturation (%)	46.3
Na base saturation (%)	7.2
Al base saturation (%)	15.00
Ca:Mg Ratio	0.5
Aluminium (ppm)	25.0
Sodium (ppm)	30.0
Calcium (ppm)	88.0
Magnesium (ppm)	101.0
Potassium (ppm)	51.0

Hydraulic Modelling

One-dimensional models

- Simple, but useful and widely used.
- Calculations are based on (assumed) characteristic properties of the cross-section (eg hydraulic diameter, average velocity).


40

Two-dimensional models

- More useful
- BUT still some significant constraints due to assumptions, and can't do very sophisticated calculations.

Three-dimensional models

- Serious computational power
- Expensive

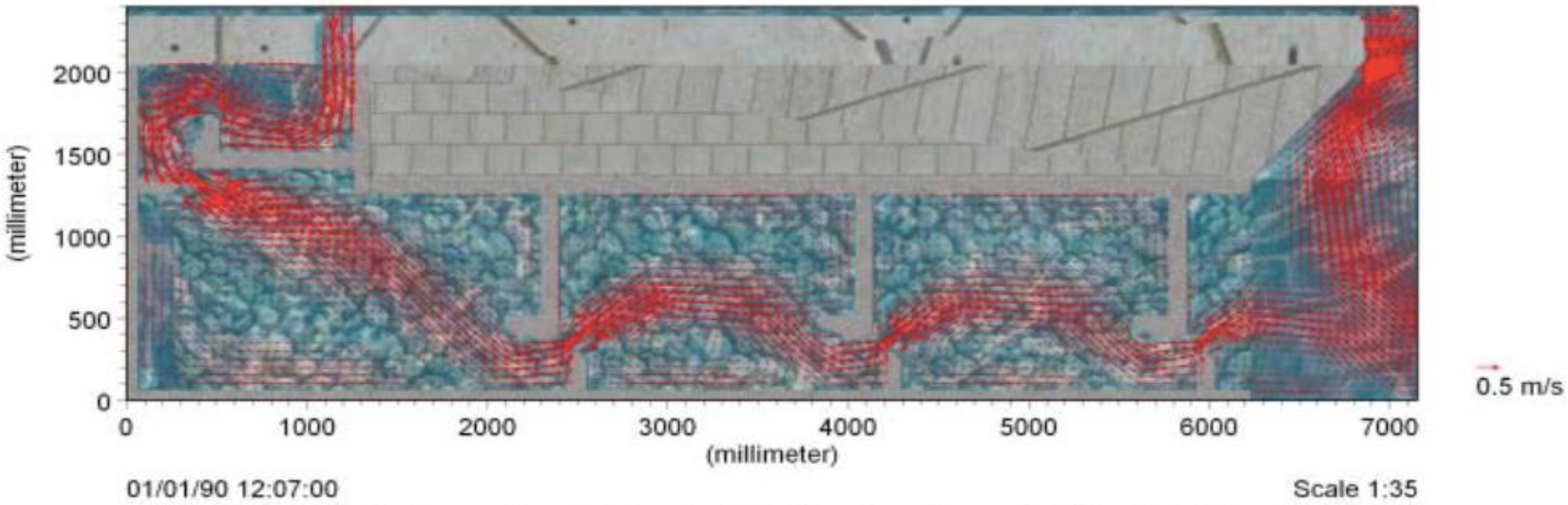


Figure 4 –Resultant Velocity Distribution from 2D Model (Design A)

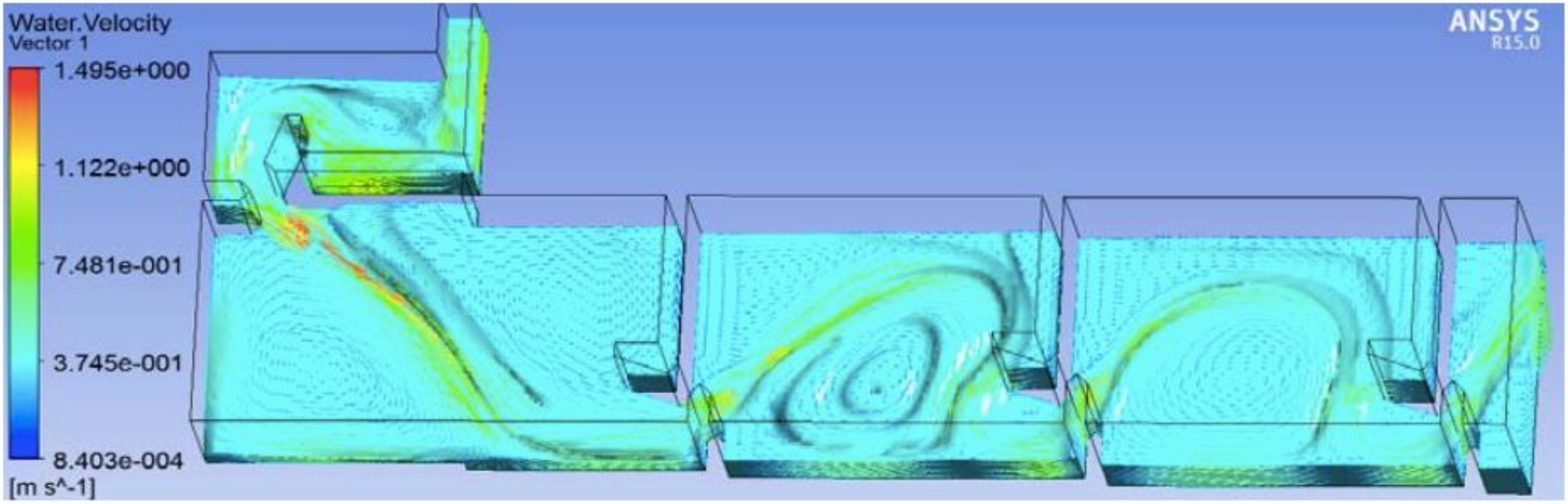


Figure 5 –Resultant Velocity Distribution from 3D Model (Design A)

Wrong Modelling (or . . .)


1
2

Engineering Assessment

- Civil Engineers x 2
- Geotechnical Engineer

- Water velocity

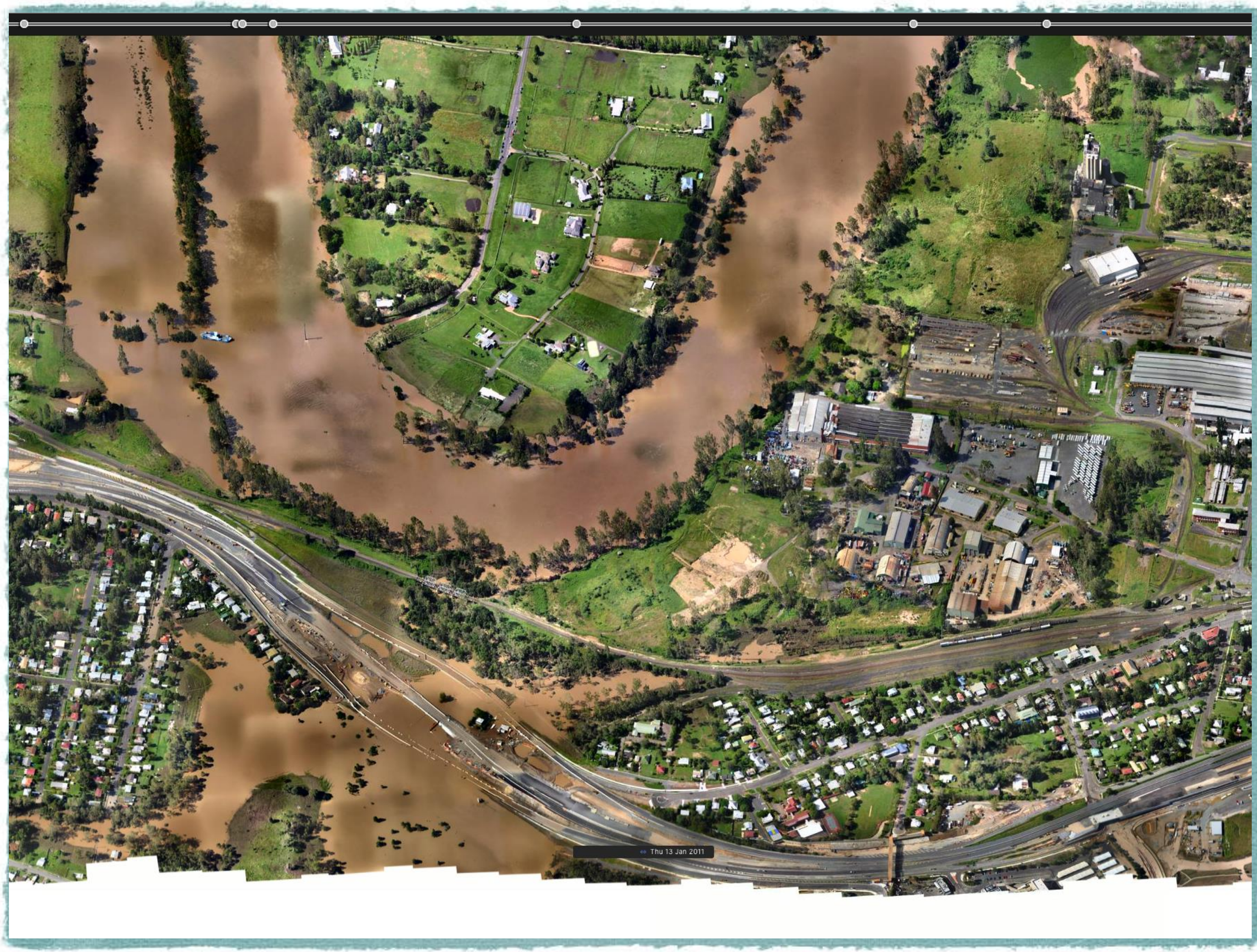
and

- Water velocity

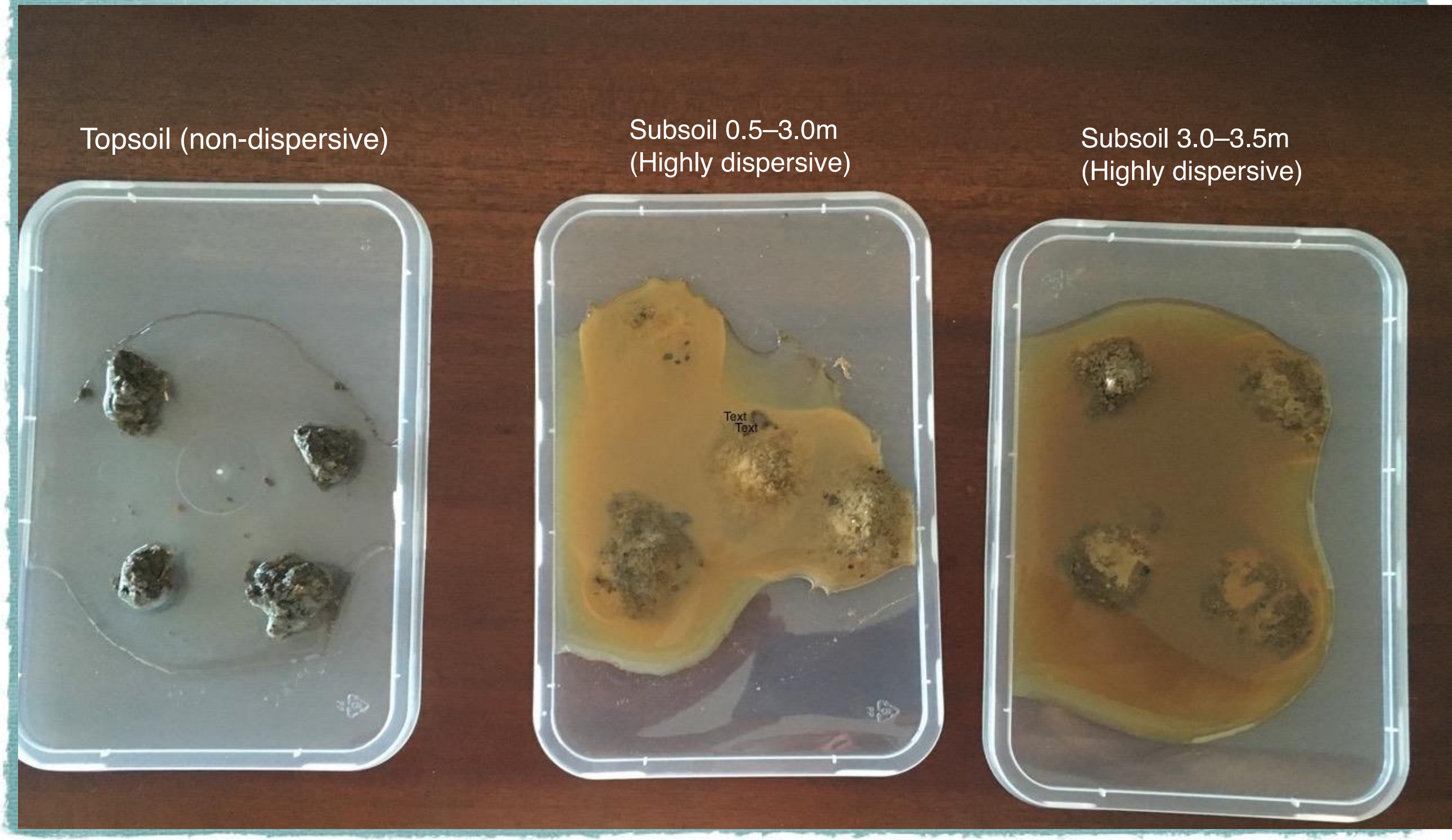
Engineering Conclusions

WRONG


4/16/2007
2A Brisbane Rd
Image © 2015 Sinclair Knight Merz & Fugro
72 m
2003
Google earth
Imagery Date: 4/16/2007 27°36'03.52" S 152°51'34.61" E elev 15 m eye alt 339 m


Thu 13 Jan 2011

Dispersive Soils



Soil Structure

MUSIC

Model for Urban Stormwater Improvement Conceptualisation

Bio-Retention Basins

Caveats

Caution Notes For User

First, **music** is not a detailed design tool. **music** should be viewed as a conceptual design tool.

Second, **music** should be only one of several tools used in Water Sensitive Urban Design. **music** does not incorporate:

- Hydraulic analysis for stormwater drainage,
- Life-cycle cost analysis,
- Indicators of ecosystem health, . . .

The third caution relates to (a) the assumptions inherent in the design of **music**, and (b) the ***need for calibration***. Simulations developed without calibration should be reported with appropriate caveats.

Bioretention Technical Design Guidelines Review Panel re Revised Standard

Regulator
WSUD Modellers
Soil Scientist
Soil and Water Chemist
Permaculturalist
ESC and rehabilitation specialist
Landscape architect
Filter media supplier
Manager: Bioretention maintenance and operations

Bioretention Technical Design Guidelines Review Panel re Revised Standard

How much compost is required for plants?

The model can’t be wrong
The sand must be poor quality

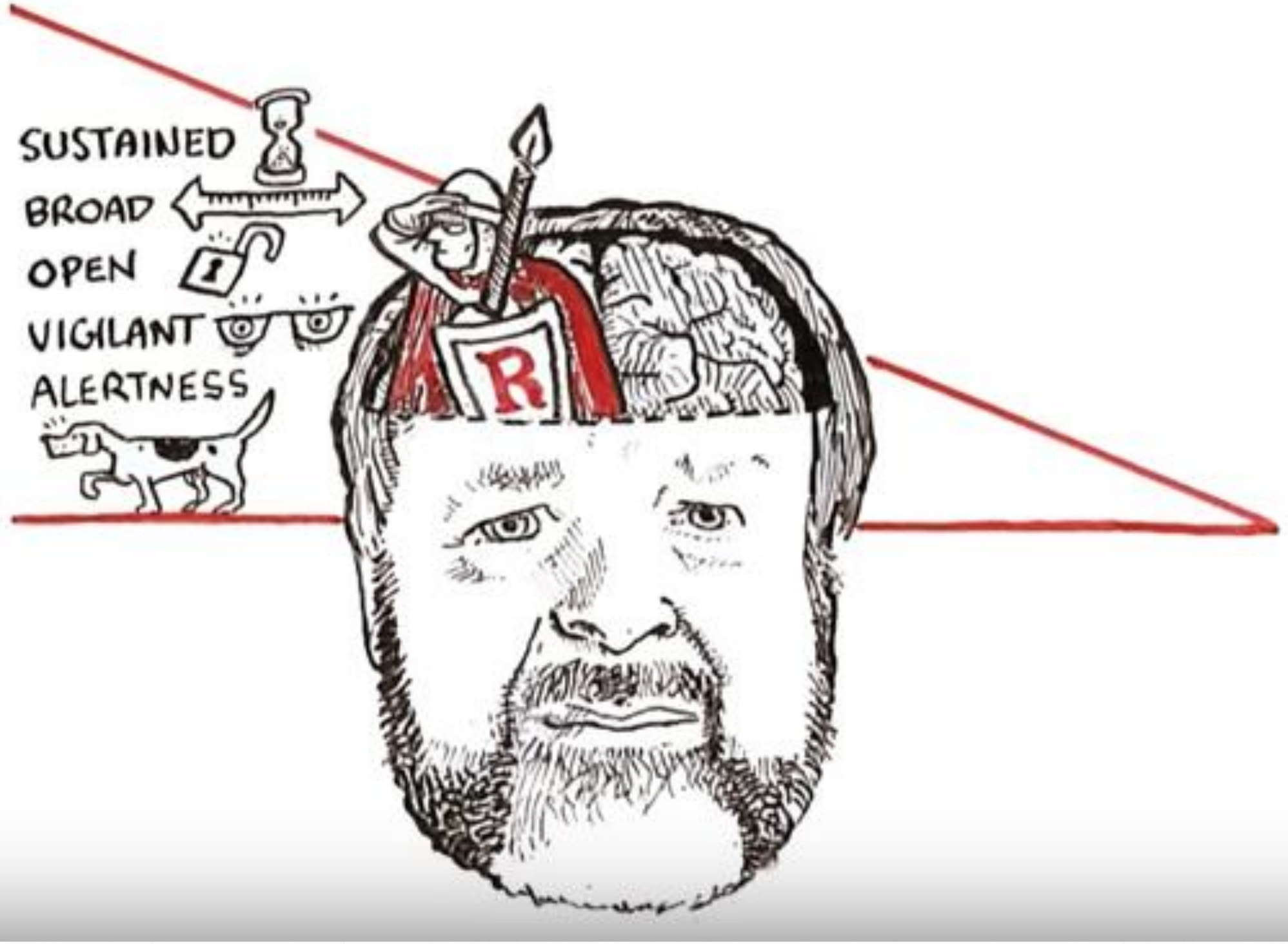
How do you grow plants without water?

The Divided Brain

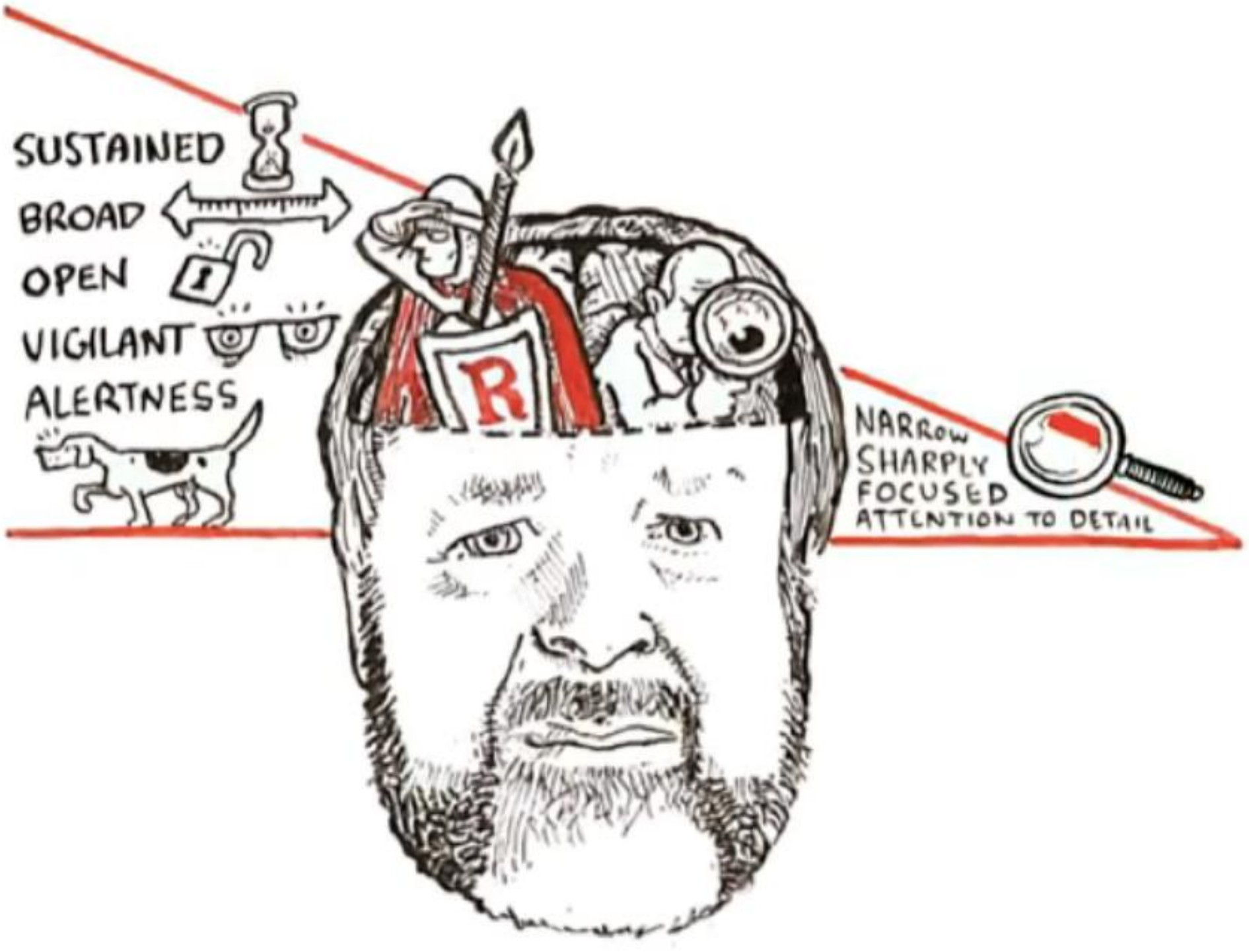
The Master And His Emissary - The Divided Brain And The Making Of The Western World

Iain McGilchrist

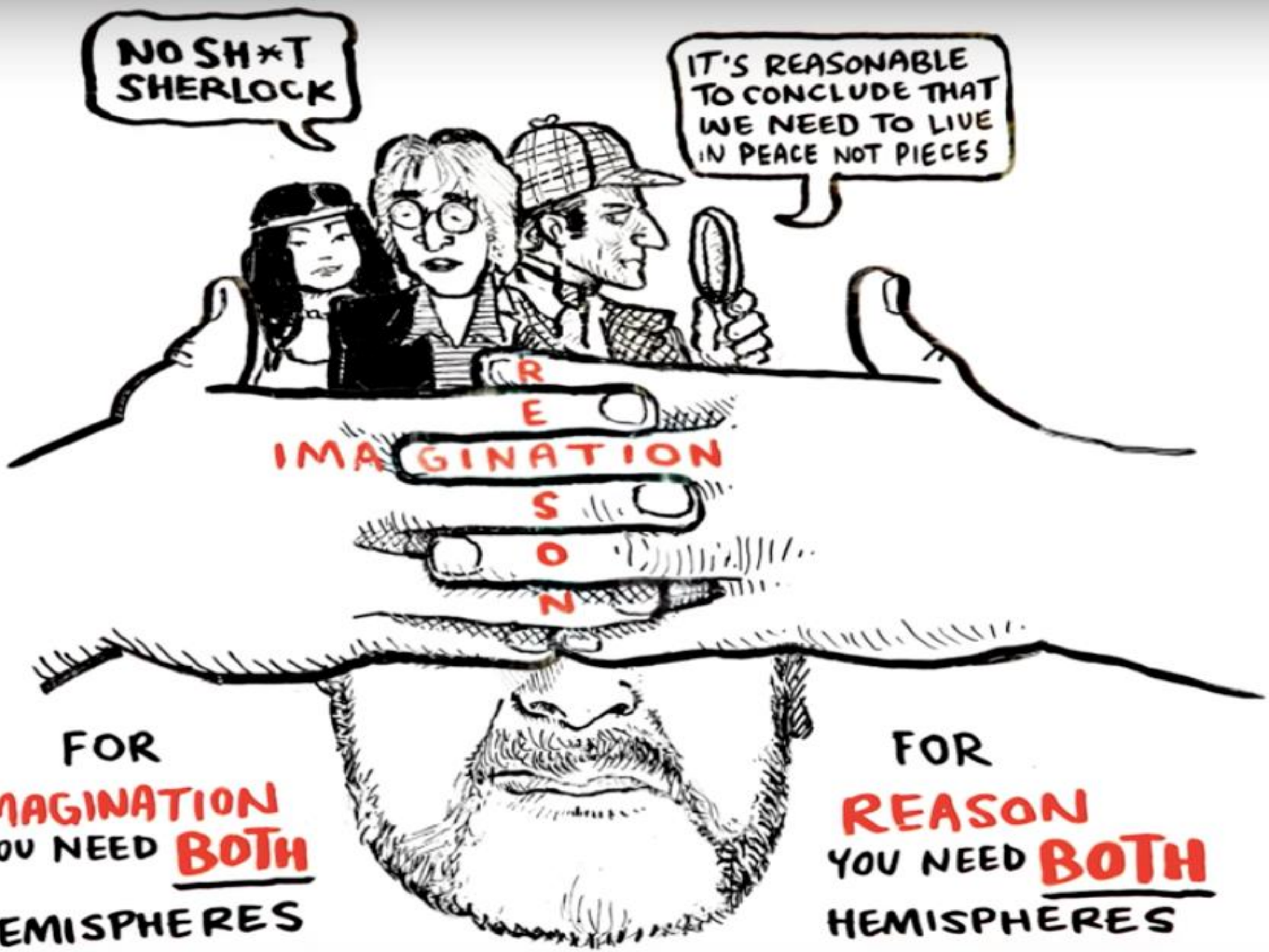
The Divided Brain

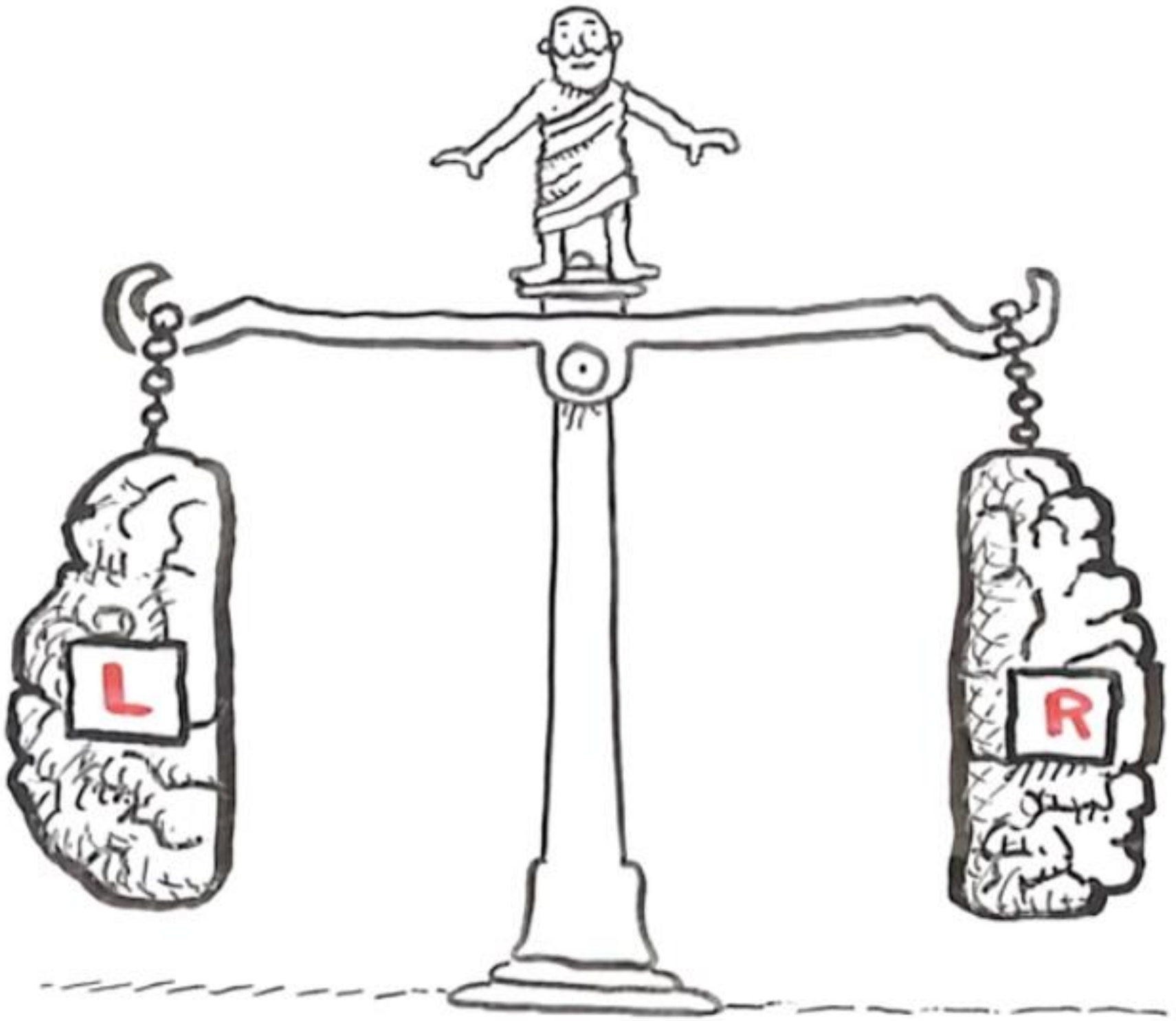


The Divided Brain

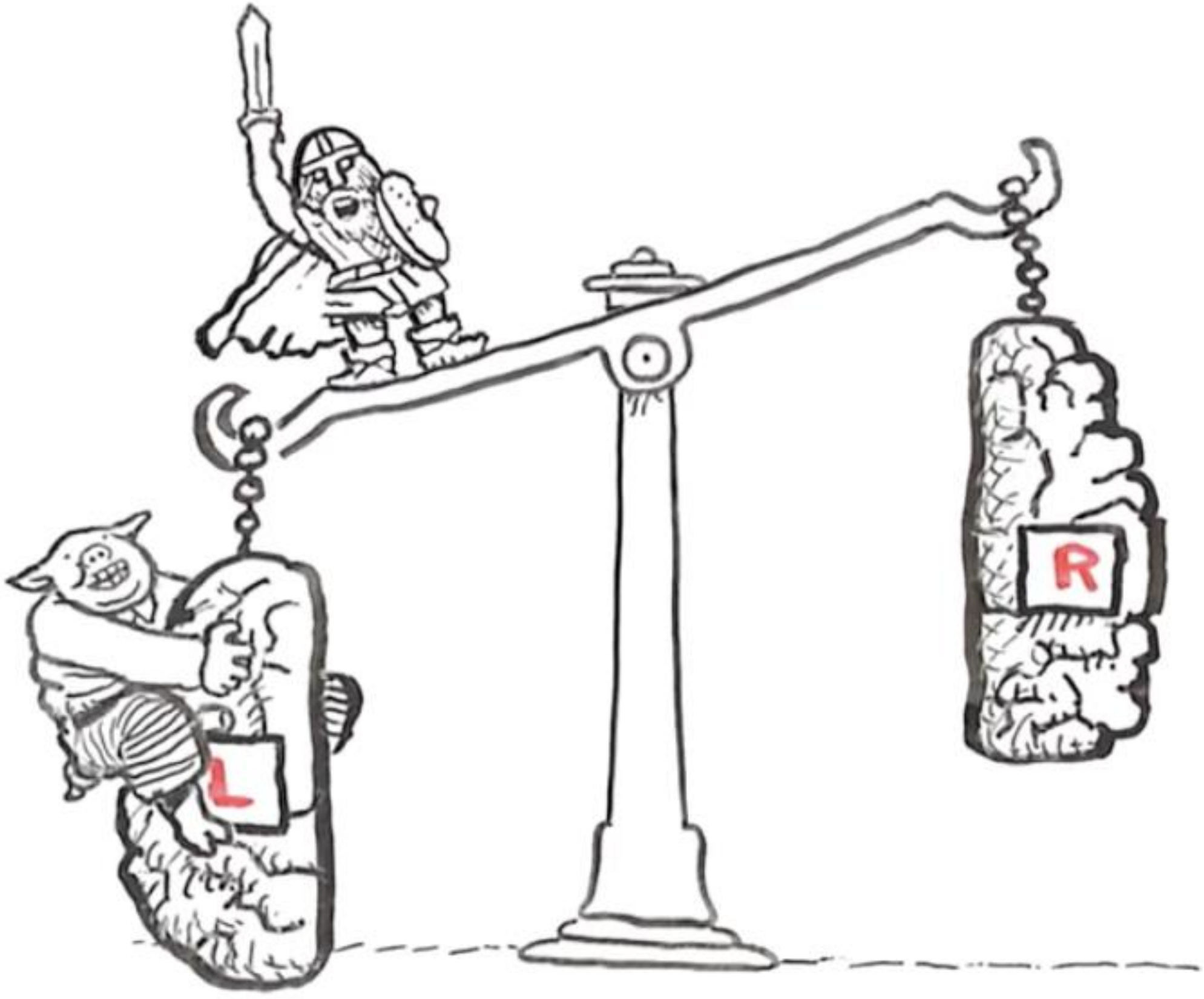


The Divided Brain


NO SH*T SHERLOCK
IT'S REASONABLE TO CONCLUDE THAT WE NEED TO LIVE IN PEACE NOT PIECES
R
E
IMAGINATION
S
O
N
FOR IMAGINATION YOU NEED BOTH HEMISPHERES
FOR REASON YOU NEED BOTH HEMISPHERES



6th CENTURY B.C. AUGUSTAN ERA



15th/16th CENTURY IN EUROPE

VIVA LA FRAGMENTATION!

THIS ENGRAVING EMBODIES PERFECTLY THE MOST IMPORTANT ASPECTS OF THE LEFT HEMISPHERE TRIUMPH IT DEPICTS

RIGHT HAND

HEAD REDUCED TO A THING

REJECT THE PHYSICAL & RETREAT INTO AN ABSTRACTED CEREBRALISED WORLD

SO THIS MODEL IS ENTIRELY SELF CONSISTENT BECAUSE IT'S MADE ITSELF SO

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IT'S VERY VOCAL ON ITS OWN BEHALF

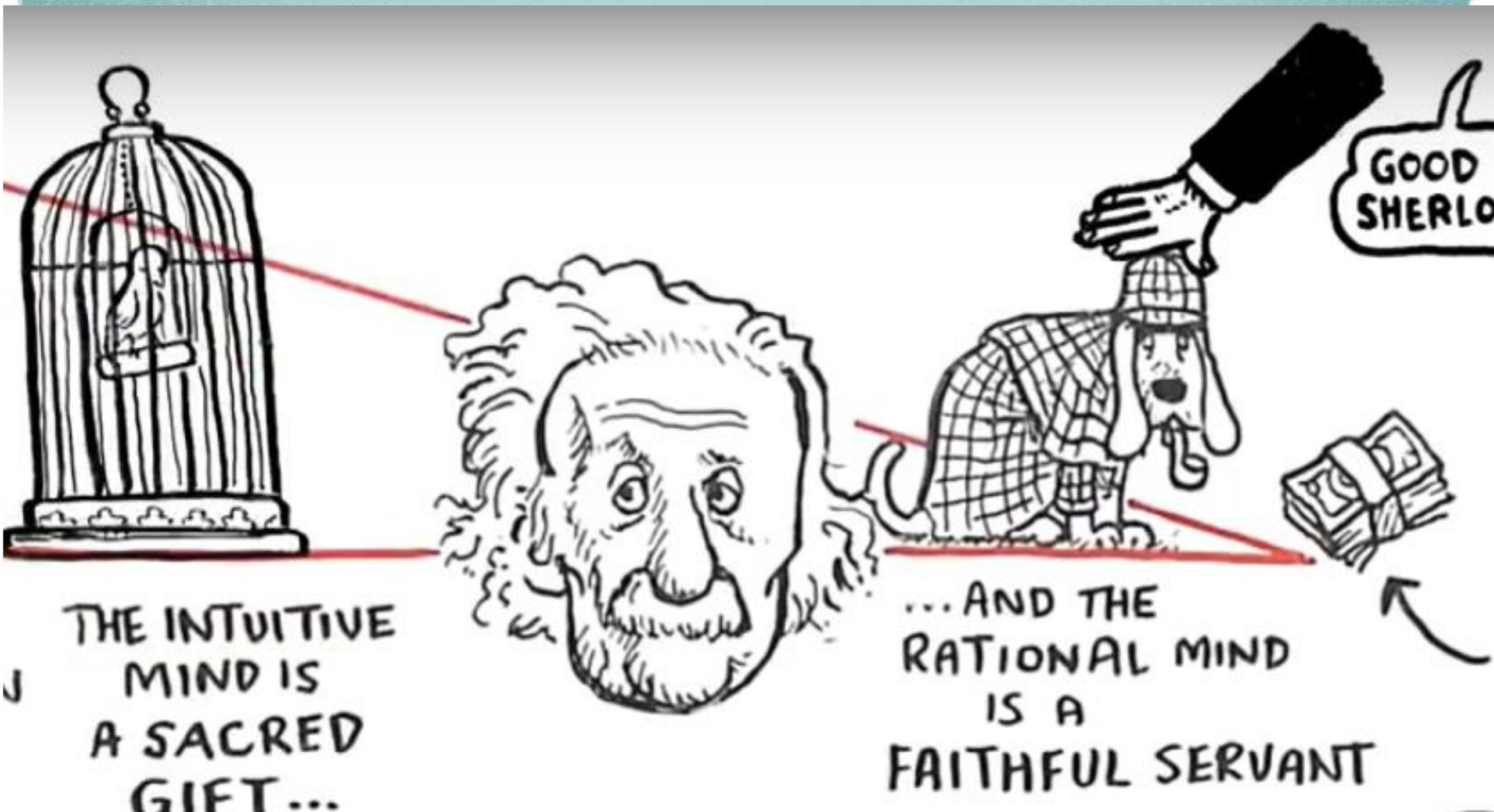
SHOVE

I AM THE JESUS CHRIST OF POLITICS. I AM A PATIENT VICTIM. I PUT UP WITH EVERYONE. I SACRIFICE MYSELF FOR EVERYONE

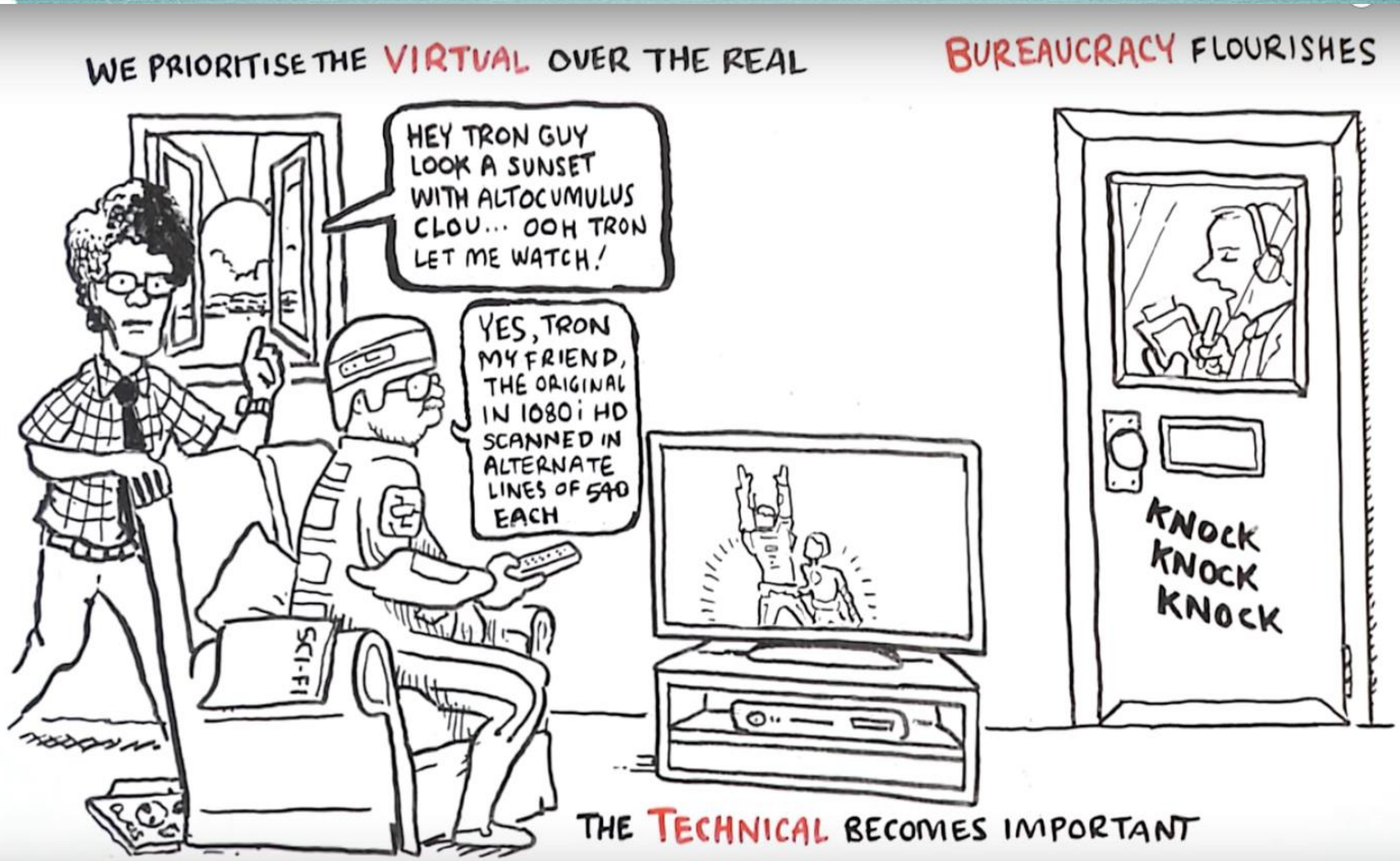
THE RIGHT HEMISPHERE DOESN'T HAVE A VOICE AND IT CAN'T CONSTRUCT THE SAME ARGUMENTS

The Divided Brain

The Divided Brain



The Divided Brain



Joseph Campbell

- Judaism
- Christianity
- Islam

Shift from:

- Feminine to the Masculine
- Being to Doing
- Group vs the Individual
- Thinking rather than Feeling
- Logic vs Intuition
- Nurture vs Aggression

Google

Google gives AN answer, not necessarily THE answer.

Gen Y

Yes, I know.

Crochet proves Euclidean Geometry

References

Google:
Numerical Limitations of Hydraulic Models

YouTube:
The Divided Brain – Iain McGilchrist

TED Talks:
- How Trees Talk to One Another
- The roots of plant intelligence
- The beautiful math of coral