Budapest, 17 October 2025

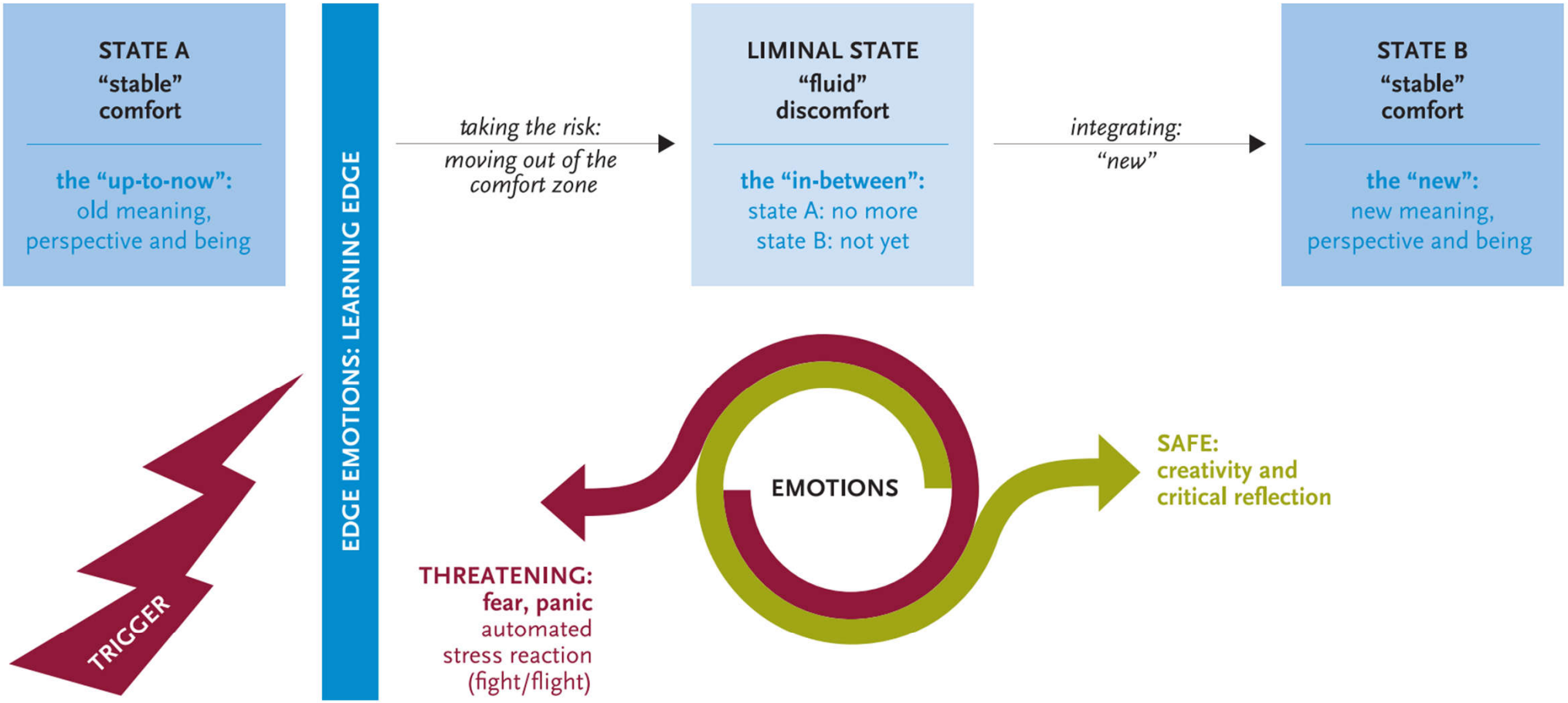
BEYOND TECHNOCENTRISM

Fostering Inner Transformation in Engineering Education for Sustainability

Dr Giulia Sonetti
Marie-Curie Post Doc Fellow at ISGlobal - Institute of Global Health, ISGlobal Barcelona, Spain
Professor at the Research Institute for Sustainability Science and Technology
Universitat Politècnica de Catalunya, Barcelona, Spain
Co-funder @Pulmons de Barri

giulia.sonetti@isglobal.org

FIGURE 1: A model of transformative learning including liminality and emotions.

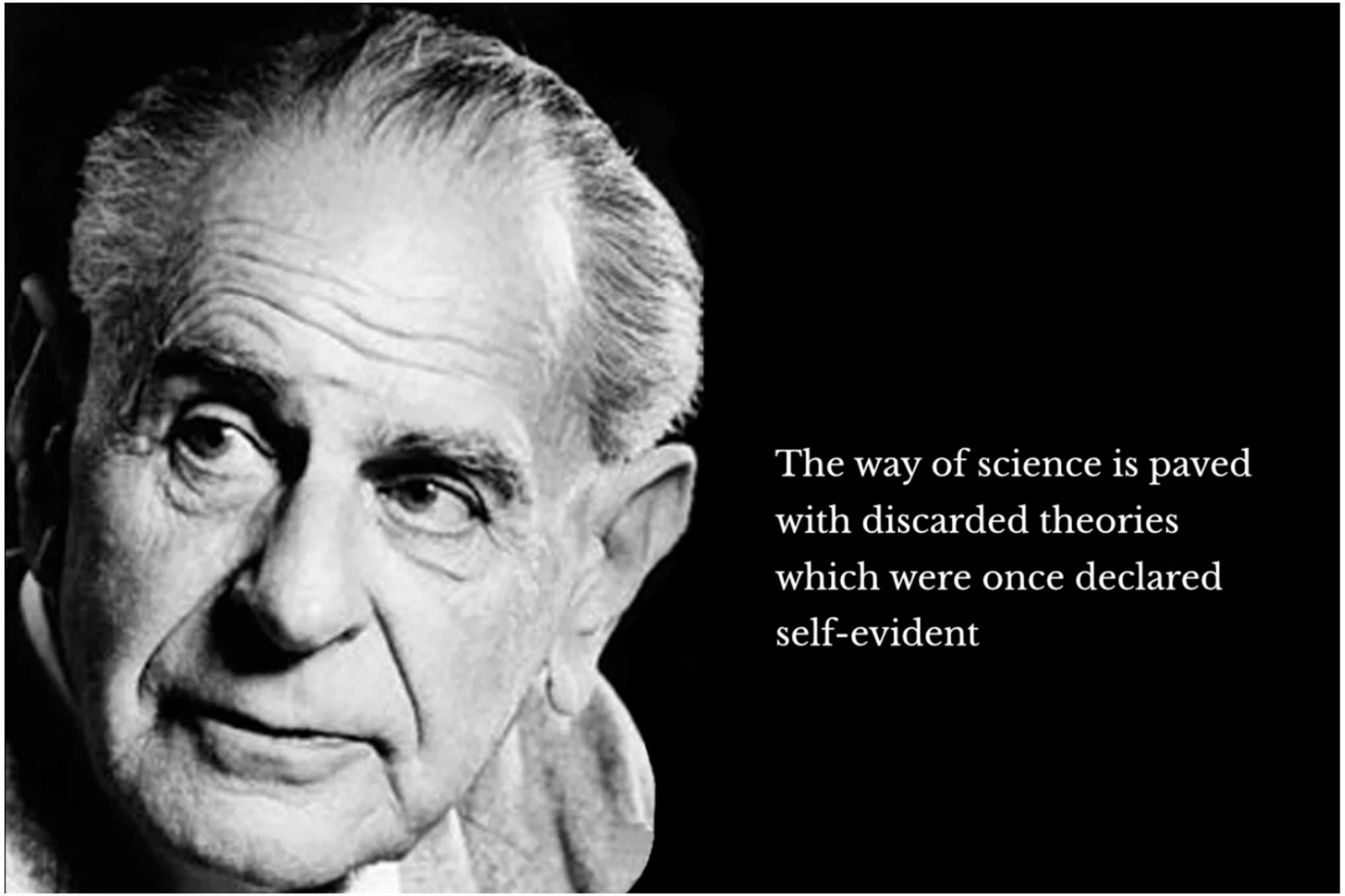


"No, this is the elephant."


GOOD
SCIENCE ISN'T
ENOUGH

“I used to think that top environmental problems were biodiversity loss, ecosystem collapse and climate change. I thought that thirty years of good science could address these problems. I was wrong. The top environmental problems are selfishness, greed and apathy, and to deal with these we need a cultural and spiritual transformation. And we scientists don’t know how to do that.”

— James Gustave Speth

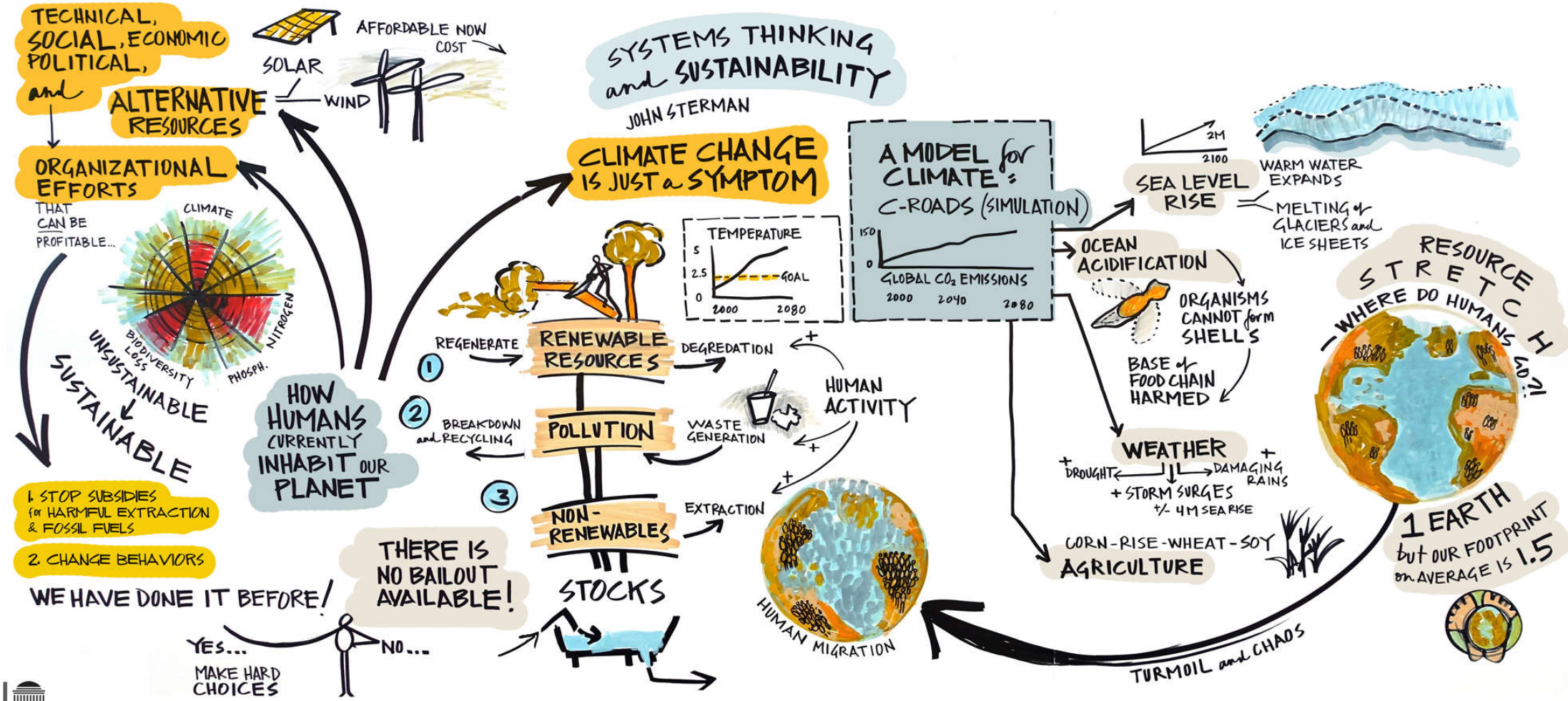

The way of science is paved
with discarded theories
which were once declared
self-evident

SUSTAINABILITY SCIENCE

Table 1 Four dimensions of how humans understand and experience reality (c.f. Esbjörn-Hargens 2010), and their actual or potential contribution to sustainability science

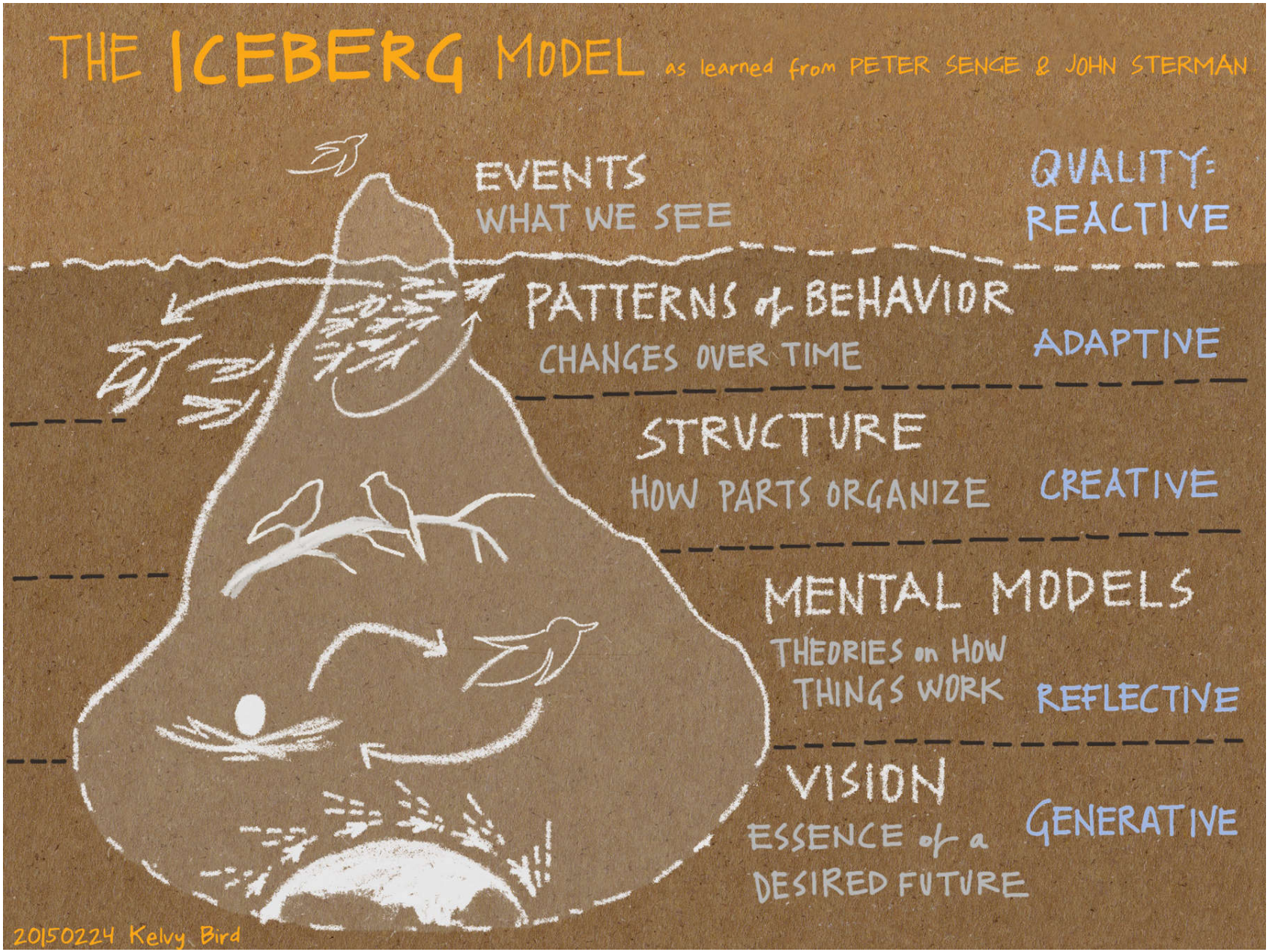
Realm of enquiry	Mode of enquiry	Focus of enquiry	Insights for sustainability practice	Examples of sustainability questions
It	Empirical, positivist, reductionist	Biophysical	Composition of the exterior world (descriptive)	How much carbon is captured in permafrost?
They	Systems thinking, e.g. stocks, flows and feedbacks	Natural, social, or social-ecological systems, e.g. institutions and ecosystems	Dynamics of the exterior world, including change dynamics	What is the effect of climate change on permafrost, and which feedbacks result from permafrost melting?
We	Recognition of plurality, both qualitative and quantitative	Cultures	Recognising plurality in values to effect social and cultural change; increasing public participation	What are the implications of a post-truth culture in trying to address climate change?
I	Personal reflection and introspection	Personal experience and beliefs	Beliefs about what constitutes a 'good life'; deep assumptions about what matters; mental wellbeing; psychological maturity; spiritual outlook	What is the inner basis for taking action to influence the exterior world? How can individuals tap into inner sources—e.g. spiritual, emotional, value-related—to resource and sustain creative (scientific and other) endeavour in the face of climate change in a post-truth culture?

Source: Inside-out sustainability: The neglect of inner worlds. Christopher D. Ives, Rebecca Freeth & Joern Fischer
Ambio volume 49, pages 208–217 **(2020)**



MITSloan Executive Education

dpict 13-21 October 2014 | Cambridge, MA USA
Images by Kelvy Bird | www.dpict.info


THE ICEBERG MODEL as learned from PETER SENGE & JOHN STERMAN
EVENTS
WHAT WE SEE
QUALITY:
REACTIVE
PATTERNS of BEHAVIOR
CHANGES OVER TIME
ADAPTIVE
STRUCTURE
HOW PARTS ORGANIZE
CREATIVE
MENTAL MODELS
THEORIES on HOW
THINGS WORK
REFLECTIVE
VISION
ESSENCE of a
DESIRED FUTURE
GENERATIVE
20150224 Kelvy Bird

nature climate change

Comment | Published: 03 October 2024

Scientists have emotional responses to climate change too

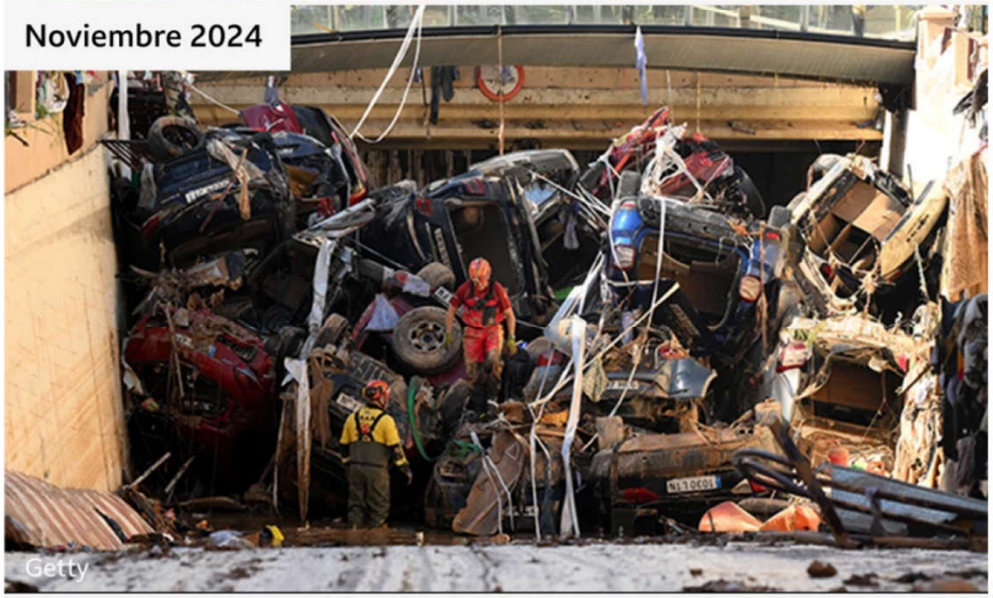
E. L. F. Schipper, S. S. Maharaj & G. T. Pecl

Nature Climate Change **14**, 1010–1012 (2024) | Cite this article

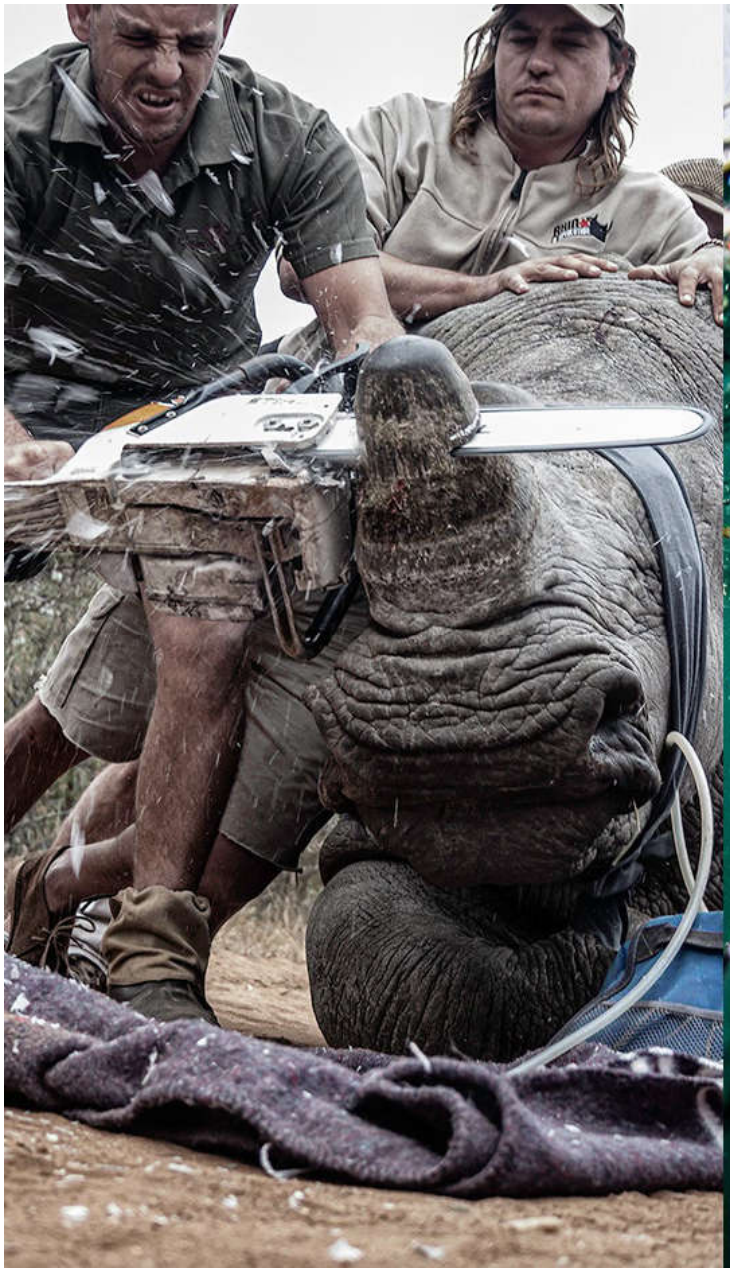
The dominant paradigm holding that science is always objective needs to be challenged. When scientists' opinions about climate change and their own fears are seen as irrelevant, it suggests that science is separate from society; however, this perspective ultimately weakens climate science.

BBC

15/10/2025, 20:22 DANA en Valencia: las imágenes del antes y después que muestran la magnitud de la devastación en España - BBC News Mundo



BBC



(Mustafa Hassona/Anadolu via Getty Images)

Swedish climate activist Greta Thunberg attends the Fridays for Future protest outside the Parliament in Stockholm on December 15, 2023
(photo credit: REUTERS/ILZE FILKS)

The planet has entered a ‘new reality’ as it hits its first climate tipping point, landmark report finds

OCT 13, 2025

By Laura Paddison

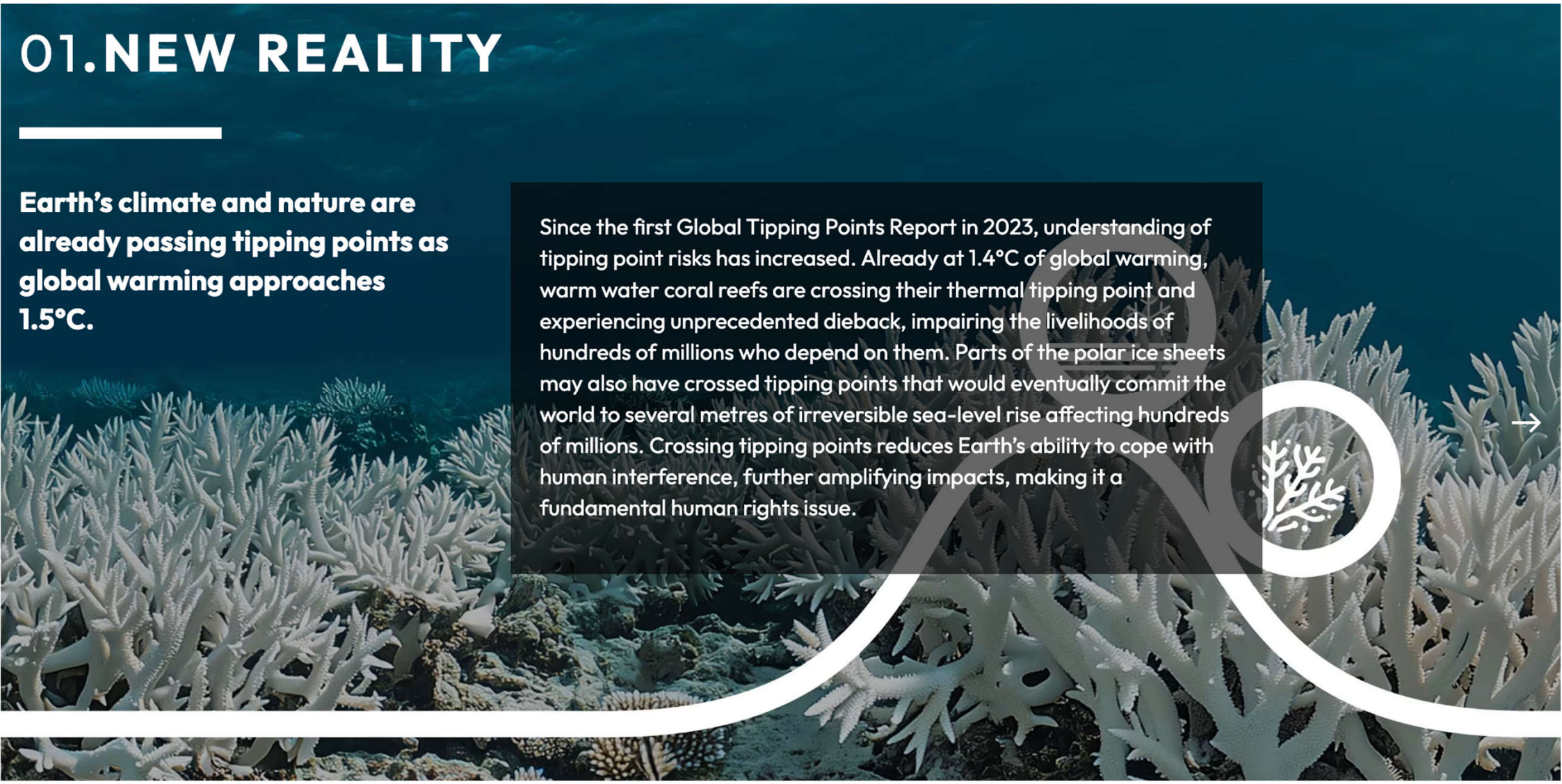
There’s even worse to come if temperatures continue to rise. The planet is on the brink of several more tipping points as it’s **all but certain to breach** the globally agreed goal of limiting warming to 1.5 degrees Celsius above pre-industrial levels, according to the report.

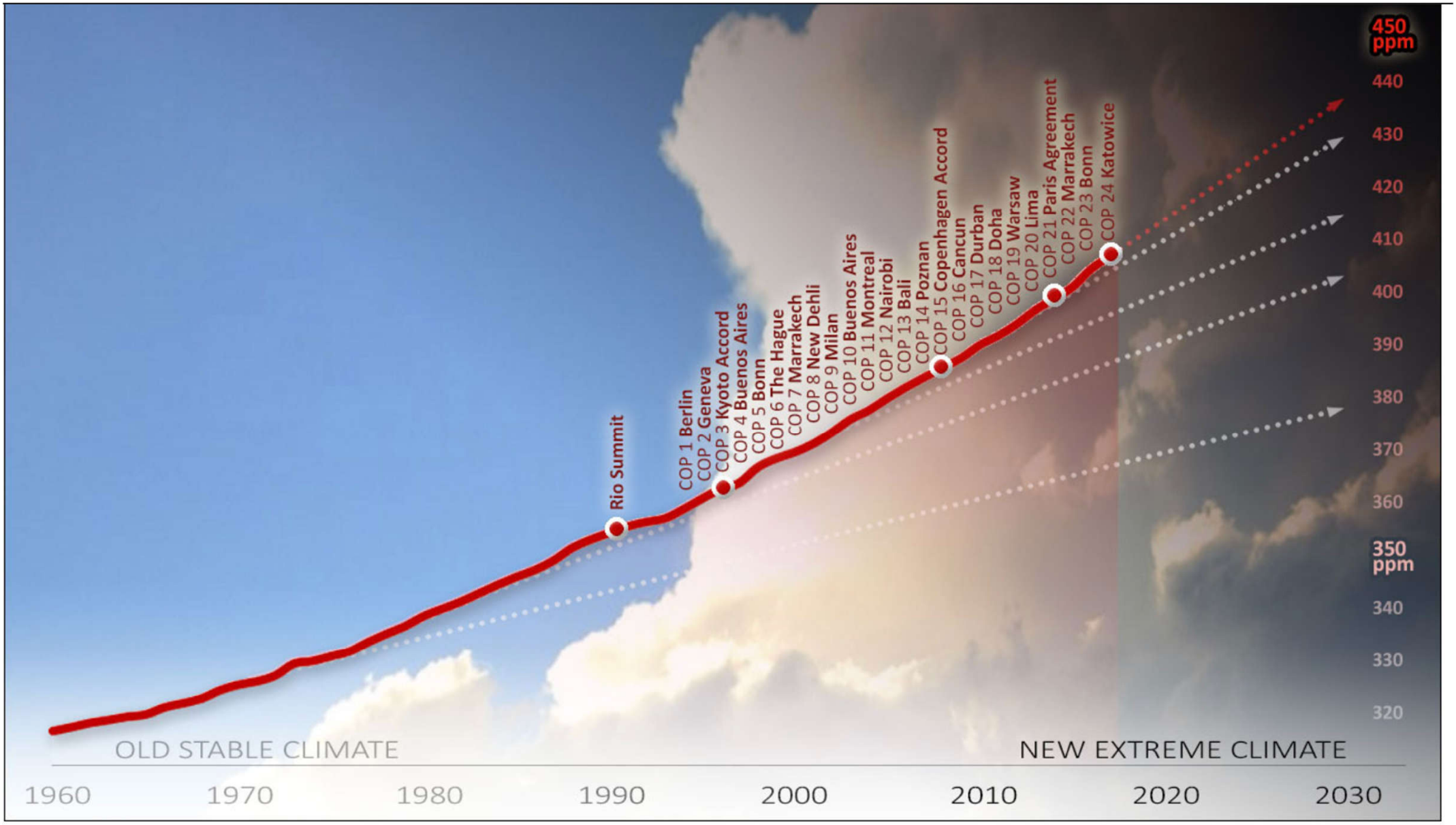
One of the most alarming of these is the potential **collapse of the Atlantic Meridional Overturning Circulation**, a crucial network of ocean currents known as the AMOC. This would have catastrophic global consequences, pushing parts of the world into a deep freeze, heating up others, disrupting monsoon seasons and raising sea levels.

01.NEW REALITY

Earth's climate and nature are already passing tipping points as global warming approaches 1.5°C.

Since the first Global Tipping Points Report in 2023, understanding of tipping point risks has increased. Already at 1.4°C of global warming, warm water coral reefs are crossing their thermal tipping point and experiencing unprecedented dieback, impairing the livelihoods of hundreds of millions who depend on them. Parts of the polar ice sheets may also have crossed tipping points that would eventually commit the world to several metres of irreversible sea-level rise affecting hundreds of millions. Crossing tipping points reduces Earth's ability to cope with human interference, further amplifying impacts, making it a fundamental human rights issue.

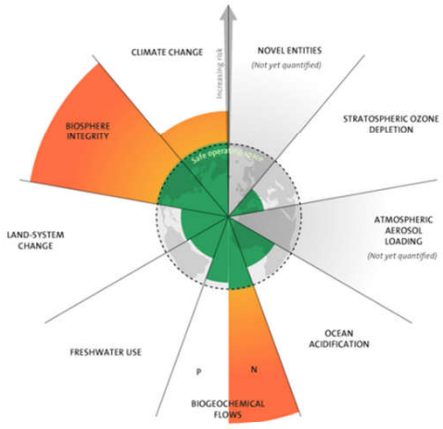




Despite decades of global climate conferences, CO2 levels are rocketing upwards at record pace. Chart by Barry Saxifrage

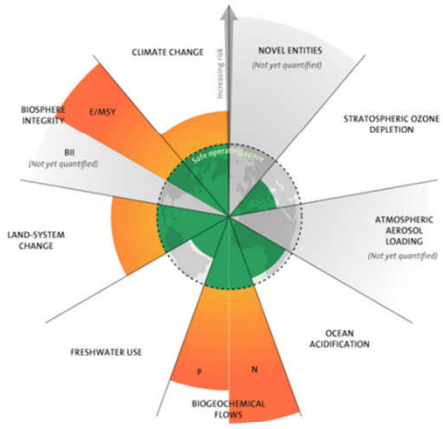
Planetary boundaries

2009



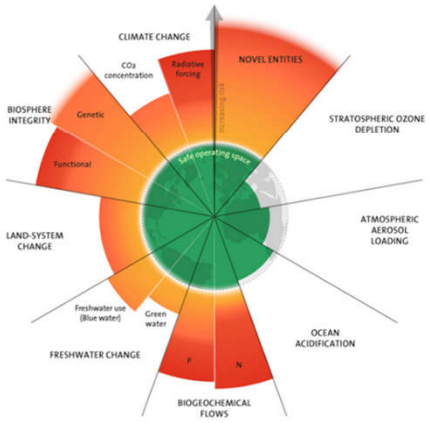
7 boundaries assessed,
3 crossed

2015



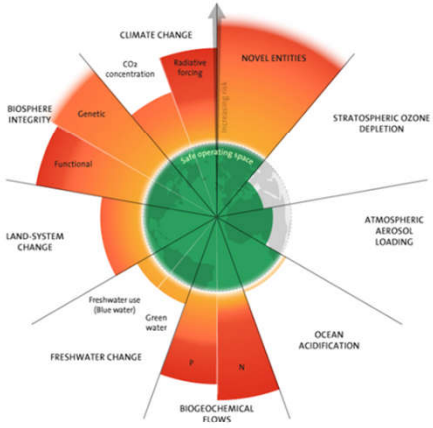
7 boundaries assessed,
4 crossed

2023



9 boundaries assessed,
6 crossed

2025



9 boundaries assessed,
7 crossed

The evolution of the planetary boundaries framework. (Credit: Azote for Stockholm Resilience Centre, Stockholm University. Based on Sakschewski and Caesar et al. 2025, Richardson et al. 2023, Steffen et al. 2015, and Rockström et al. 2009).

EMBODIED MAPPING

PURPOSE

Becoming aware of one's own and others' disciplinary biases and assumptions by physically positioning along an axis that represents a spectrum

DESCRIPTION

Scholars are trained in one or many scientific paradigms. These paradigms come with their own biases and assumptions on about what constitutes knowledge and how to get to knowledge

PHASE

Starting well

COMPETENCE

Disciplinary Grounding

TIME

30 – 45 minutes


JOY
INSIDE OUT 2
JUNE 14
ANGER
INSIDE OUT 2
JUNE 14
SADNESS
YAY!
INSIDE OUT 2
JUNE 14


ENNUI*
*IT MEANS THE BOREDOM
INSIDE OUT 2
JUNE 14
DISGUST
INSIDE OUT 2
JUNE 14
FEAR
INSIDE OUT 2
JUNE 14


ANXIETY
INSIDE OUT 2
JUNE 14
ENVY
INSIDE OUT 2
JUNE 14
EMBARRASSMENT
INSIDE OUT 2
JUNE 14

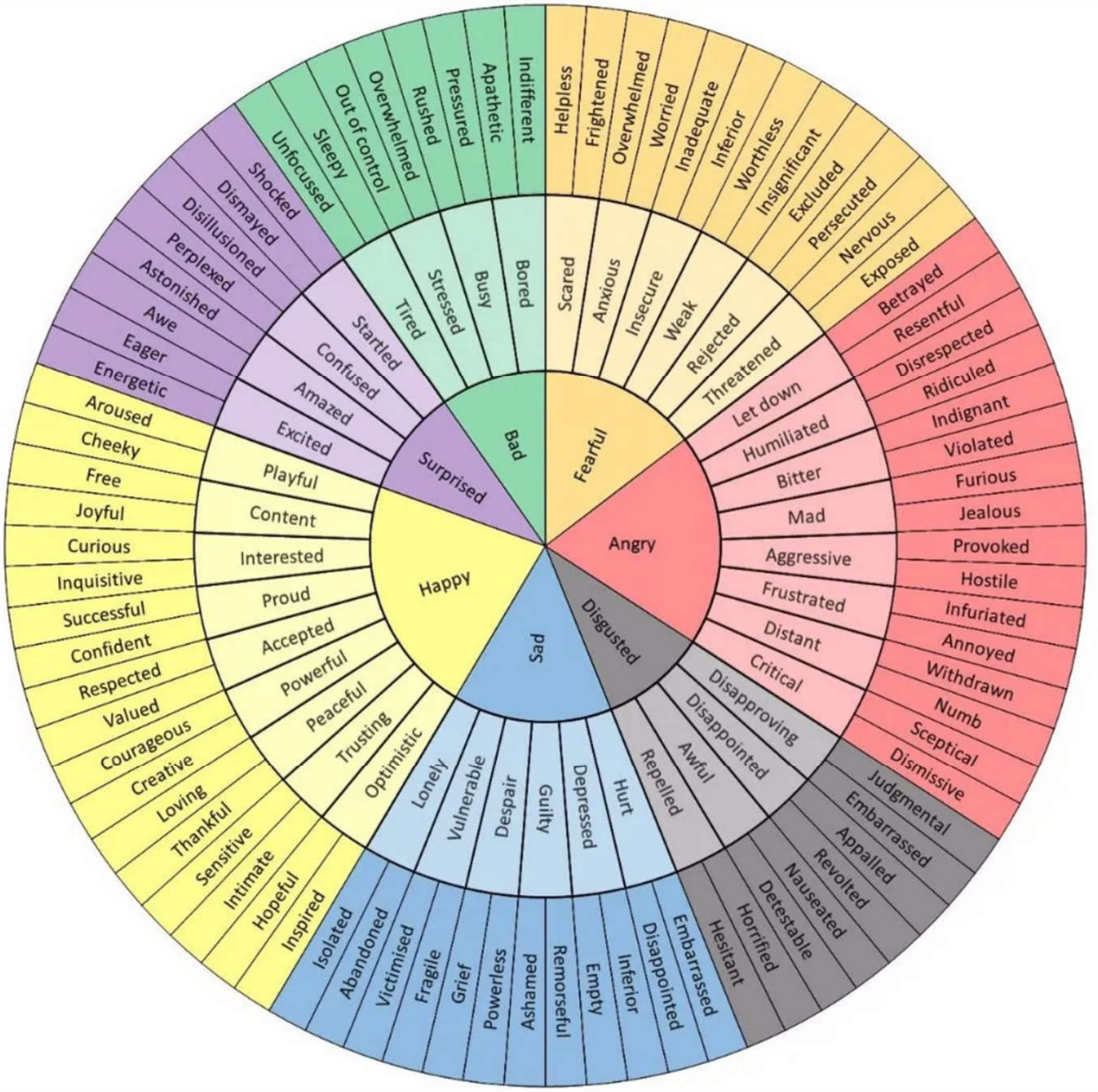


Image by @trainingsbyromy on Instagram

DEAR DARKENING GROUND

NEWS FEATURE | 10 April 2024

The rise of eco-anxiety: scientists wake up to the mental-health toll of climate change

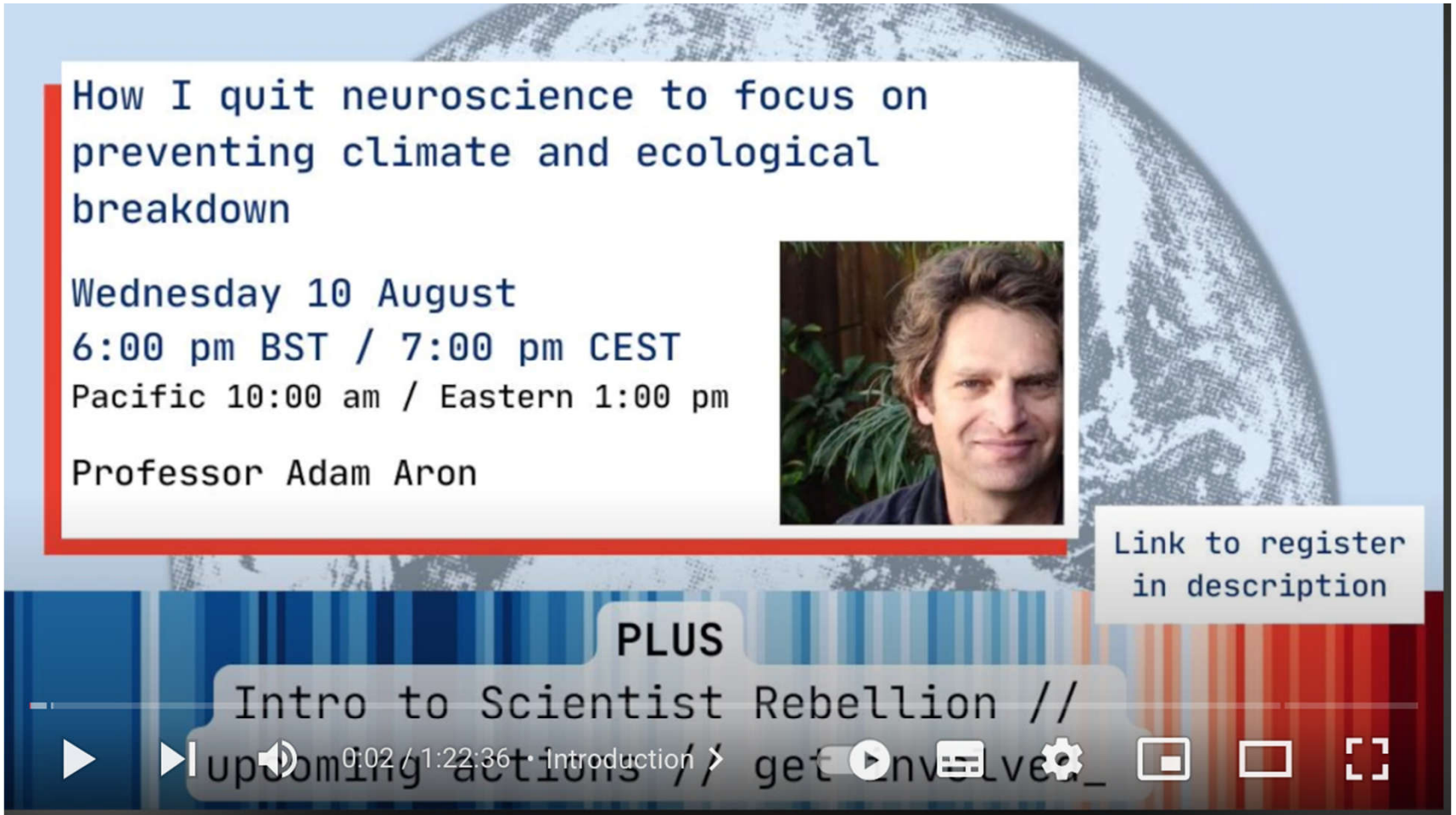
Researchers want to unpick how climate change affects mental health around the world — from lives that are disrupted by catastrophic weather to people who are anxious about the future.

By Helen Pearson

Viewpoint

‘Collective trauma requires a collective response’

The climate emergency is an opportunity to reimagine habitual ways of doing things, says **Steffi Bednarek**



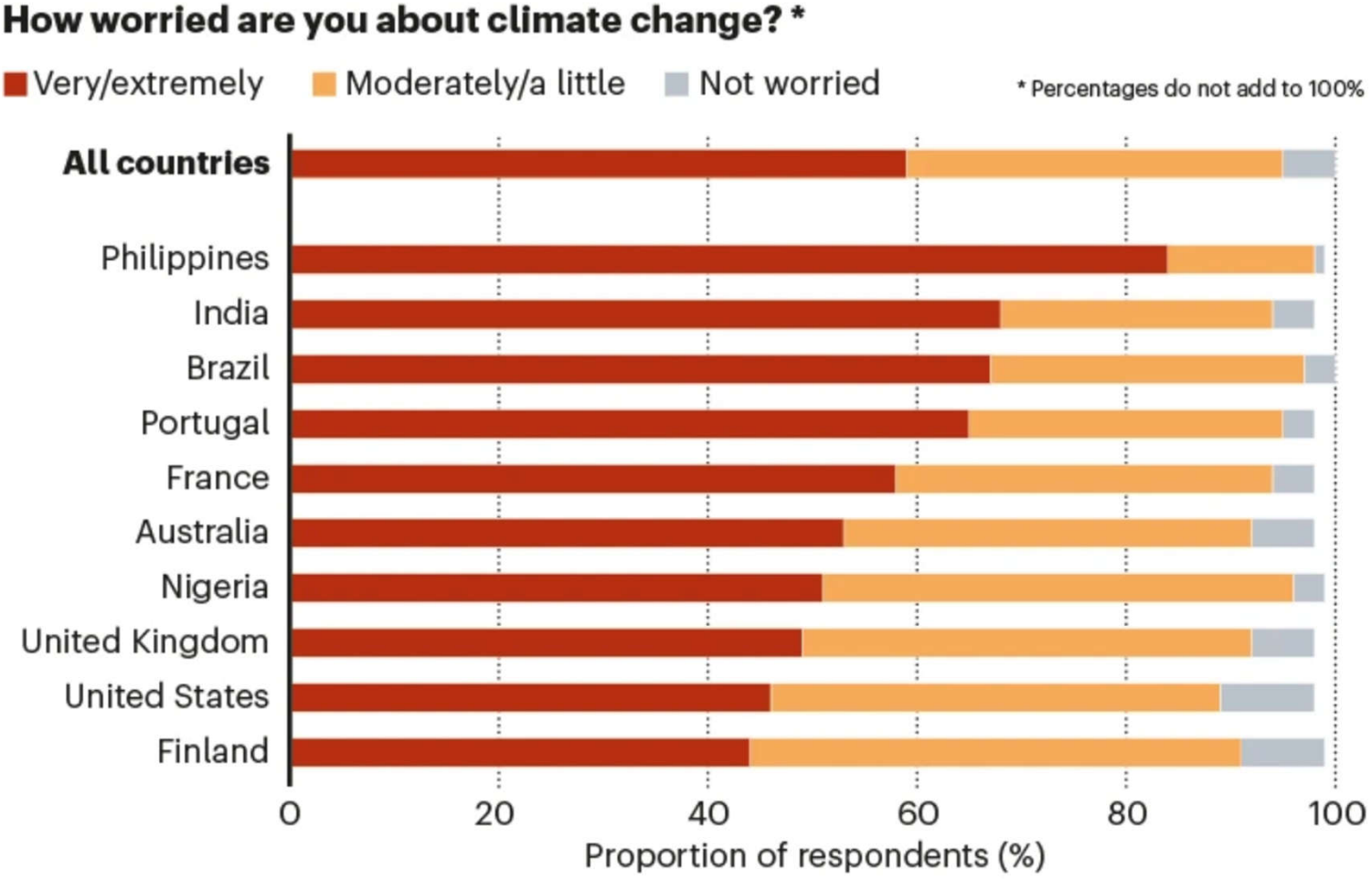
SR Talks | How I quit neuroscience to focus on preventing climate breakdown – Prof. Adam Aron

Scientist Rebellion
4500 iscritti

Iscritto | 25 | Condividi

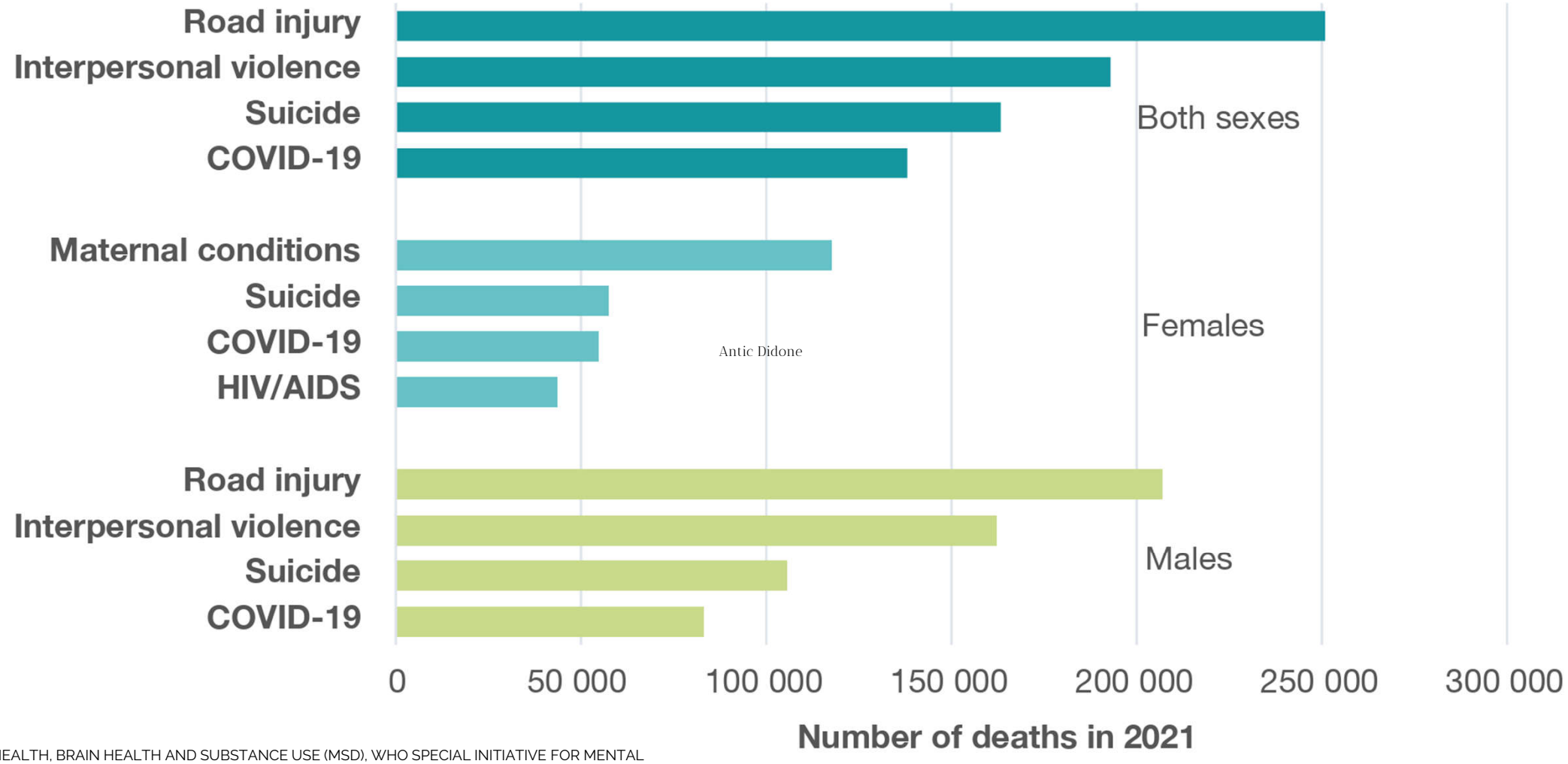
CLIMATE ANXIETY AROUND THE WORLD

Young people everywhere are worried about climate change, according to a 2021 global survey of 10,000 people aged 16–25 years old. Those in low-income countries and regions that are affected by climate change reported greater levels of concern and distress.



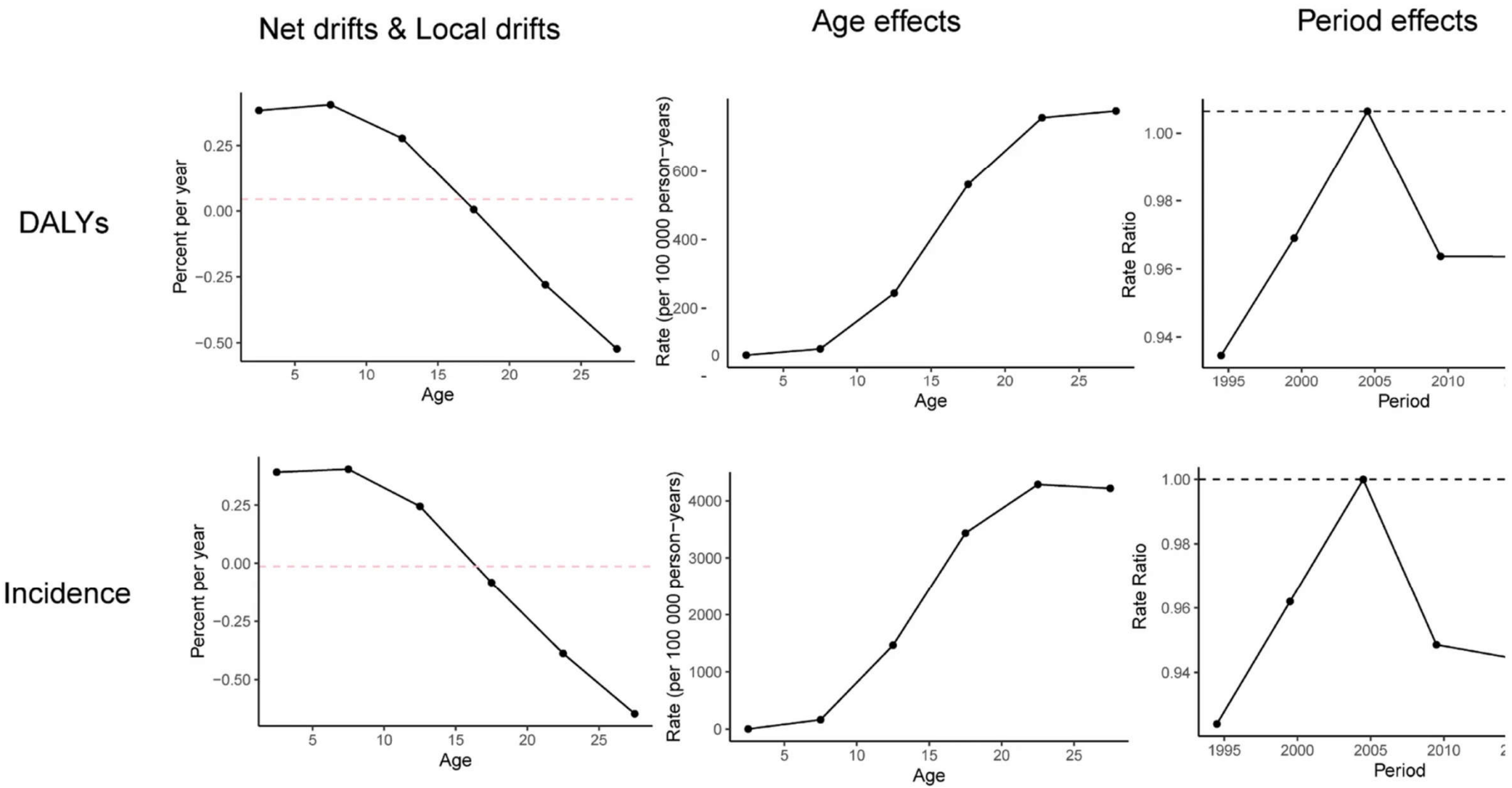
Hickman, C., Marks, E., Pihkala, P., Clayton, S., Lewandowski, R. E., Mayall, E. E., ... & Van Susteren, L. (2021). Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey. The Lancet Planetary Health, 5(12), e863-e873.

Fig. 6. Top four causes of death, ages 15–29 years, 2021



MENTAL HEALTH, BRAIN HEALTH AND SUBSTANCE USE (MSD), WHO SPECIAL INITIATIVE FOR MENTAL HEALTH
WORLD HEALTH ORGANIZATION
ISBN: 978-92-4-011006-9

From: [The global burden of depression in adolescents and young adults, 1990–2021: systematic analysis of the global burden of disease study]



The global burden of depression in adolescents and young adults, 1990–2021: systematic analysis of the global burden of disease study

Zhuo Liu &
Mengni Kuai

Bitácora

de las *pasejadas* del proyecto de recercacciòn “Clycling to Care”

cycling2care

Sustainability Science
https://doi.org/10.1007/s11625-020-00882-y

SPECIAL FEATURE: ORIGINAL ARTICLE

Leverage Points for Sustainability Transformations

Inner transformation to sustainability as a deep leverage point: fostering new avenues for change through dialogue and reflection

Christoph Woiwode[1,9] · Niko Schäpke[2,10] · Olivia Bina[3] · Stella Veciana[4,11] · Iris Kunze[5] · Oliver Parodi[6] · Petra Schweizer-Ries[7] · Christine Wamsler[8]

Received: 30 December 2019 / Accepted: 9 November 2020

Challenge	Current approaches	Proposed solutions
Traditional engineering paradigms	Focus on technical problem-solving with limited sustainability integration.	Shift to **systems thinking** that includes environmental, social, and economic factors (Beagon et al., 2022; Sigahi et al., 2022).
Lack of interdisciplinary integration	Sustainability is taught in isolated courses with little collaboration between disciplines.	Embed **interdisciplinary coursework** merging engineering with environmental science, economics, and policy studies (Gutierrez-Bucheli et al., 2022; Redman and Wiek, 2021).
Resistance to curricular change	Accreditation bodies provide vague sustainability requirements, leading to inconsistent implementation.	**Policy and accreditation reforms** to mandate sustainability as a core competency in all engineering programs (Theis et al., 2008).
Limited practical exposure	Sustainability is mostly taught through lectures and case studies rather than real-world applications.	Expand **experiential learning** through industry partnerships, internships, and field-based sustainability projects (Hadgraft and Kolmos, 2020).
Weak industry involvement	Limited collaboration between universities and companies working on sustainability projects.	Strengthen **university-industry partnerships** to provide students with hands-on experience in sustainable engineering (Nazzal et al., 2015).
Insufficient use of technology	Digital tools such as AI, VR, and digital twins are underutilized in sustainability education.	Leverage **emerging technologies** to simulate sustainability scenarios and enhance learning outcomes (Hou et al., 2023).

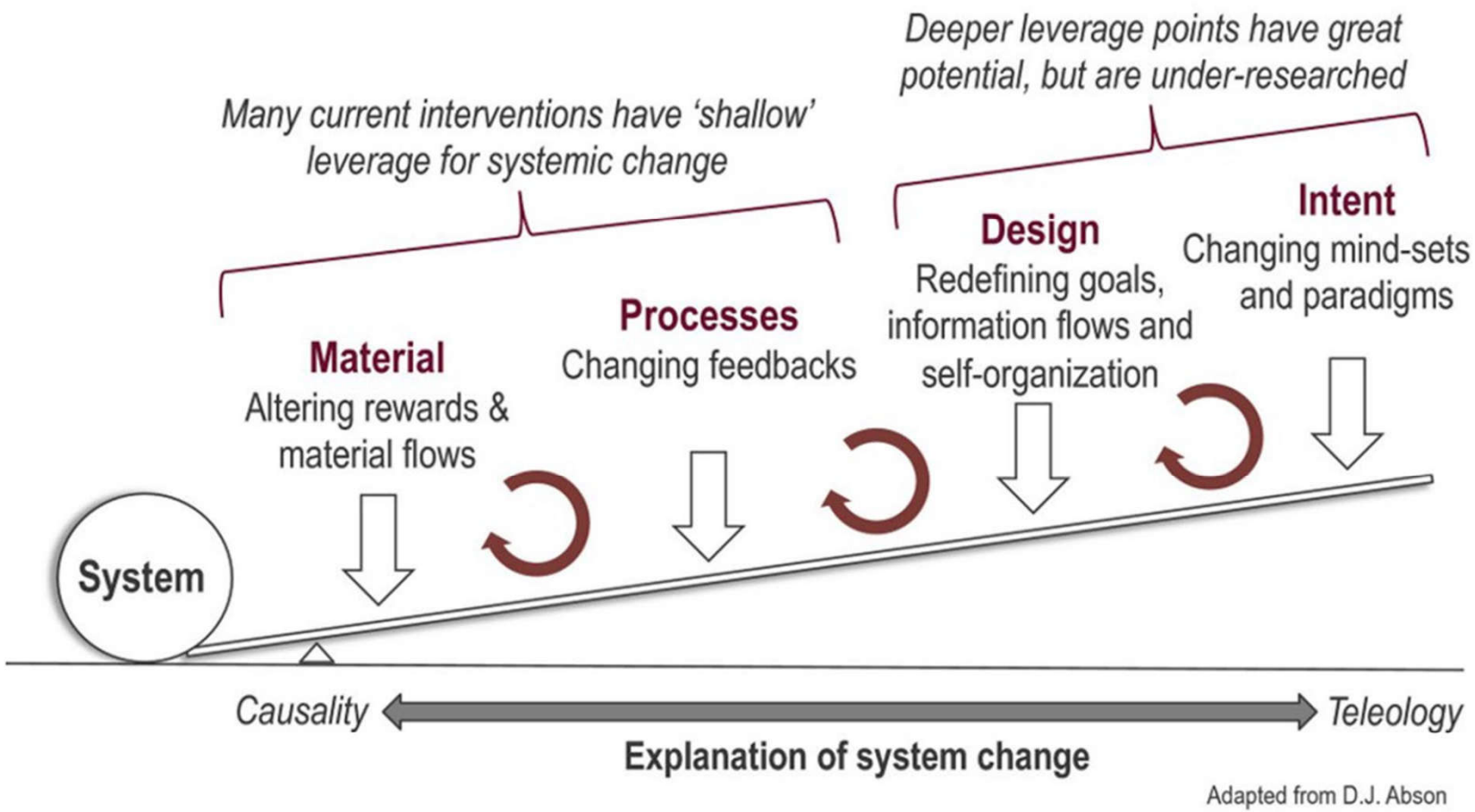
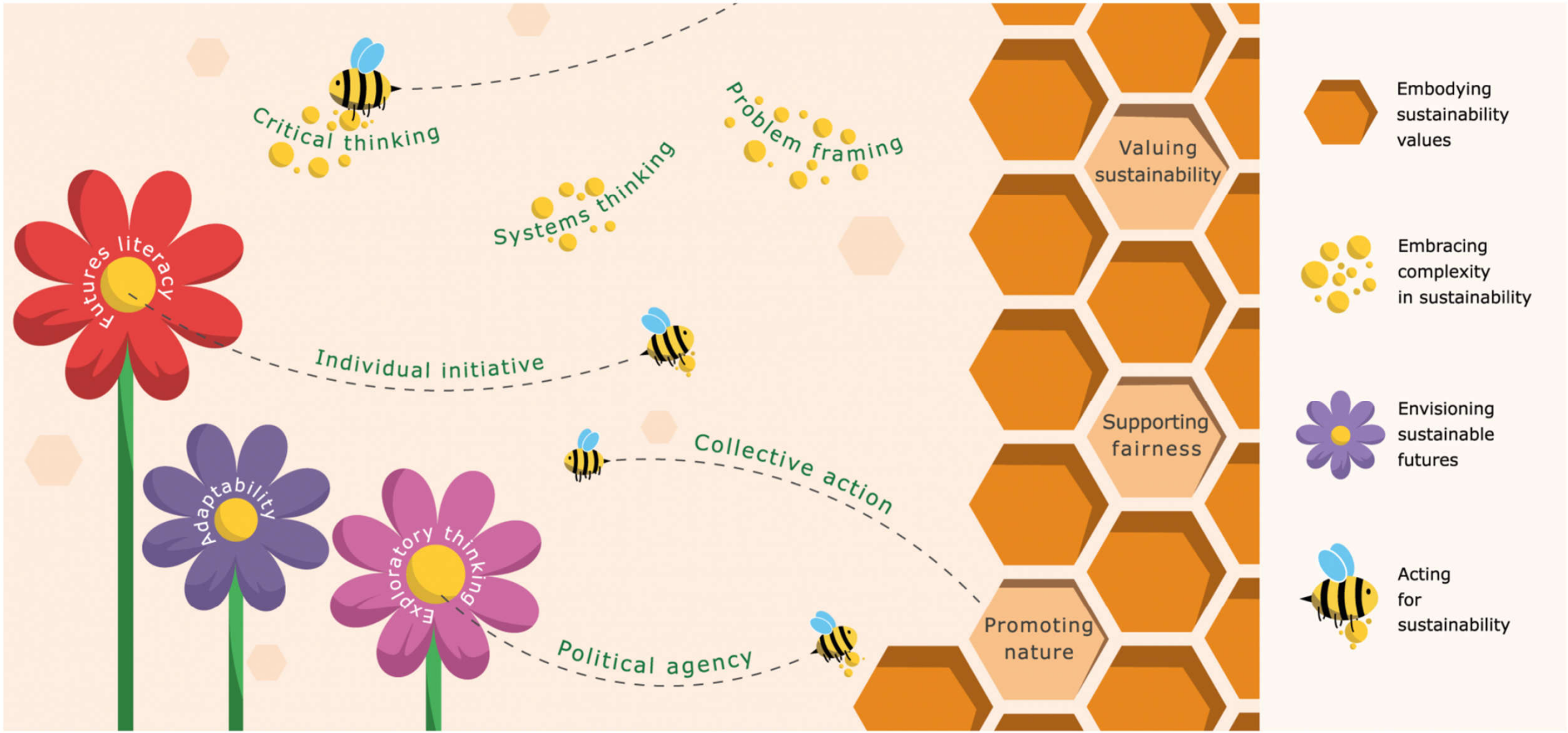


Fig. 1 Schematic illustration of four realms of leverage showing a gradient from shallow leverage points to deep leverage points (Source: Fischer and Riechers 2019, based on Abson et al. 2017, adapted from an ealier version of D.j. Abson)

Beyond Skills

Cultivating Virtues for Sustainable Education


1
BEING - Relationship to Self
2
THINKING - Cognitive Skills
3
RELATING - Caring for Others and The World
4
COLLABORATING - Social Skills
5
ACTING - Enabling Change



GreenComp Visualisation


Cloud Cities
Barcelona
Tomás Saraceno


CAT ESP ENG
y hacer la vida
más amable,

köszönöm <3

#cycling2care
@cycling2care on IG
giuliasonetti.it

linkedin: giulia sonetti

giulia.sonetti@isglobal.org