Symbiosis

Stars, crabs to Autonomous vehicles

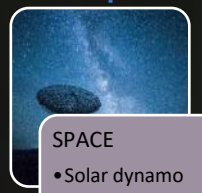
Personal Observations, through the lens of Science and Engineering

Prof. Spencer Salter FIMechE MCSFS

This talk

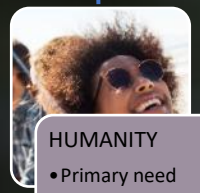
- Universe
- Sun
- Earth
- Life
- Humans
- Civilisation
- Experience's
- Autonomous Vehicles
- Motion Sickness

Symbiosis



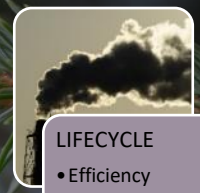
SPACE
- Solar dynamo
- Space weather
- Satalites, waste, risks

PLANET
- Climate
- Resources

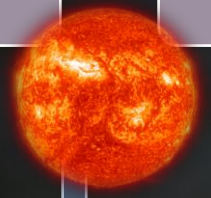


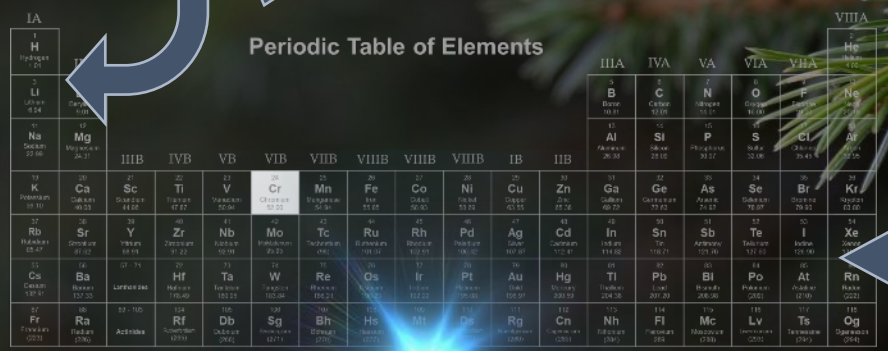
HUMANITY
- Primary need
- Belonging
- Politics
- Conspiracy vs. science and data

EXPERIENCE
- Value
- Visceral
- Trust
- Expectations



LIFECYCLE
- Efficiency
- Circular
- Off grid
- Resiliance





Perfect sequence of Celestial Events

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Big Bang
~15Bn years

1st Generation

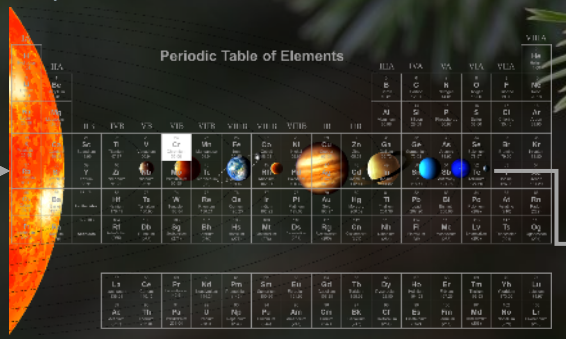
~2nd Generation

Cosmic Fusion

8Bn Neutron Star Crab Nebulae 1054 AD

Massive Stars, Red Giants, Supernova, closest is Gacrux in the southern cross

White Dwarfs ~8BN years



Our sun 4.5BN years old

Most heavy matter (>H, He) is made in the last moments of a star's death, a few years to mostly a few seconds.

Universal Human Privilege

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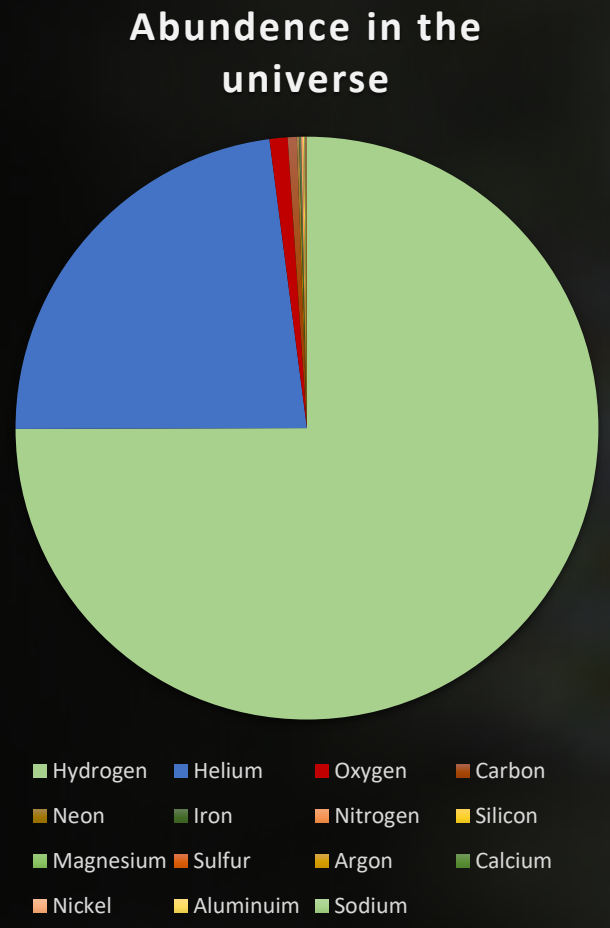

Star birth and death of the right types and order has led to our tool shed. Universally we only loan, never consume

Global Warming Provenance

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1824 — France

Joseph Fourier
(FFT's)

1836 — France

Claude Pouillet
- Suggested CO_2+H_20 could heat the atmosphere

1856 — USA

Eunice Foote
- Discovered that CO_2+H_20 trap escaping heat

1859 — Ireland

John Tyndall
- A more comprehensive experiment, confirmation of the mechanism for greenhouse gases.

1896 — Sweden

Svante Arrhenius
- Predicted changes in atmospheric due to CO_2 could substantially increase surface temperatures

1938 — UK

Guy Callendar
- Linked the increases in C02 to actual climate data

1969 — USA

- Andrew Ingersoll
- Venus, the runaway greenhouse

Symbiosis with the Sun

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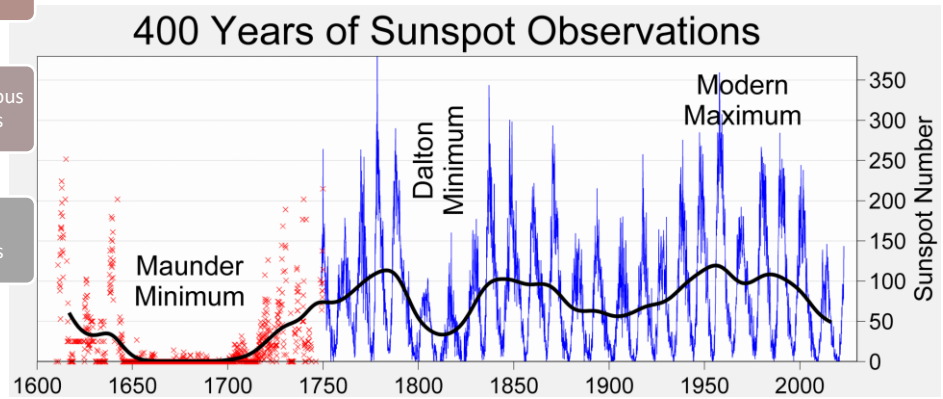
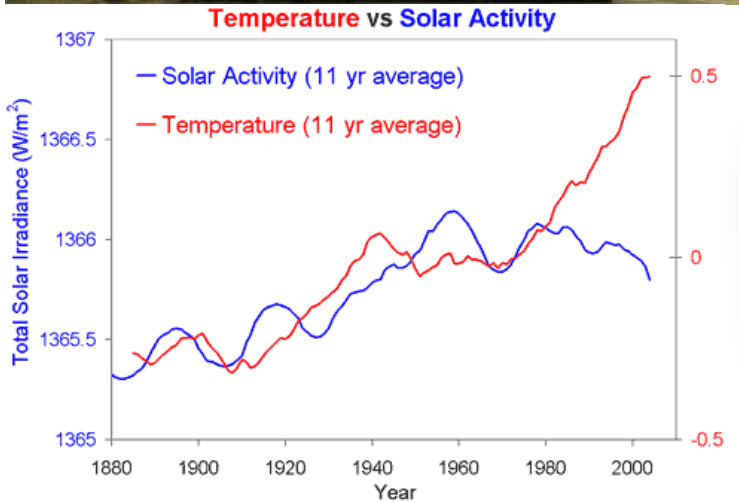
Gliesberg (~80 years), **Maunder** cycles are aligned currently for a minimum around 2030-2040

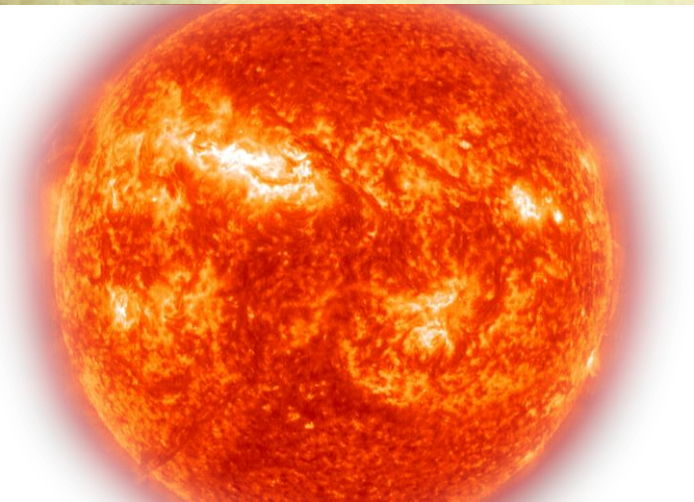
These reverse and drive more irradiance by ~2% >2050

Maunder minimum was the cause of the mini-ice age around 1677 depicted in the painting by Abraham Hondius

Schwabe cycle, 11 years is just a perturbation, sunspots, CME's leading to aurora







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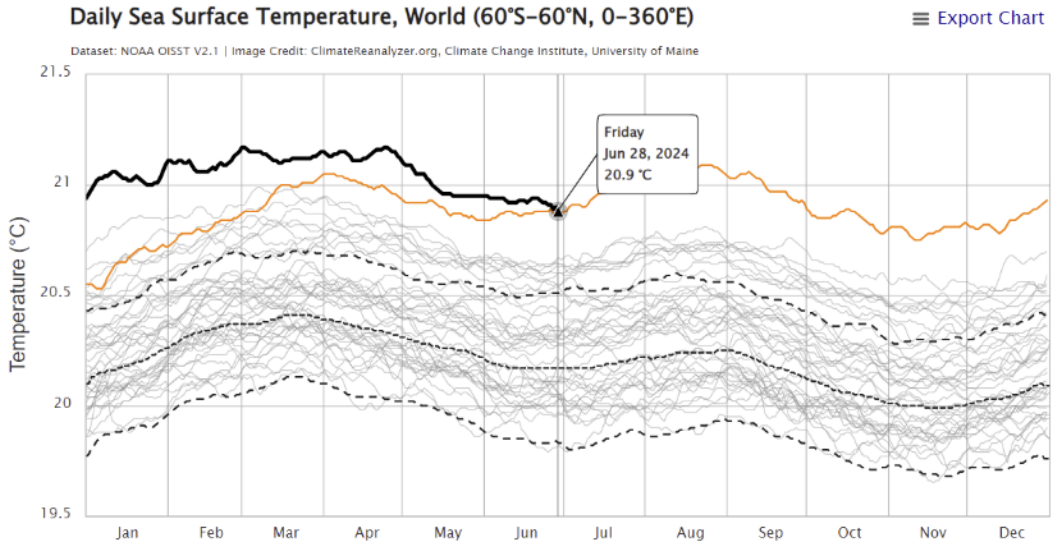

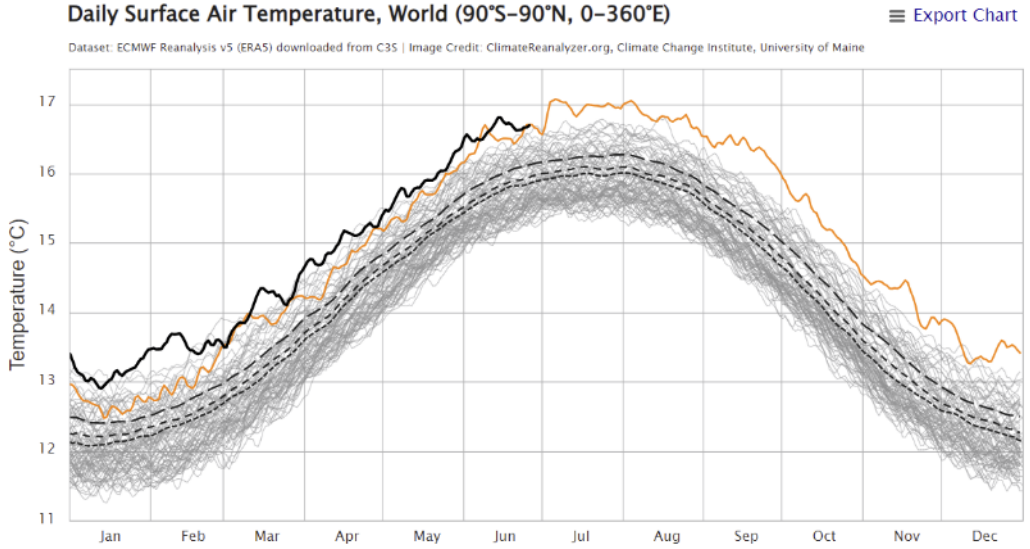

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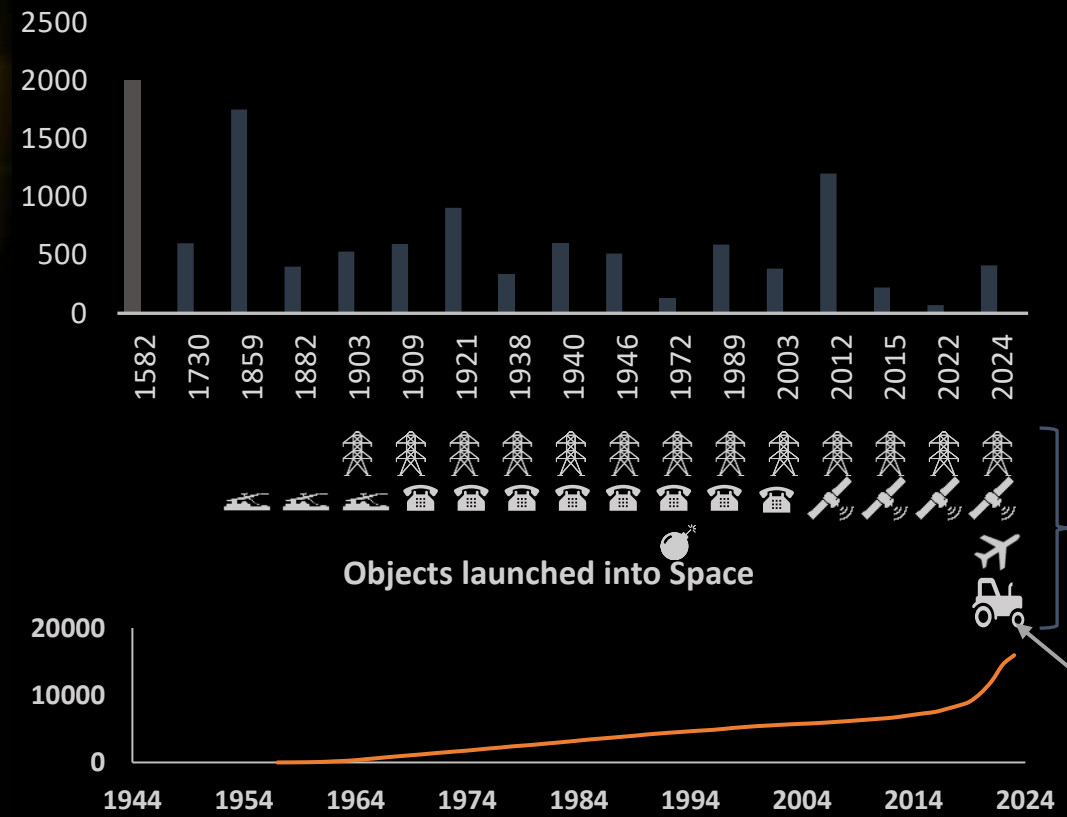
Solar Minimum

-nT Disturbance



Technology effected

?Autonomous Vehicles
Ionosphere Scintillation

Solar Maximum

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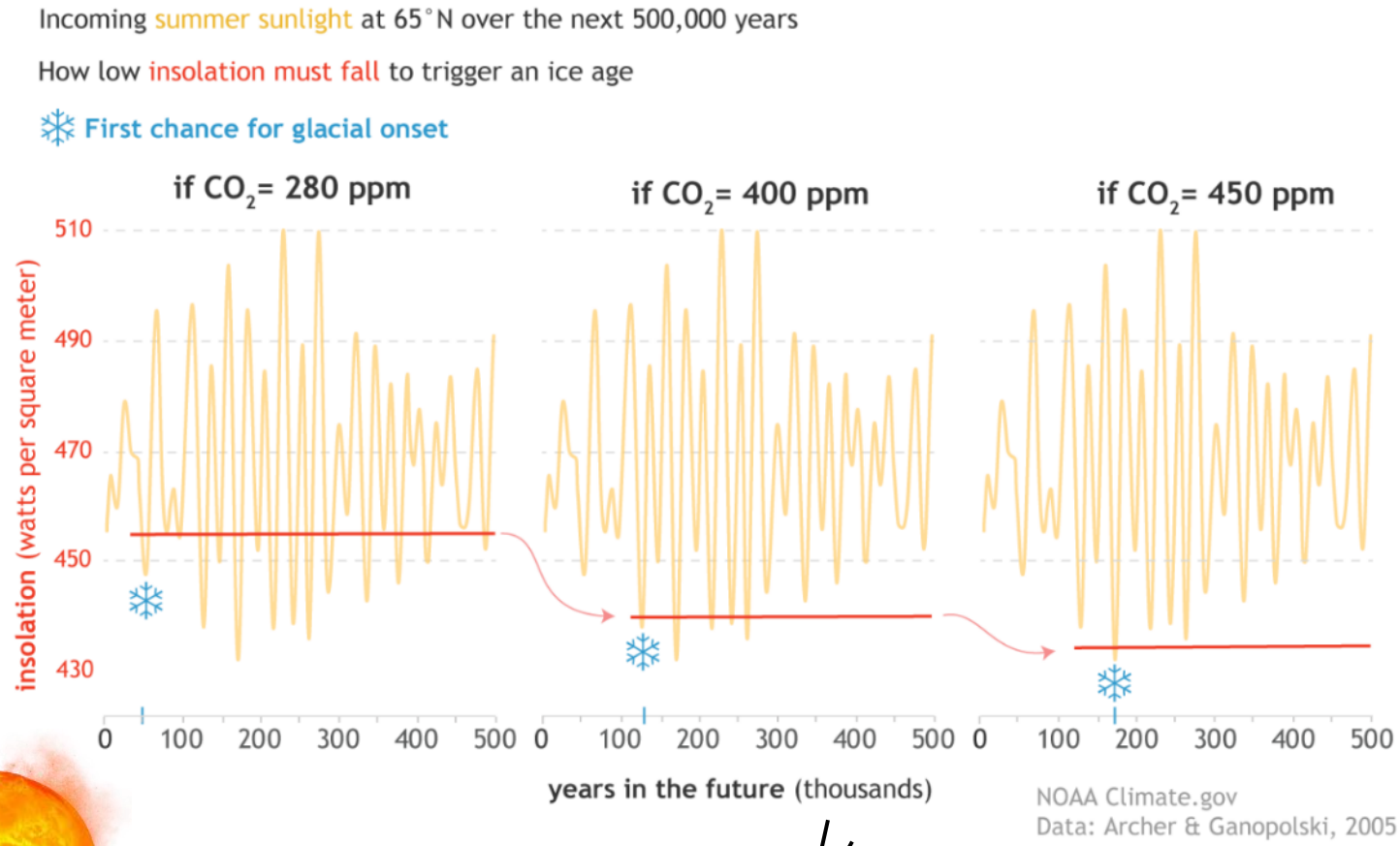
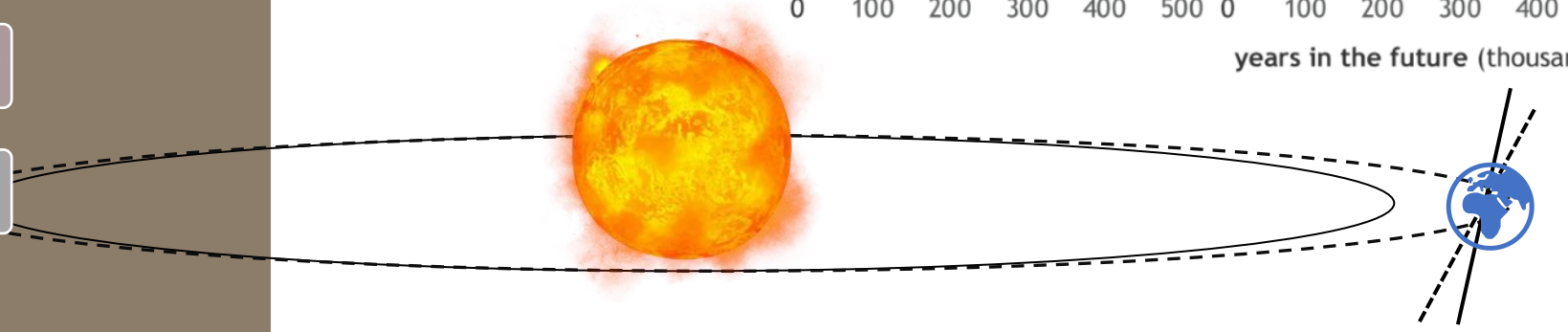
'Milankovitch' Geometric Earth to Sun Variation





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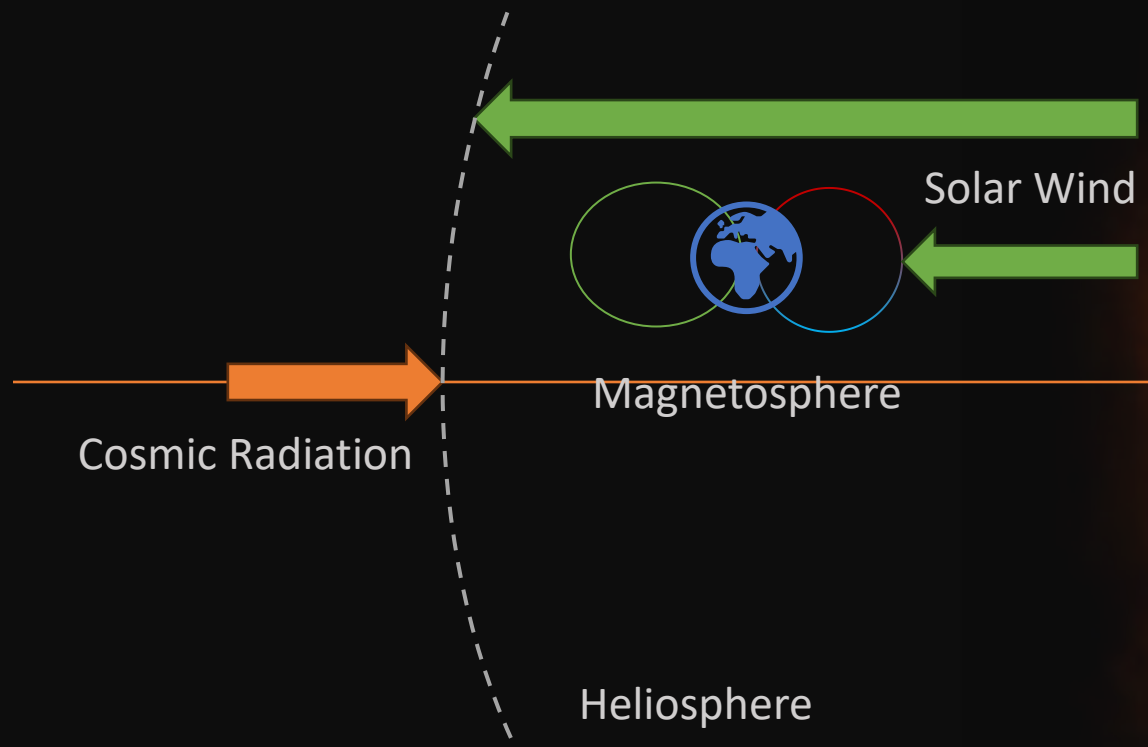

Cosmic balance

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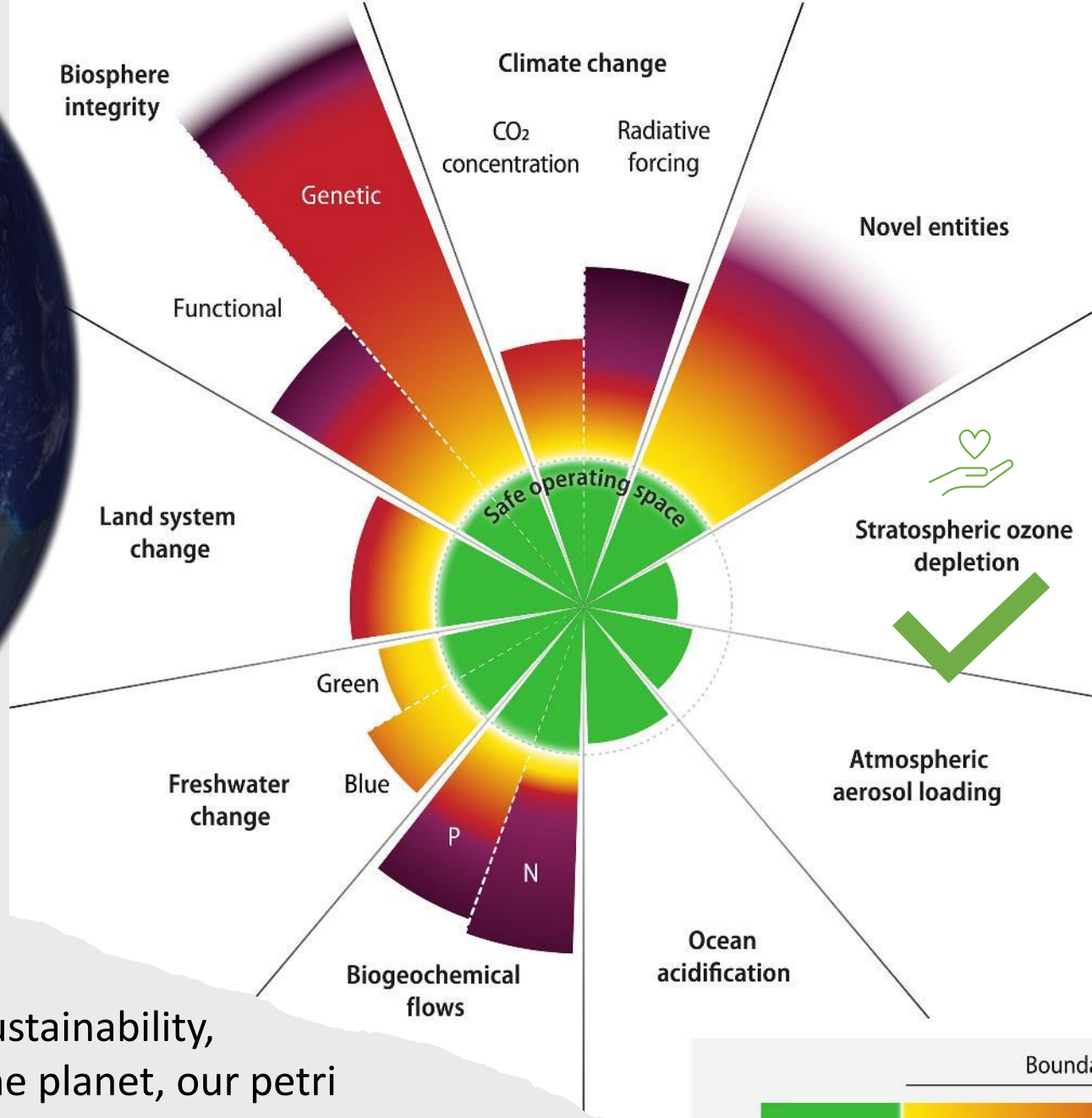

6/9 Metrics beyond limits

? Doughnut Economics, thrive on the fringe of sustainability, Growth Economics is fundamentally flawed as the planet, our petri dish is itself not growing

Status

Progress takes time

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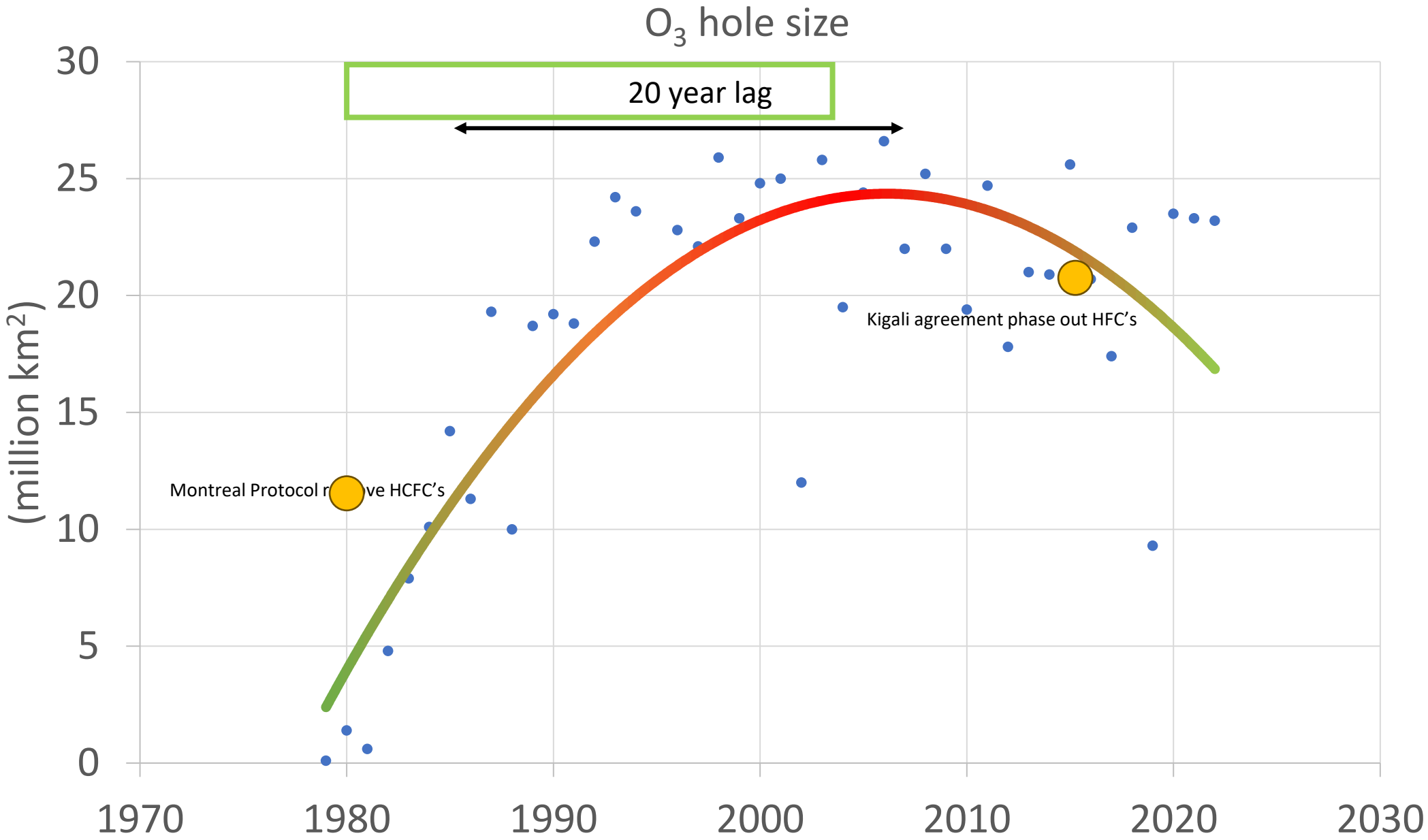

Biodiversity

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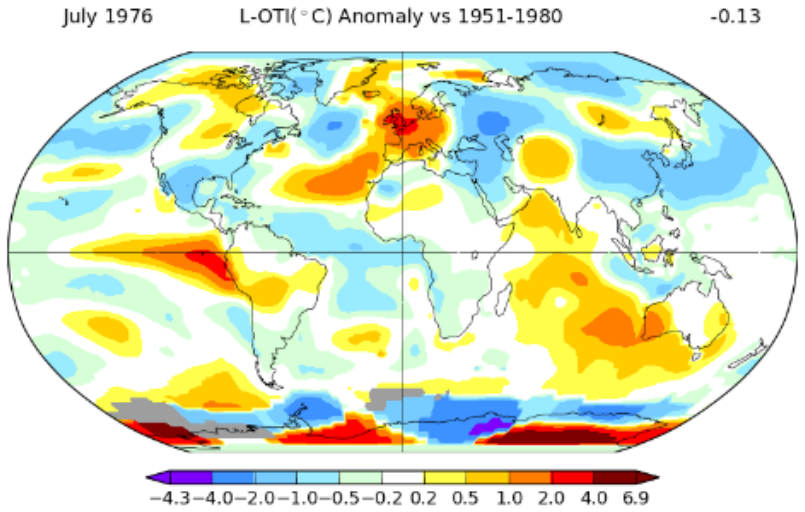
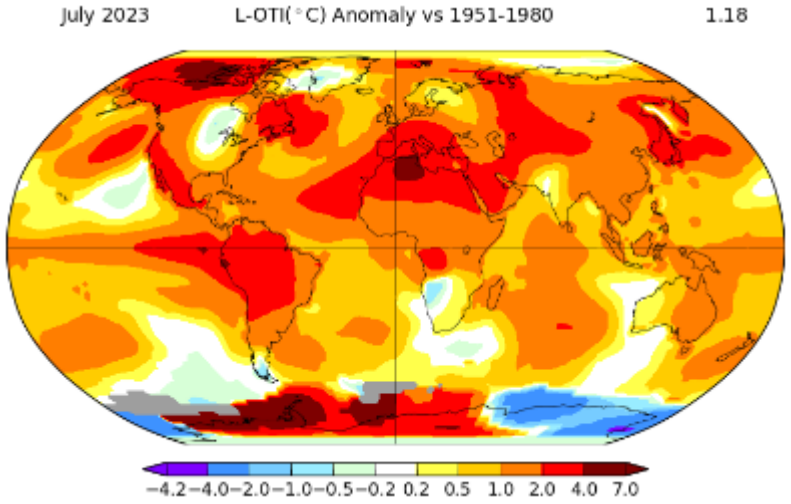
<1976 | >1976 | >2023

1 | 0.75 | ?

(Cavin et al., 2013)





We know about Wimpy, McD, desertification of eastern Brazil, 1970's Mahogany furniture et al.

We now know photosynthesis limit is being reached across many areas. Air temp of >46Deg stops photosynthesis which will lead to a slow down in CO_2 absorption in those areas

Doughty, C.E., Keany, J.M., Wiebe, B.C. et al. Tropical forests are approaching critical temperature thresholds. Nature (2023). https://doi.org/10.1038/s41586-023-06391-z

Nature as a Service

Gretchen Daily

Director, Center for Conservation Biology
Professor of Environmental Science, Stanford Department of Biology

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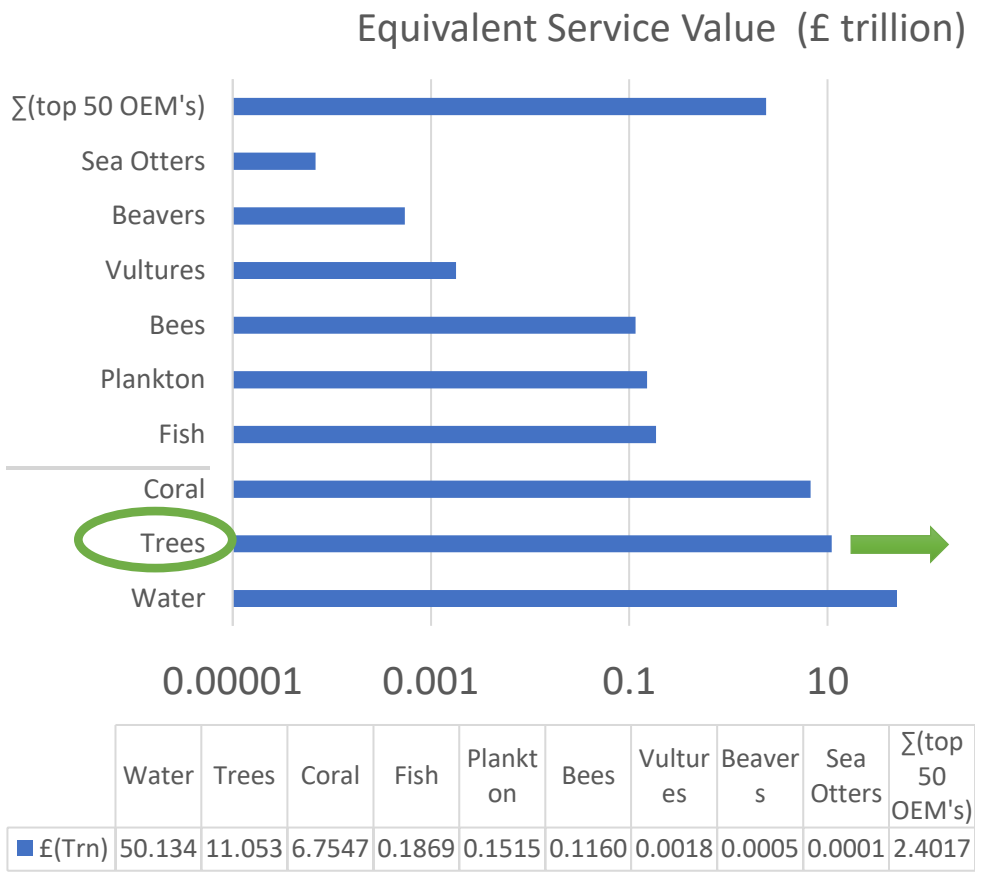

	Water	Trees	Coral	Fish	Plankton	Bees	Vultures	Beavers	Sea Otters	∑(top 50 OEM's)
£(Trn)	50.134	11.053	6.7547	0.1869	0.1515	0.1160	0.0018	0.0005	0.0001	2.4017

The value of trees will increase as oil extraction reduces leading to shortages in bitumen for tarmac, note only 20% of roads are paved

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Let's make it real

(June-July in the UK during astronomical twilight)

Noctilucent clouds were rare.. But are now common

Caused by methane, water and dust in the Mesosphere when it is much cooler than it should be around 50 miles up... Krakatoa in 1883 caused a spike in observations

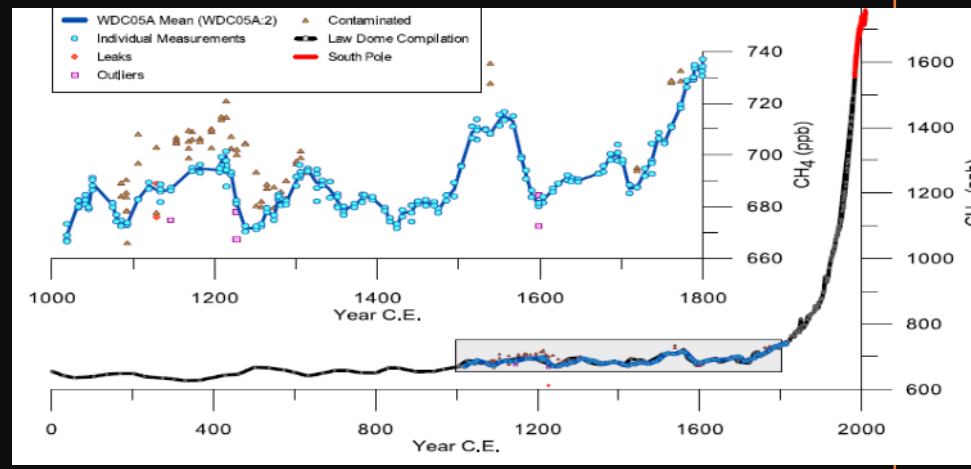
They are now brighter and seen much further south than previous observations dating back to 1600's. Trends are congruent with atmospheric methane, Maunder and Gliessberg solar cycles

They shimmer silvery blue and dynamic like the northern lights. Beautiful, but in essence its the planet setting up a new washing machine below the thermosphere to cleanse CH_4 with UVC

Lübken, F.-J., Berger, U., & Baumgarten, G. (2018). On the anthropogenic impact on long-term evolution of noctilucent clouds. *Geophysical Research Letters*, 45, 6681–6689. https://doi.org/10.1029/2018GL077719

Solihull 2020

Paris 2021



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Lithium Carbonate is environmentally expensive, let's keep it circular within society once we have it

gold in them thar hills.. ? Mark Twain?

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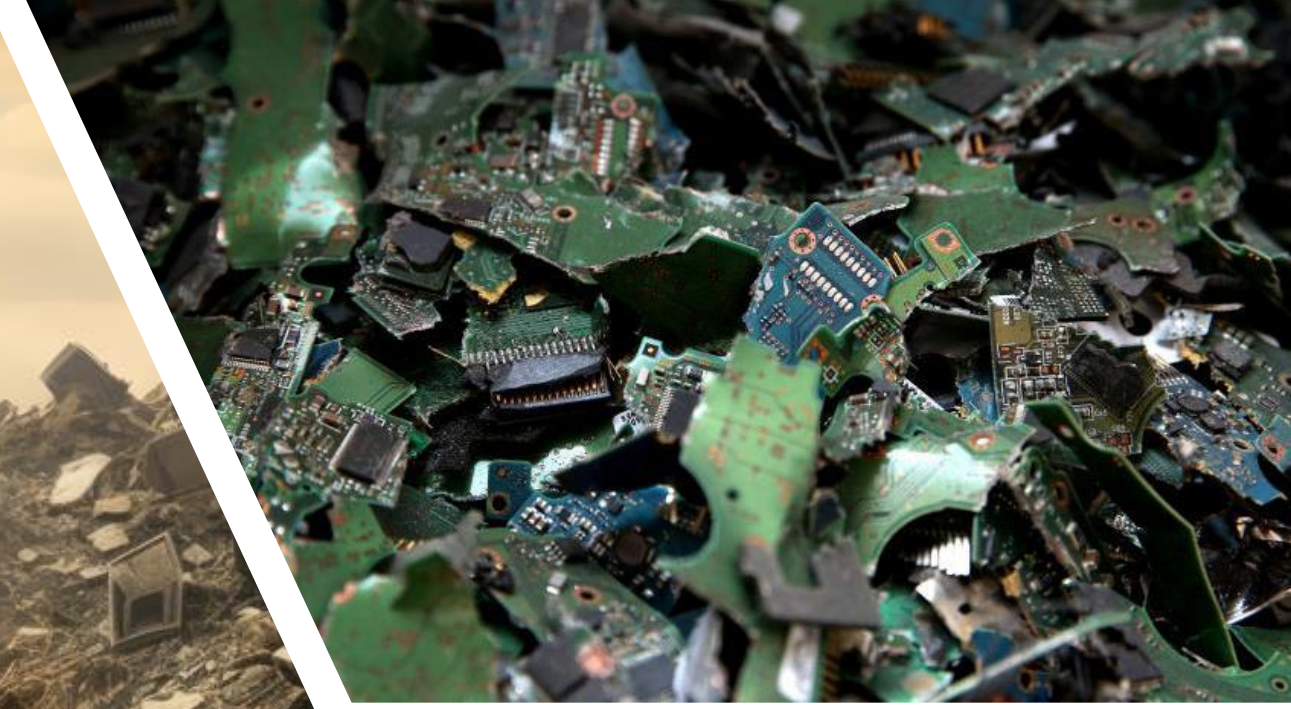

Circularity

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	Circularity	R-1 Reverse	Societal payback	% Value Recovered *	Core	Product	Revenue	Social change
Smarter		R0 Refuse	Make product redundant by abandoning its function or by offering the same function with a radically different product	100				
		R1 Rethink	Make product use more intensive **the Shared AV**					
		R2 Reduce	Increase efficiency in product manufacture or use by consuming fewer natural resources and materials	50				
Extend		R3 Re-use	Re-use by another consumer of discarded product which is still in good condition and fulfils its original function					
		R4 Repair	Repair and maintenance of defective product so it can be used with its original function					
		R6 Refurbish	Restore an old product and bring it up to date					
		R6 Remanufacture	Use parts of discarded product in a new product with the same function	30				
		R7 Repurpose	Use discarded product or its part in new product with same function					
Useful		R8 Recycle	Process materials to obtain the same (high quality) or lower (low grade) quality	≤1				
		R9 Recover	Incineration of materials with energy recovery					

** Value of circularity, University of Cambridge Circularity and Sustainability leadership*

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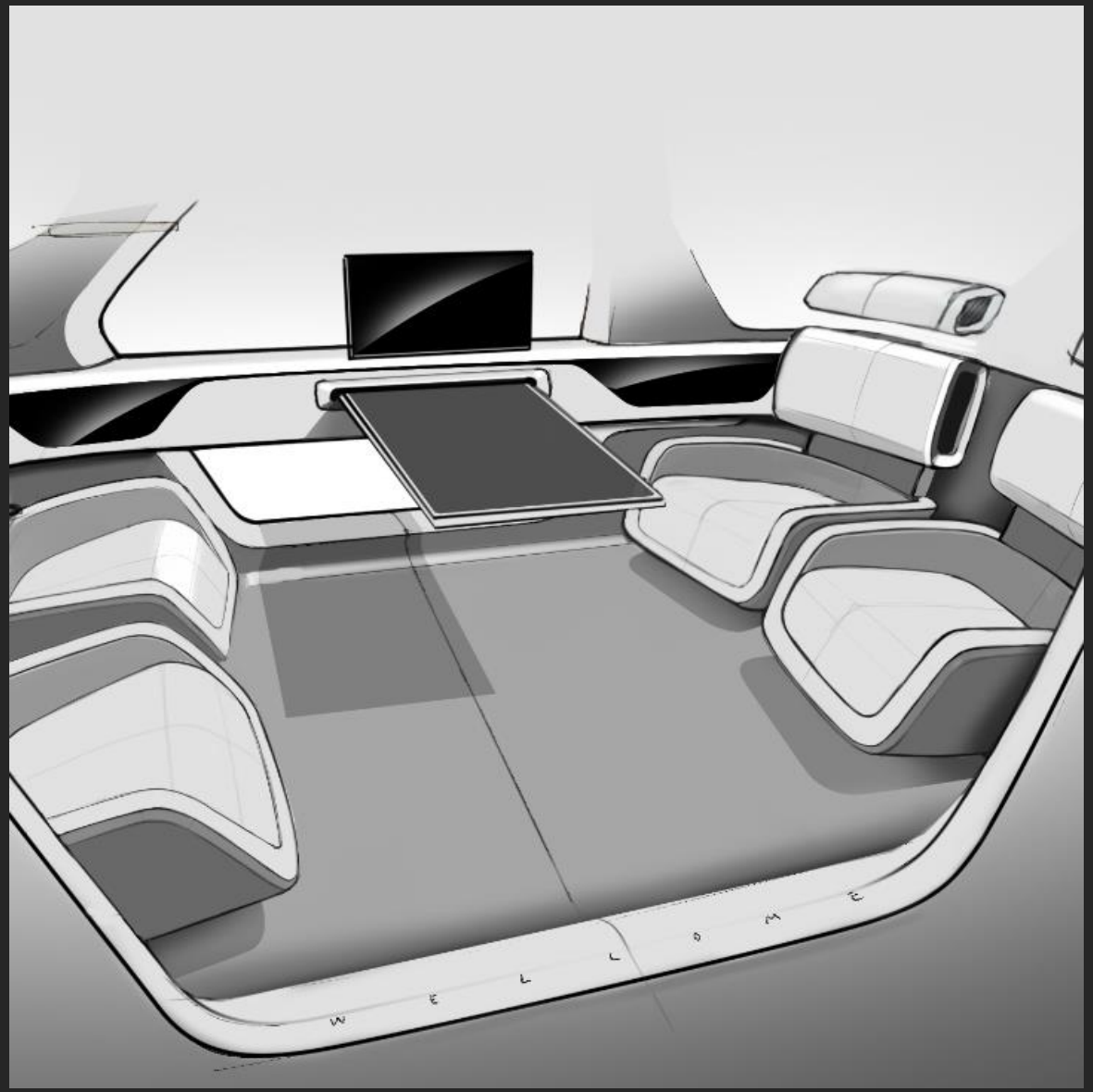


What is motion sickness within land vehicles?

Universe → Sun → Earth → Life → Humans → Civilisation → Experience's → Autonomous Vehicles → Motion Sickness

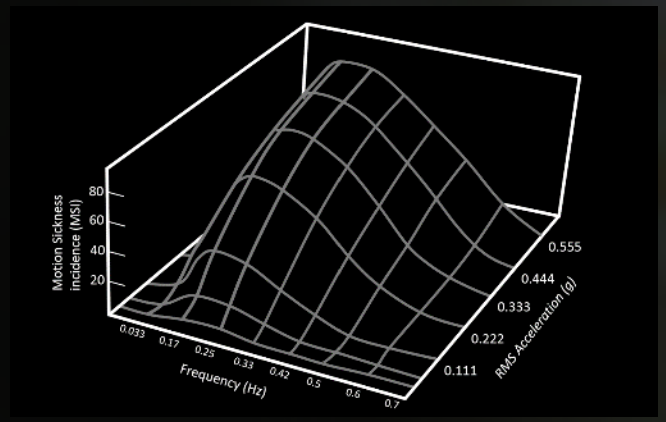
Motion ≠ Vision + Other sensors = Motion sickness

Motion sickness
- Tiredness
- Headache
- Hot/cold
- Nausea
- Vomit….

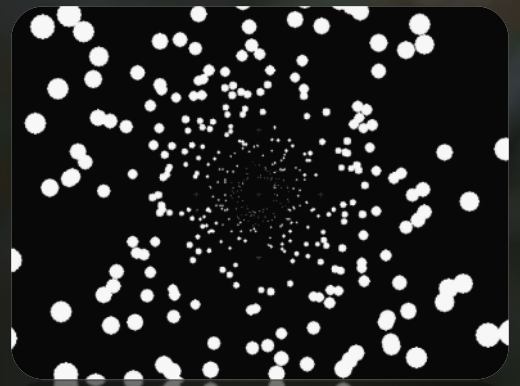
Confounding factors
Age, gender, ethnicity, experience

Subjectively measured

Human sensitivity

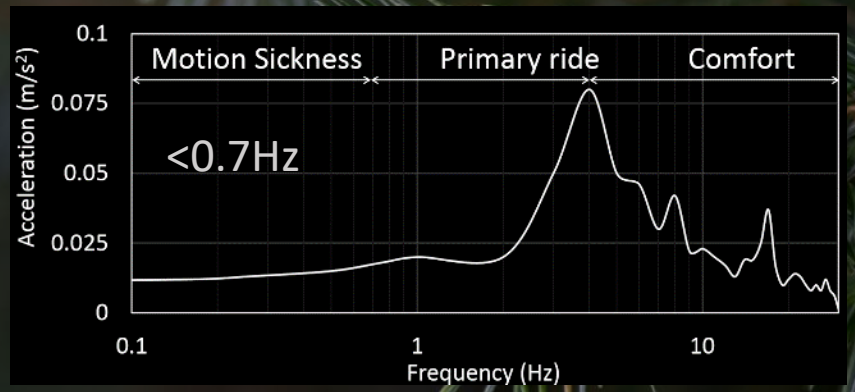


0.2Hz
(McCauley, 1974)



0.2Hz Radial flow
(Diels, 2007)

Vehicle motion



Longitudinal and lateral directions are more provocative than vertical (Griffin, 1999, 2004)

Systems Engineering and human systems

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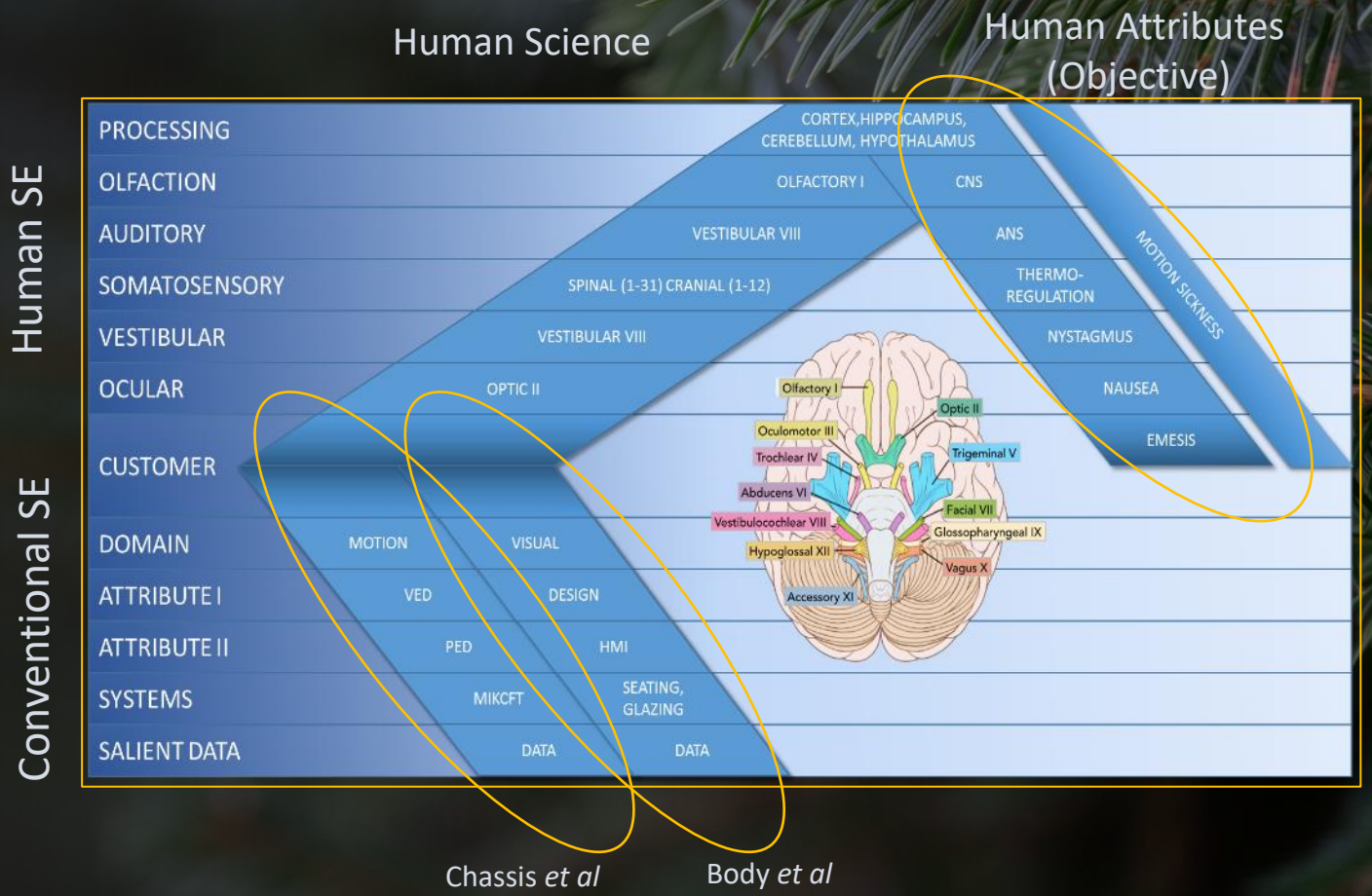
Human	'Car'
Cotex	CPU
Amygdala	Co-processor
Working memory	Cache
Short / Long Term Memory	RAM / ROM
ANS / CNS	CANBus, FlexRay, Wifi Bluetooth
Senses	Sensors



Evolution

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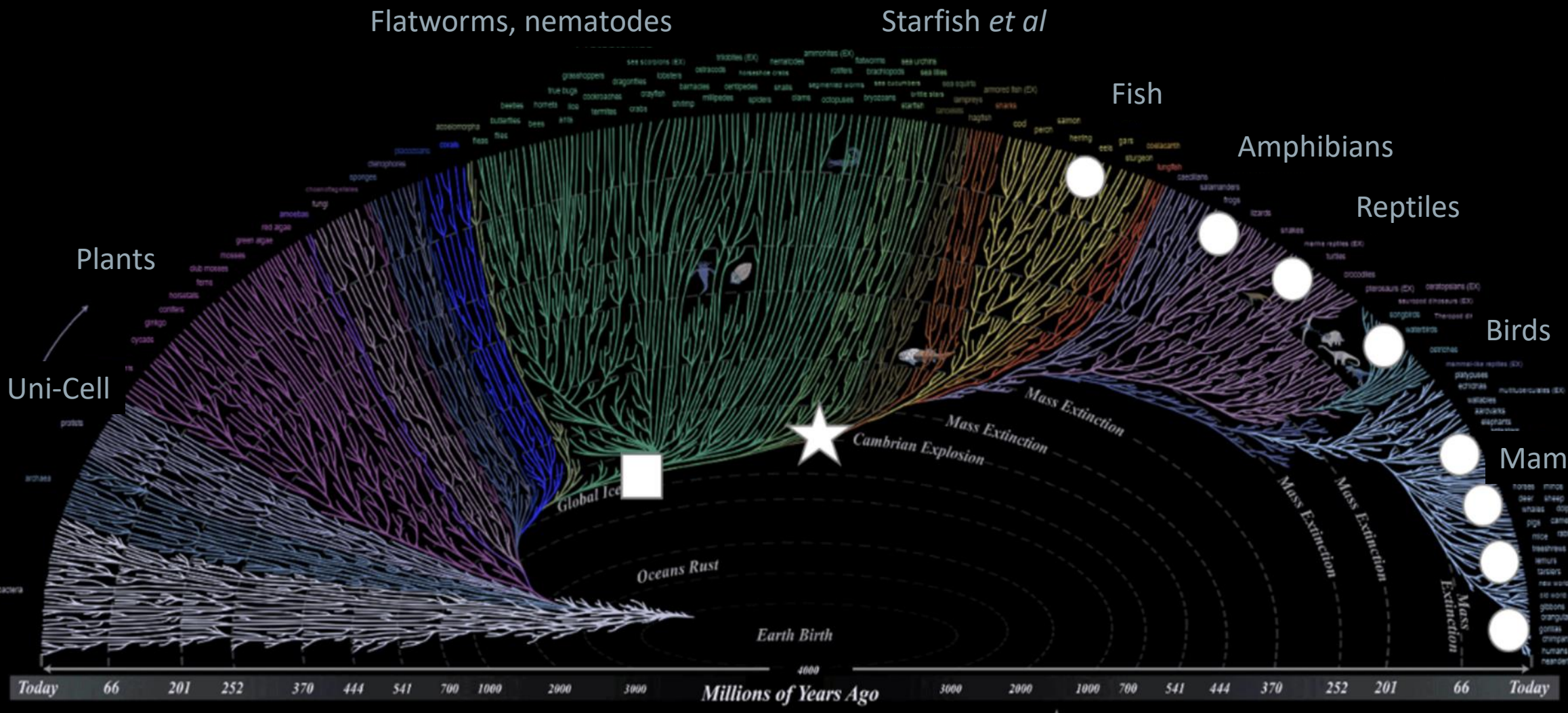

Confirmed motion sickness

630MA Crabs

550 MA Hagfish, Lamprey

Mass extinction's

445MA	Ordovician	Intense Ice age	-86% of all life
365MA	Devonian	Lack of Oxygen from rapid growth of land plants	-75% of all life
252	Permian	Volcanic in Siberia leading to a >C02, H2S, acidification.	-96% of all life
200	Triassic	Underwater volcanic activity, central Atlantic leading to change in ocean chemistry.	-80% of all life
66	Cretaceous	Asteroid, Yucatan Mexico, rapid cooling confounded by volcanic and tectonic disruption.	-76% of all life
Now	Holocene	Farming, (mutli to mono), Chemistry, rise of civilisation, Mesopotamia	~ 30% of all life by 2050, since 1900, 1000X the background extension rate

Causes:

Extraterrestrial, Solar, Asteroid,
Terrestrial, Volcanic, chemistry
Dominance of single species, type (not symbiotic)
Human > Mesopotamia-Industrial revolution-Climate change

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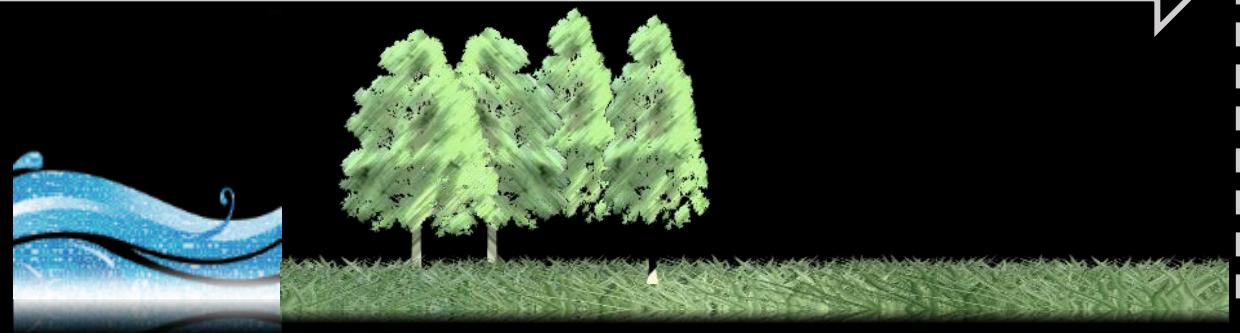
Unconscious Human evolution 99.975% of time

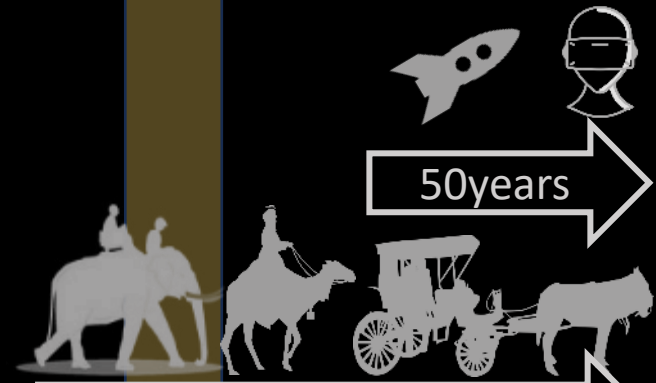
Conscious evolution 0.025% of time

Mesopotamia

550 Million years (Hagfish)

630 Million years (Crabs)





50years

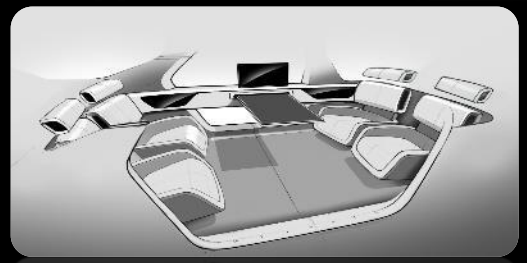
5500 years

130000 years

120 years


A


MANCHESTER
1829



What's next

Key :

- Trust
- Migration
- Requirements
- Circularity
- Ai+Quantum

Thank you for the privilege...