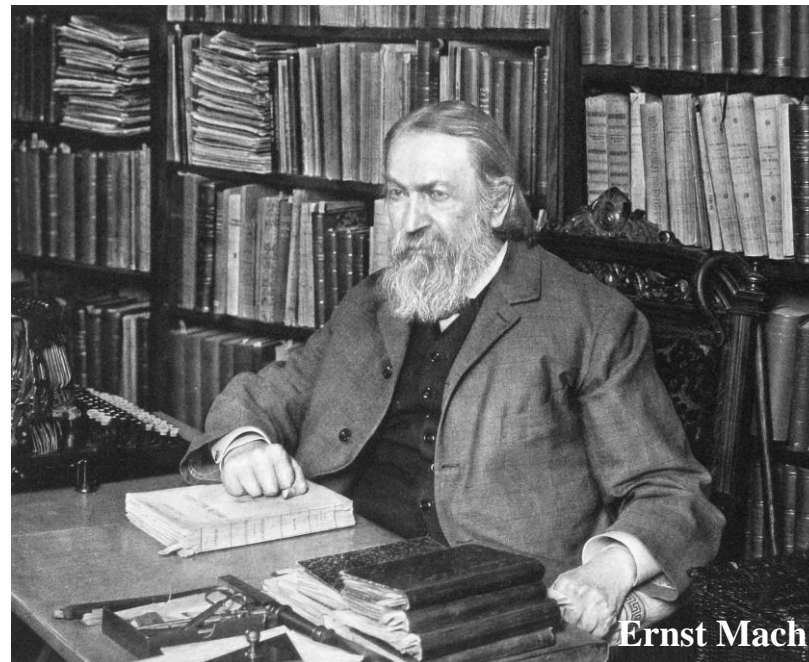
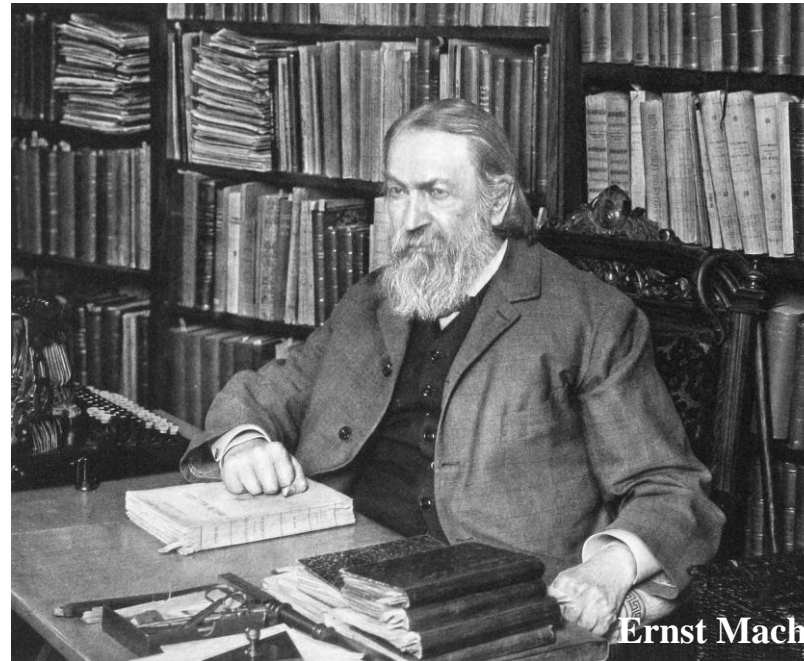


It is what it is!

Is it?





Mach: Analysis of Sensations

IV. Chief points of view for the investigation of the senses

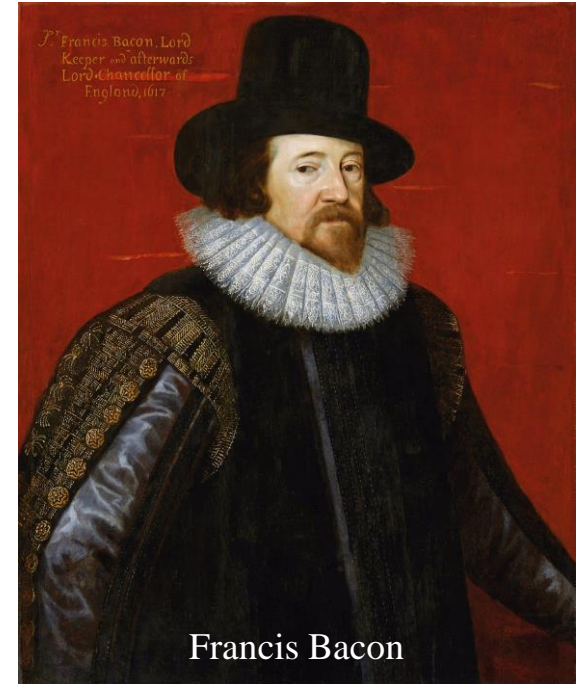
Ernst Waldfried Josef Wenzel Mach

- February 18, 1838 – February 19, 1916
 - *Contemporaries**: Boltzmann, Poincaré, Helmholtz, Darwin, Huxley, Pasteur, Fechner, Freud, Weber, Jung, Einstein...
- 1838: Born on February 18th in Moravia
- 1855-60: University of Vienna (Physics, philosophy and mathematics)
- 1862: *Doppler Effect*
- 1864-67 : University of Graz (**Professor of Mathematics**; later **Physics**)
- 1865: *Mach Bands*
- 1866: Begins writing the Analysis of Sensations
- 1867-1895: **Chair of Experimental Physics**, Praha
- 1887: Shadowgraph of Shock Waves
- 1889: The Principles of Physical Optics
- 1893: The Science of Mechanics: A Critical and Historical Account of Its Development
- 1895: University of Vienna (**Professor of Inductive Philosophy**)
- 1897: Analysis of Sensations (written over 3 decades)
- 1901: Retired following a stroke
- 1901: 'Reformer' in the Austrian Parliament

...

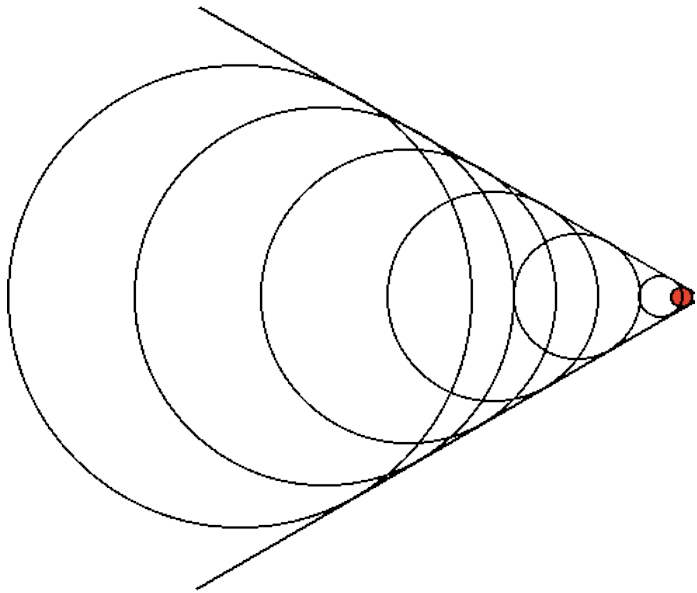
Aphorism 1:

Man, as the minister and interpreter of nature, does and **understands as much as his observations** on the order of nature, either with regard to **things or the mind**, permit him, and **neither knows nor is capable of more**.

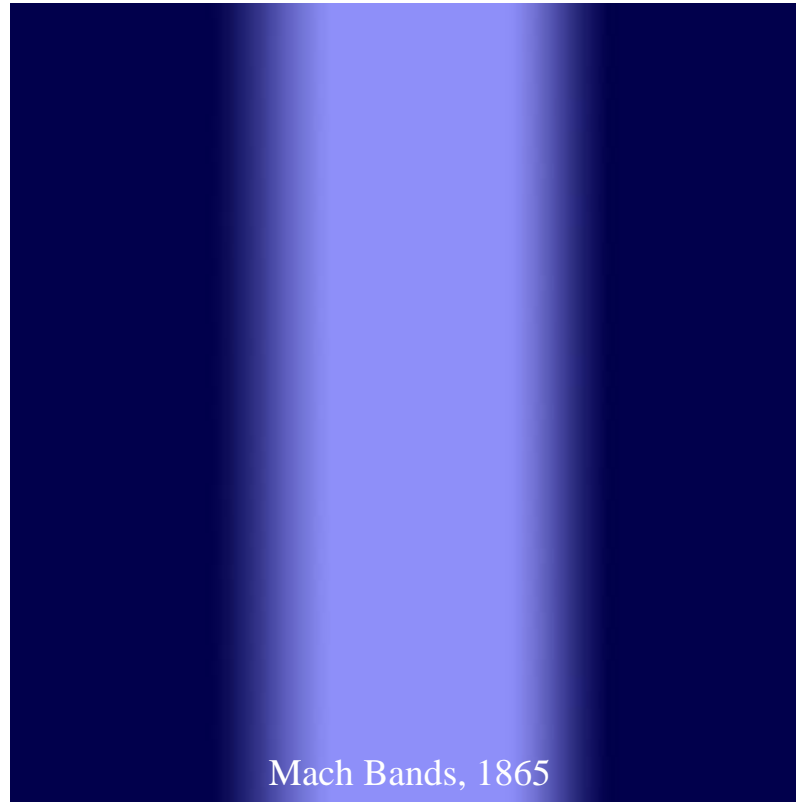


Francis Bacon

Doppler Effect, Mach Bands, Illusions...



Doppler Effect, 1862



Mach Bands, 1865

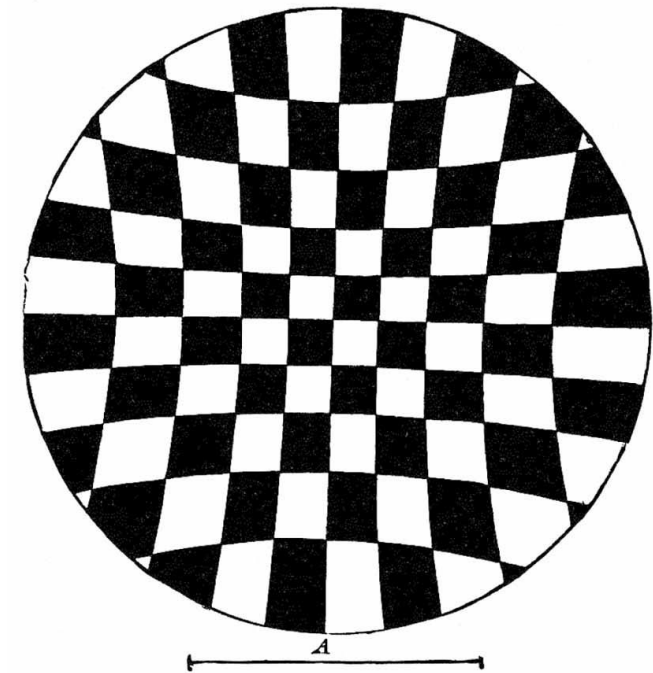
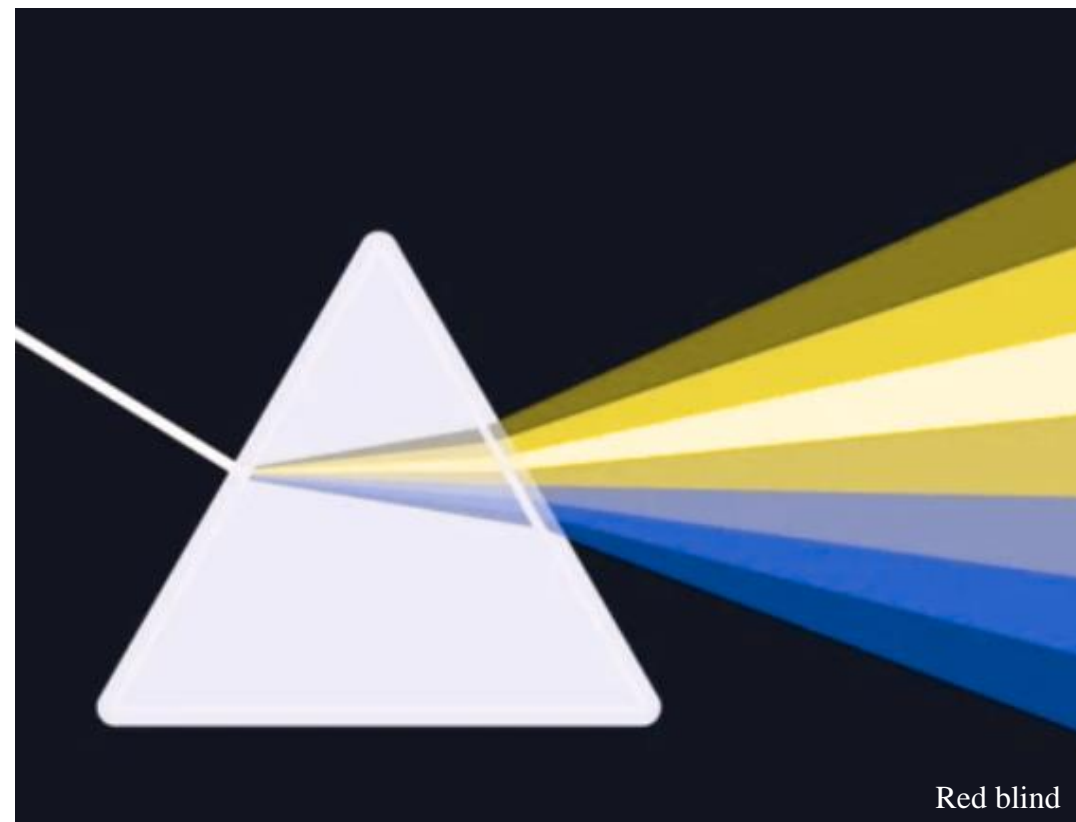
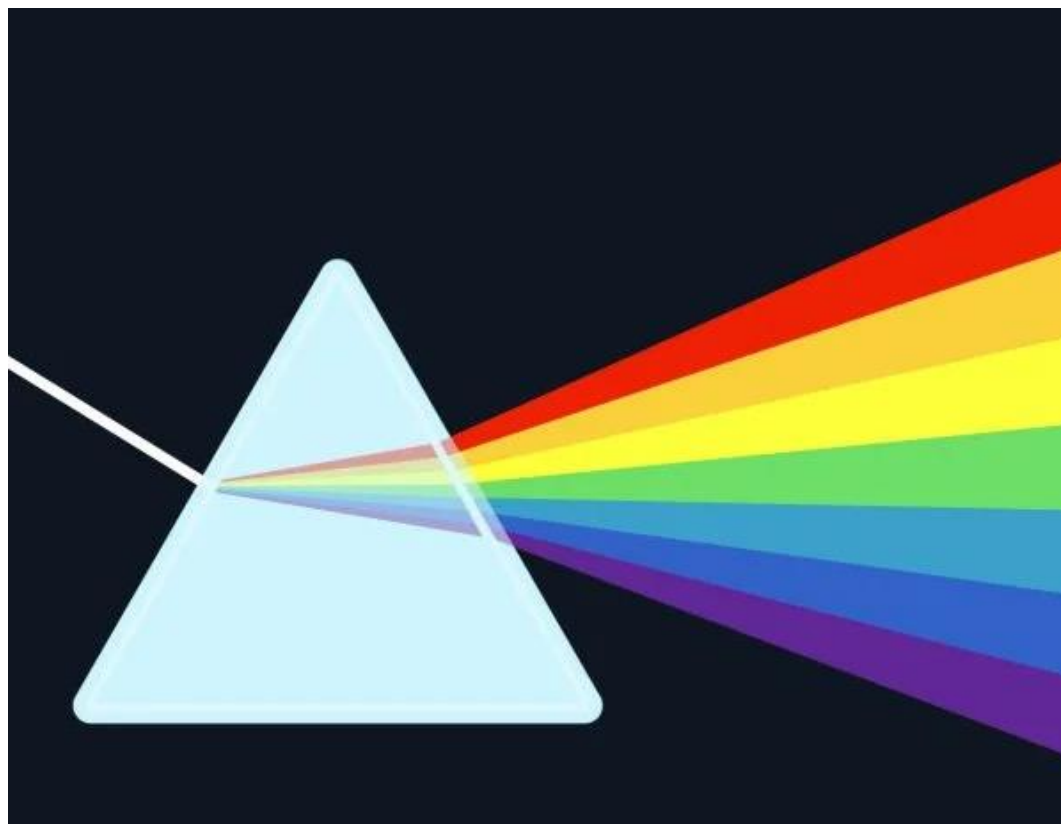


Fig. 22.

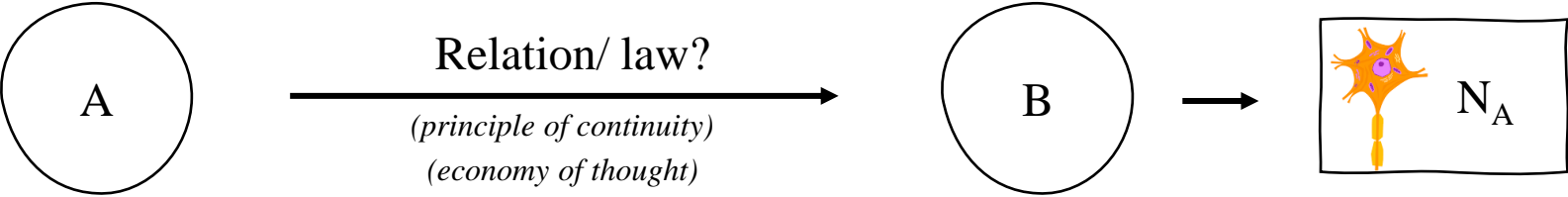
Optical Illusions, 1889

Colour → the eye has a mind of its own



we perceive not direct stimuli but relations of stimuli

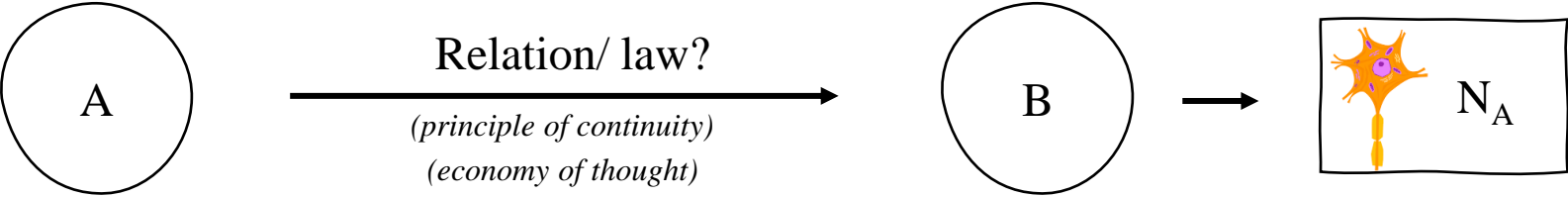
Event A – Nerve Process N_A



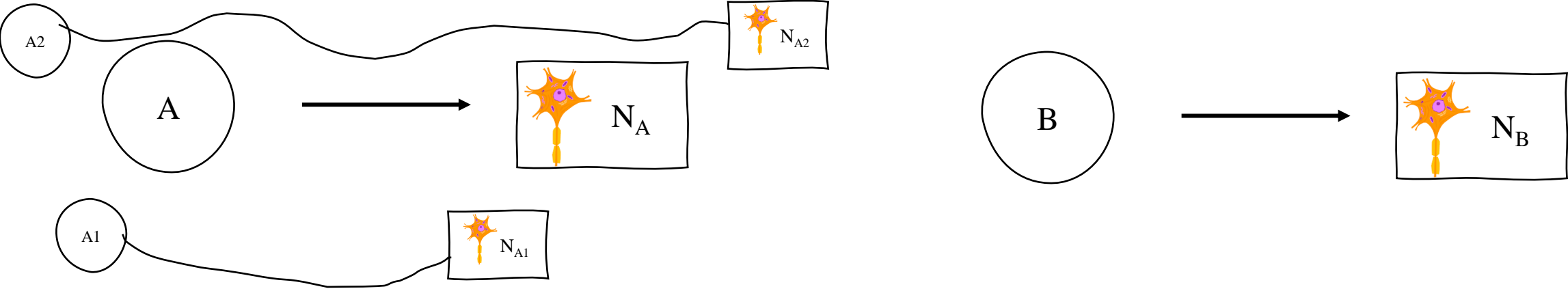
Fundamental criteria for a deterministic world:



Event A – Nerve Process N_A

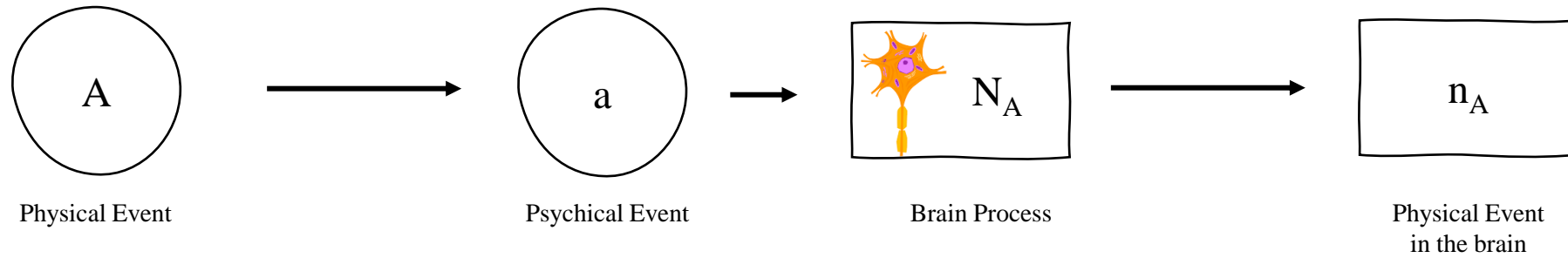


Fundamental criteria for a deterministic world:



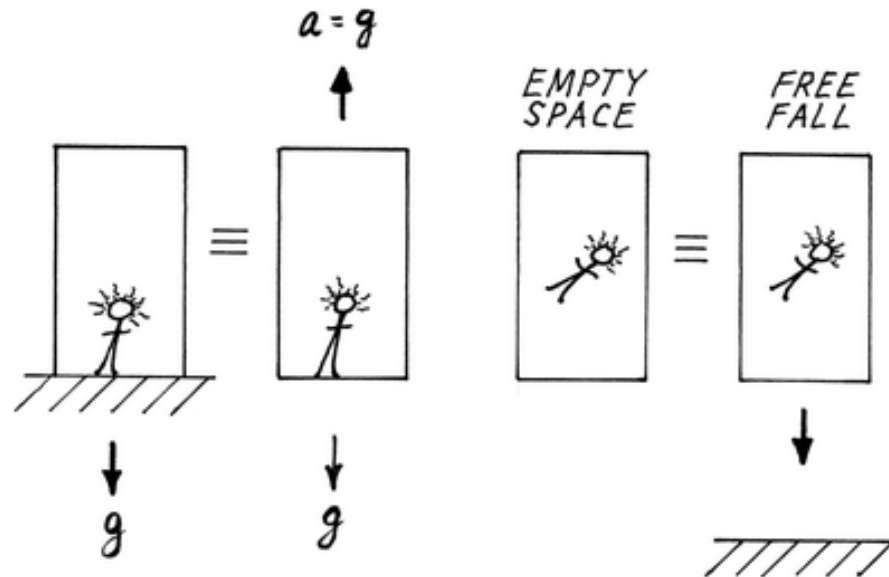
If A is a combination of A_1, A_2, \dots , there exists N_{A1}, N_{A2} , etc.

Physical – Psychological: Complete Parallelism

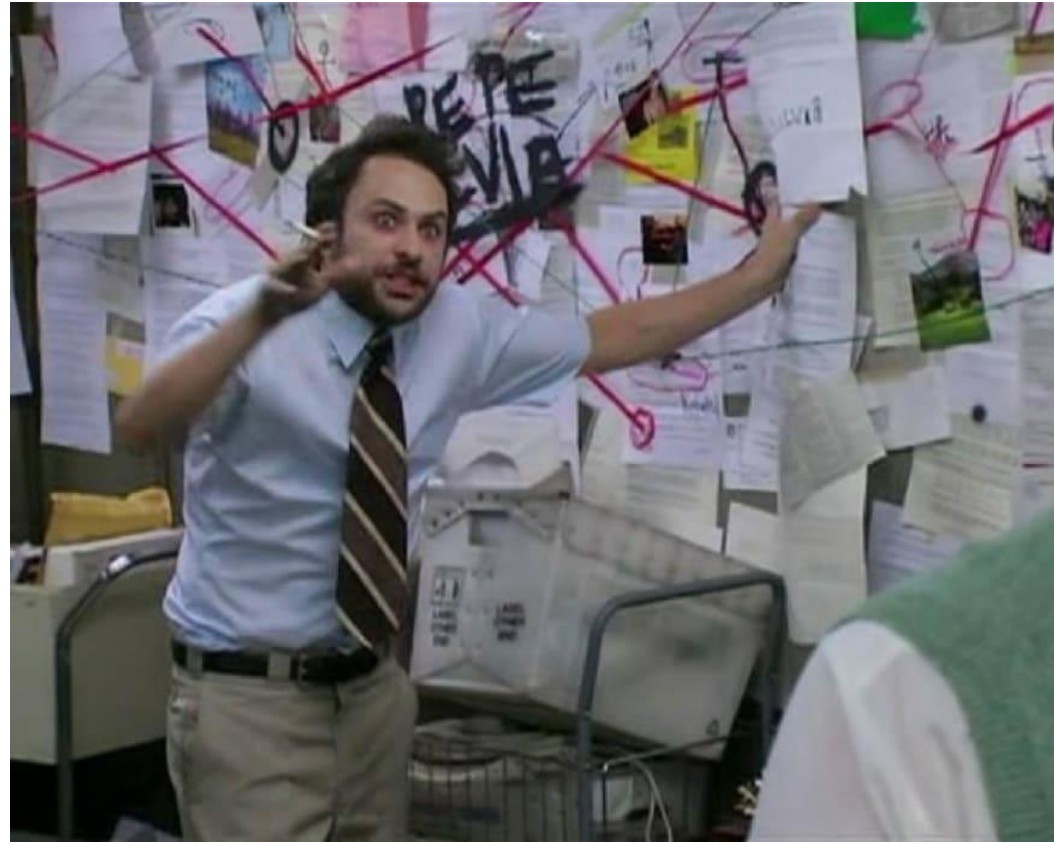


Thought Experiments

- *Imaginary* conduct of a *real* experiment
- Not true empiricism
- Acceptance of *a priori* principles if N_A, N_B, \dots are *independent*
- Inspired Einstein (among other ideas of Mach)



Music: Evolution and Sensation



Music and Darwinism



7 fundamental notes

knowledge is a product of evolution, that our senses, minds, and cultures have an evolutionary history



Non background sounds



tropical background score

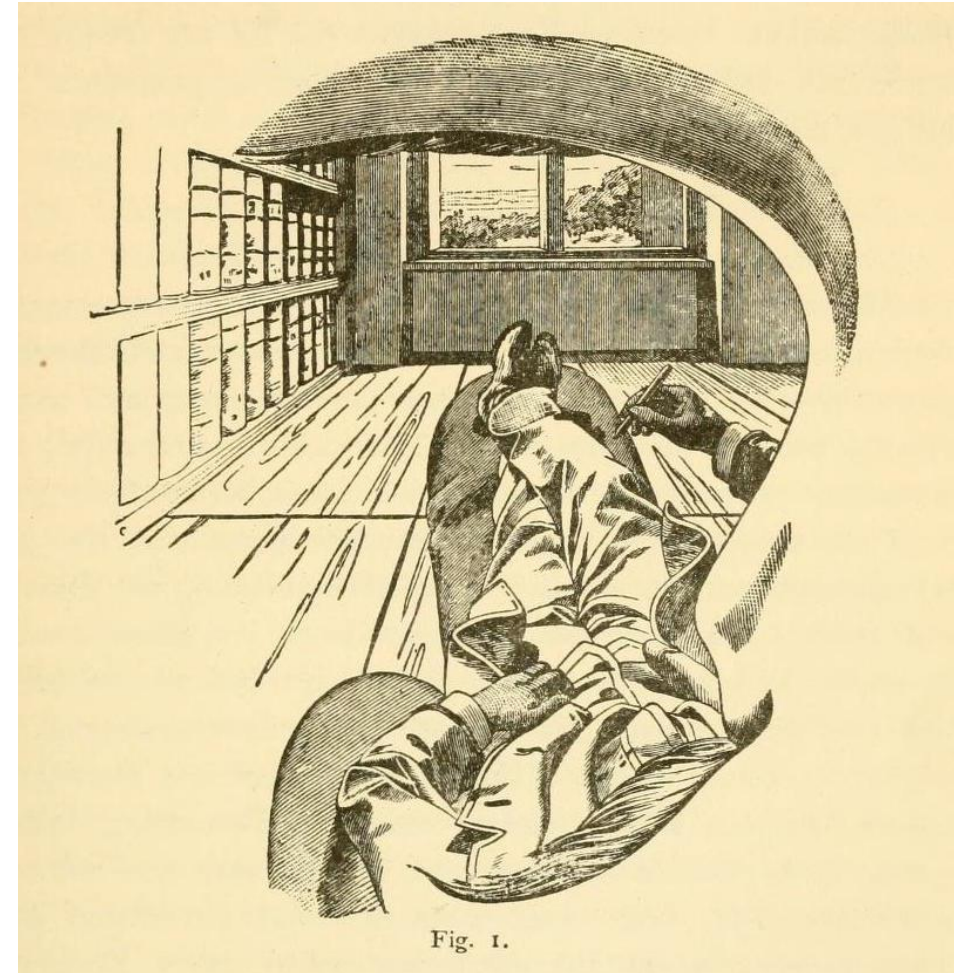
Principles of Evolution

What
sounds
make
music?

Familiarity
or
Experience

Modern day implications

- Standardisation of measures to fundamental quantities (SI)
 - General Conference on Weights and Measures, 1960
 - Methods of Calibration
 - Device approach to physiology
-
- Copenhagen interpretation (Bohr school)
 - “the observer is part of the system”



Self-Portrait by Ernst Mach (1886)