Self-Illustrating Phenomena

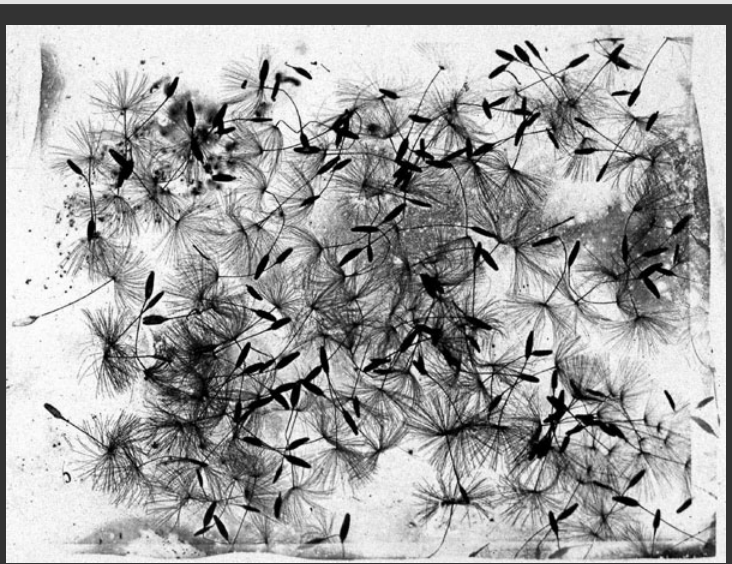
Pat Hanrahan

Two Points

1. Visualization adds observation to computational experiments
2. Photography and imaging play a major role in scientific imagery

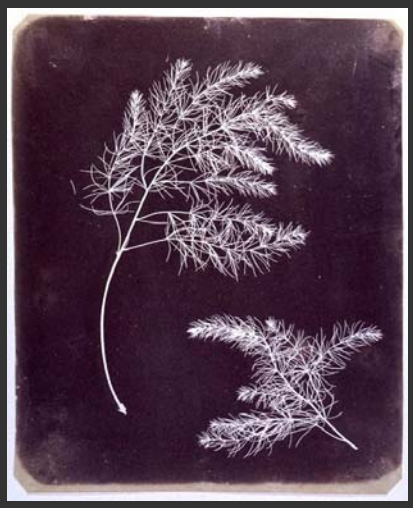
Early Photography

Talbot



http://www.foxtalbot.arts.gla.ac.uk/resources/seeds.html

Talbot



http://www.foxtalbot.arts.gla.ac.uk/resources/ferns.html

Daguerre

http://www.usc.edu/schools/annenberg/asc/projects/comm544/library/images/453.html

Graphical Methods

Watt Indicatrix

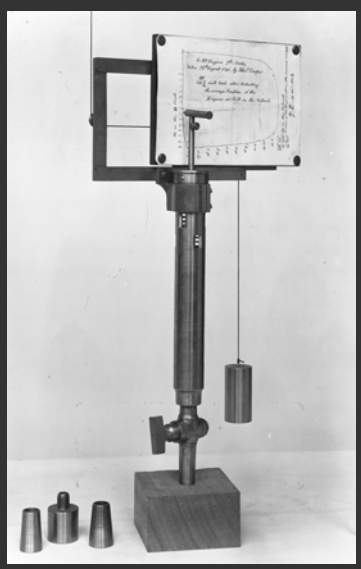
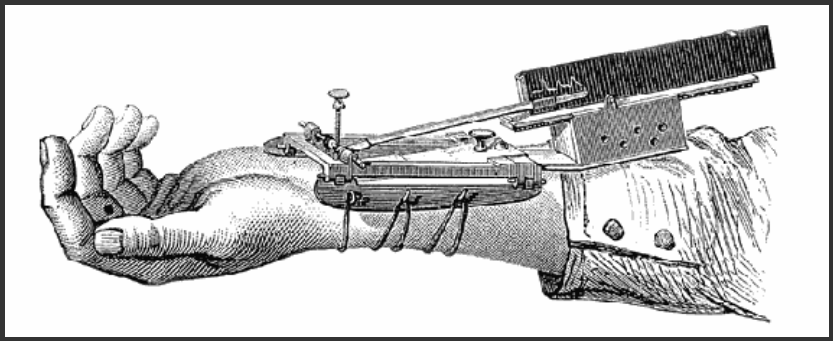
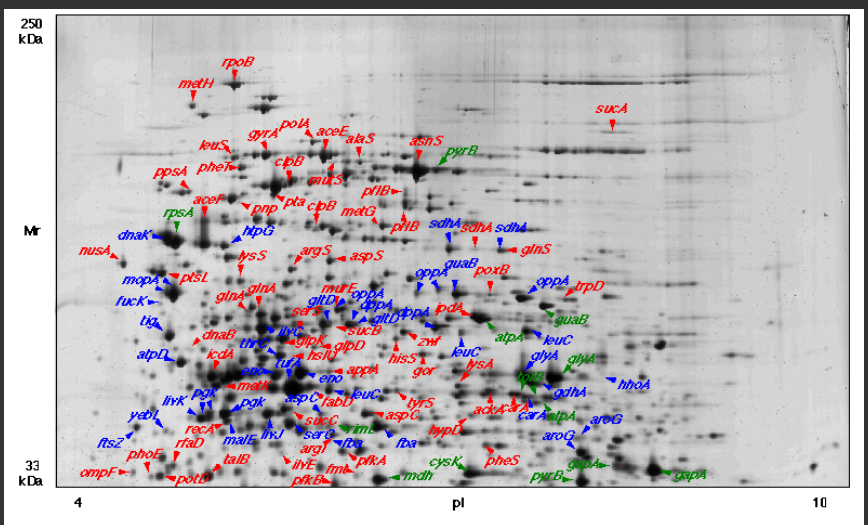


Chart Recorders



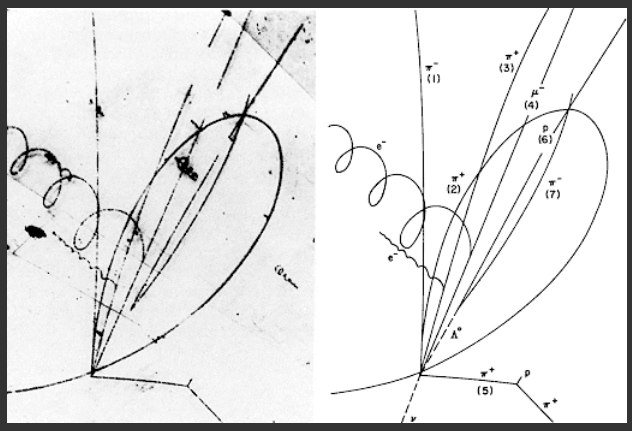
Marey's sphygmograph
1860

2D electrophoresis



http://us.expasy.org/ch2d/publi/ecoli.html

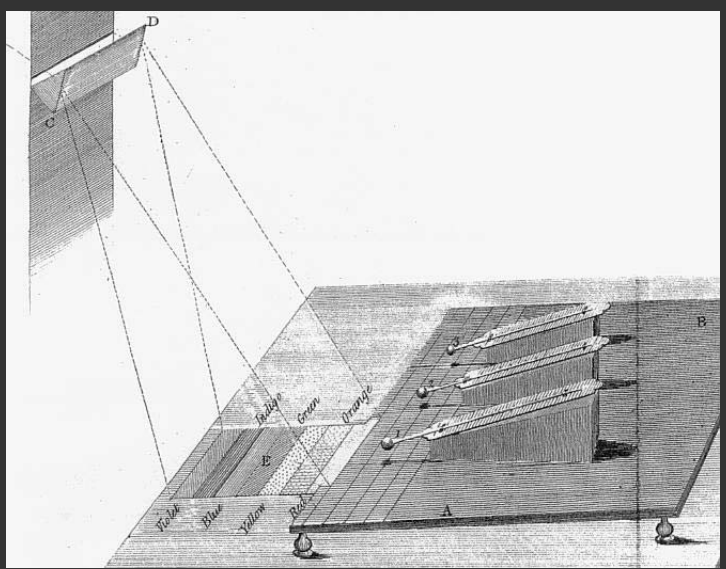
Cloud/Bubble Chamber



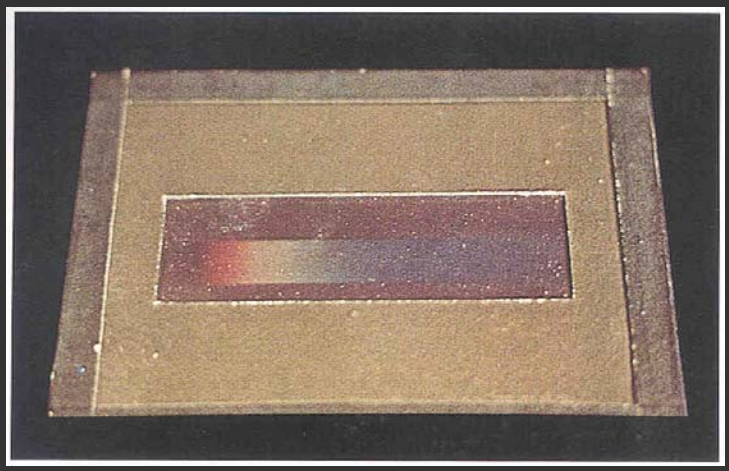
Discovery of the charmed baryon

http://www.bnl.gov/bnlweb/history/charmed.htm

Herschel Discovery of Infrared

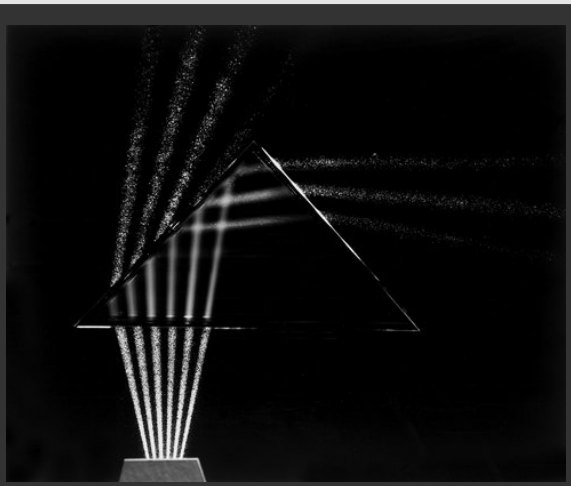


Photograph of a Spectrum



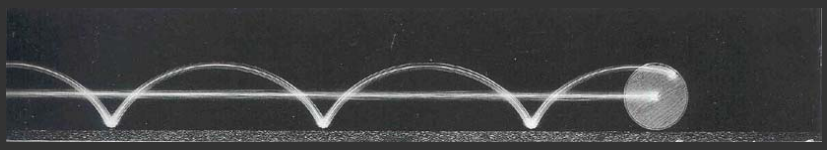
John Draper, Experimental spectrum, Daguerrotype, 1842

Beams of Light



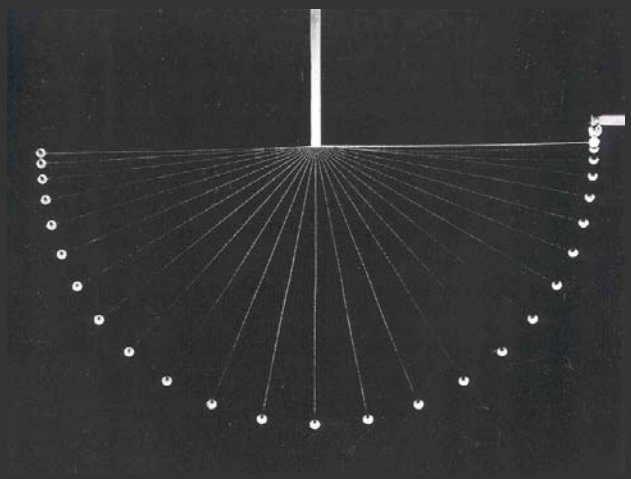
Berenice Abbott
***Beams of Light Through Glass,* about 1960**
The Minneapolis Institute of Arts, Gift of William R. Hibbs Family

Rolling



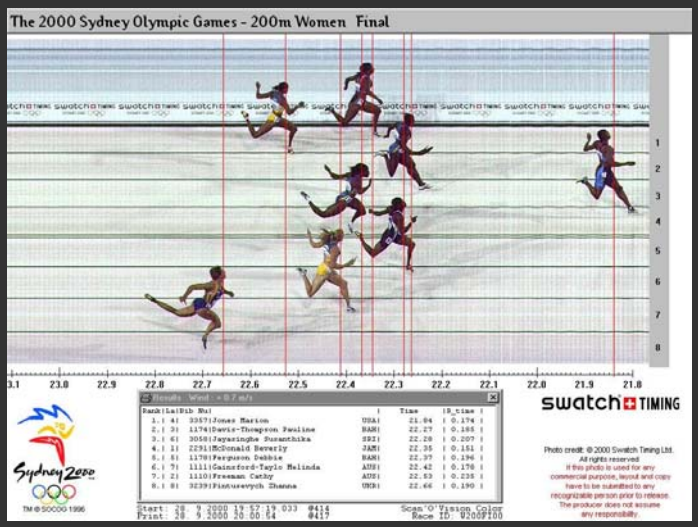
Berenice Abbott
***Cycloid: A Light Trace by Time Exposure,* about 1960**
National Gallery of Canada, Ottawa

Energy



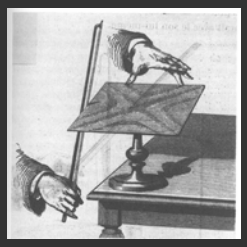
Berenice Abbott
***Transformation of Energy,* about 1960**
National Gallery of Canada, Ottawa

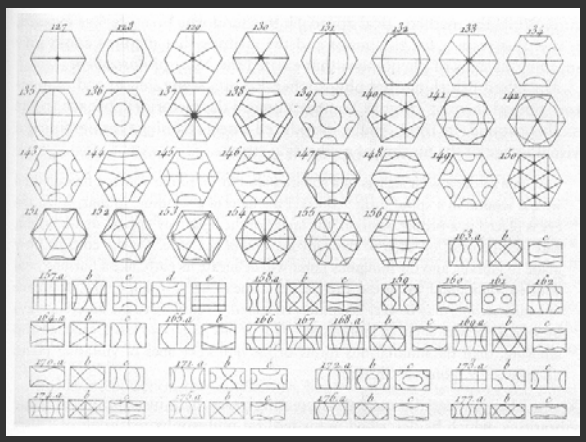
Slit-Scan Photofinish



Self-Illustrating Phenomena

Chladni Diagrams

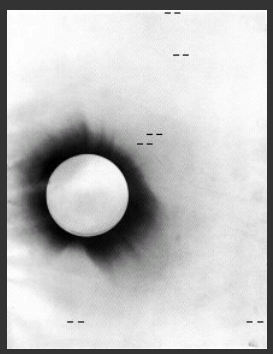


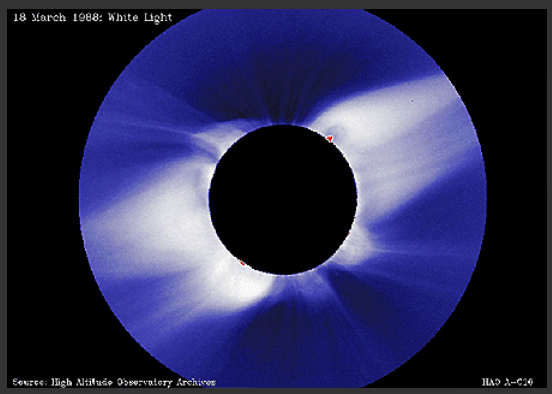


Modes of a Violin

http://www.phys.unsw.edu.au/~jw/patterns1.html

Solar Corona

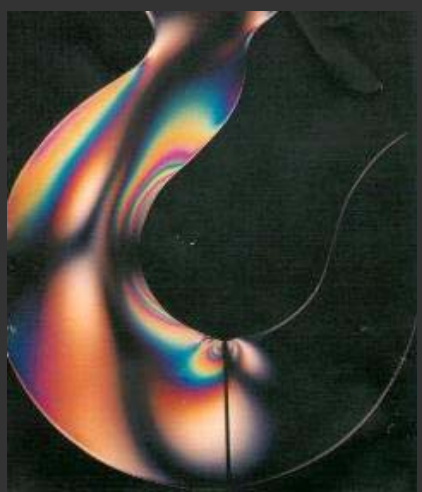




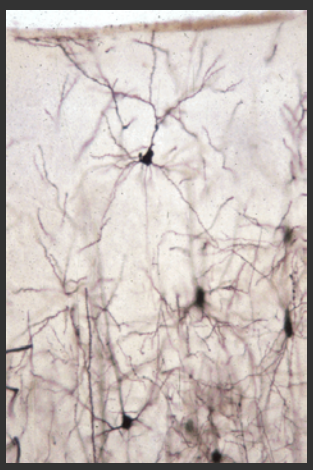
http://sci.esa.int/content/doc/1b/13851_-1.jpg

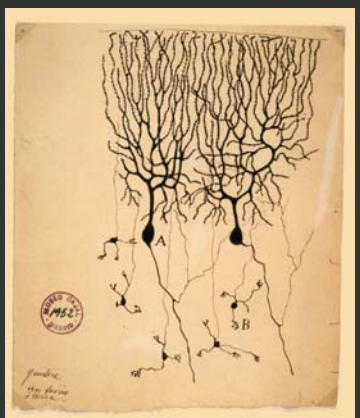
http://www.hao.ucar.edu/public/education/slides/slides.html

Photoelasticity



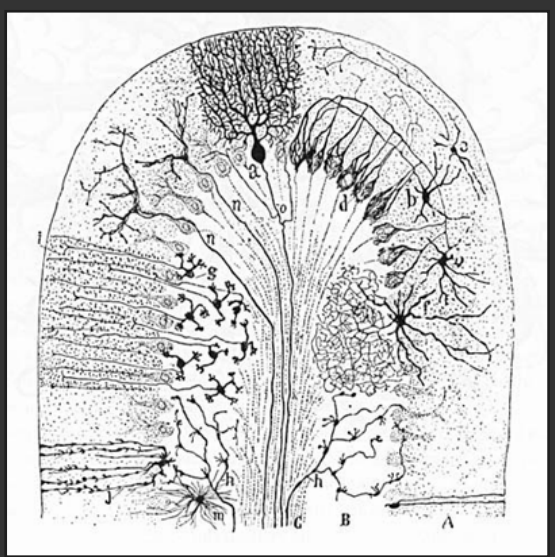
Golgi Stain – Cajal Drawing





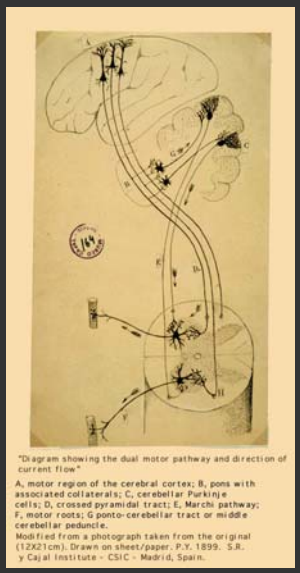
"Pigeon cerebellum. A, Purkinje cell, B, granule cell
Modified from a photograph taken from the original
(14X15.5 cm). Drawn on sheet/paper. P.Y. 1899. S.R.
y Cajal Institute - CSIC - Madrid, Spain.

Cajal



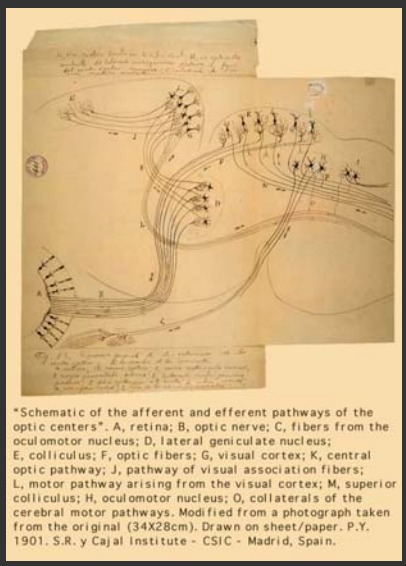
Santiago
Ramon Y Cajal (1894)
Cell Types in the Cerrebellum
From Robin, p. 44

Cajal



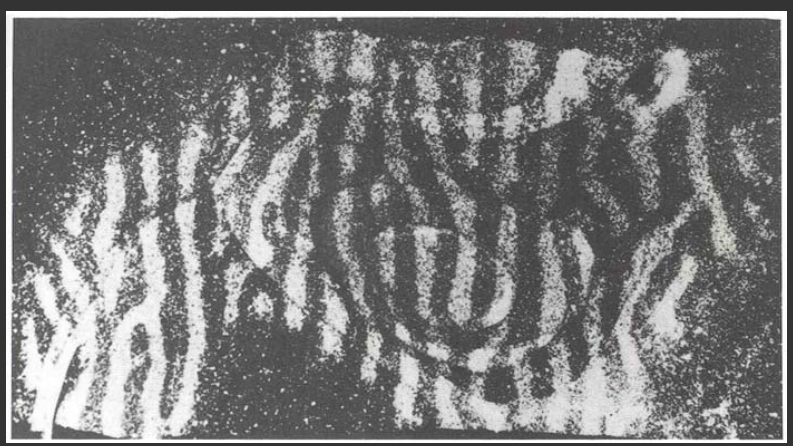
"Diagram showing the dual motor pathway and direction of current flow"

A, motor region of the cerebral cortex; B, pons with associated collaterals; C, cerebellar Purkinje cells; D, crossed pyramidal tract; E, Marchi pathway; F, motor roots; G ponto-cerebellar tract or middle cerebellar peduncle.
Modified from a photograph taken from the original (12X21cm). Drawn on sheet/paper. P.Y. 1899. S.R. y Cajal Institute - CSIC - Madrid, Spain.



*Schematic of the afferent and efferent pathways of the optic centers". A, retina; B, optic nerve; C, fibers from the oculomotor nucleus; D, lateral geniculate nucleus; E, colliculus; F, optic fibers; G, visual cortex; K, central optic pathway; J, pathway of visual association fibers; L, motor pathway arising from the visual cortex; M, superior colliculus; H, oculomotor nucleus; O, collaterals of the cerebral motor pathways. Modified from a photograph taken from the original (34X28cm). Drawn on sheet/paper. P.Y. 1901. S.R. y Cajal Institute - CSIC - Madrid, Spain.

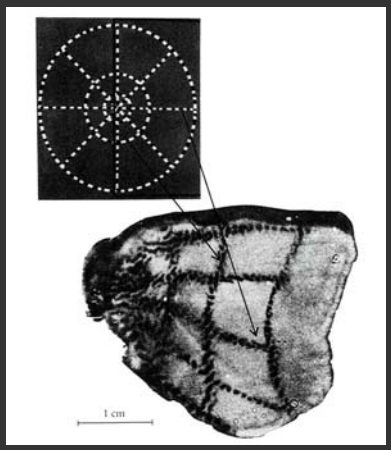
Ocular Dominance Columns



2-deoxyglucose with 1 eye open

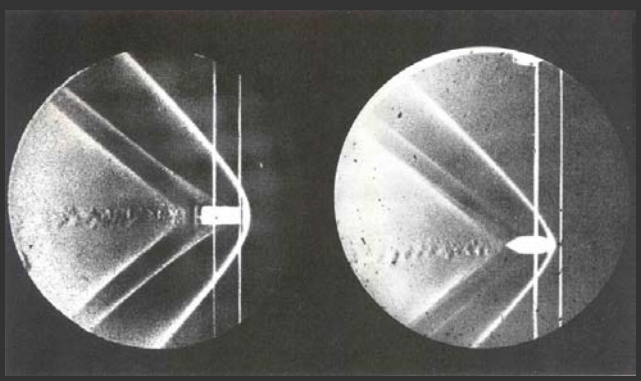
From Hubel

Retinal Mapping



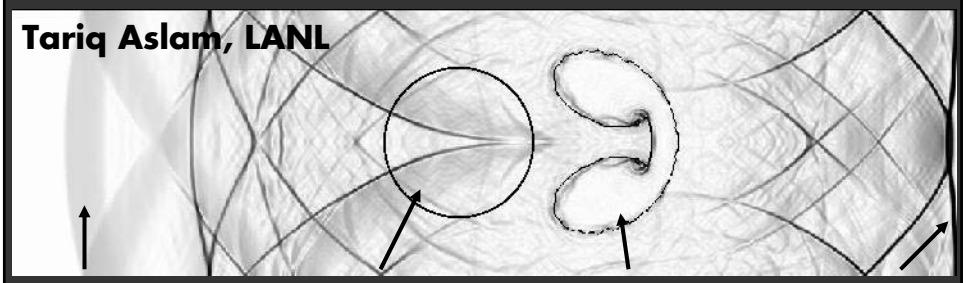
Striate cortex w/ 2-deoxyglucose with radial target
DaValois and DaValois, From Hubel

Shock Wave

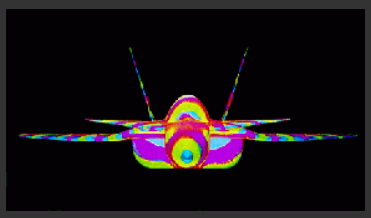


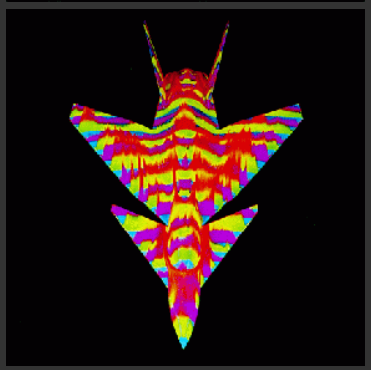
Ernst Mach
Shock waves from Bullets, 1888

From Physics to Phenomena



Air Flow





Eric Schulzinger (1988)
Air-Flow on a Supersonic Aircraft
From Robin, p. 141

Turbulence

Final Thoughts

- Instrumentation and photography
- Continuum between question, hypothesis, experiment, analysis, visualization and conclusion
- From measurements to phenomena to illustration
- One image = One answer
- All visualizations involve context, manipulation and interpretation