



Colour, sound and other “secondary” qualities between subject and object

Oliver Passon
Bergische Universität Wuppertal
Physik und ihre Didaktik

Is this apple red because of the experience it produces in us when we see it, or does it produces this experience in us because it is red?”



Overview

Traditional vs. phenomenological physics



Color, sound (and other “**secondary qualities**”) in the philosophy since Galilei



Kepler and Newton: the development of **modern physics and optics**



The camera obscura as metaphor in the **philosophy of perception** (and a bit on the qualia debate)



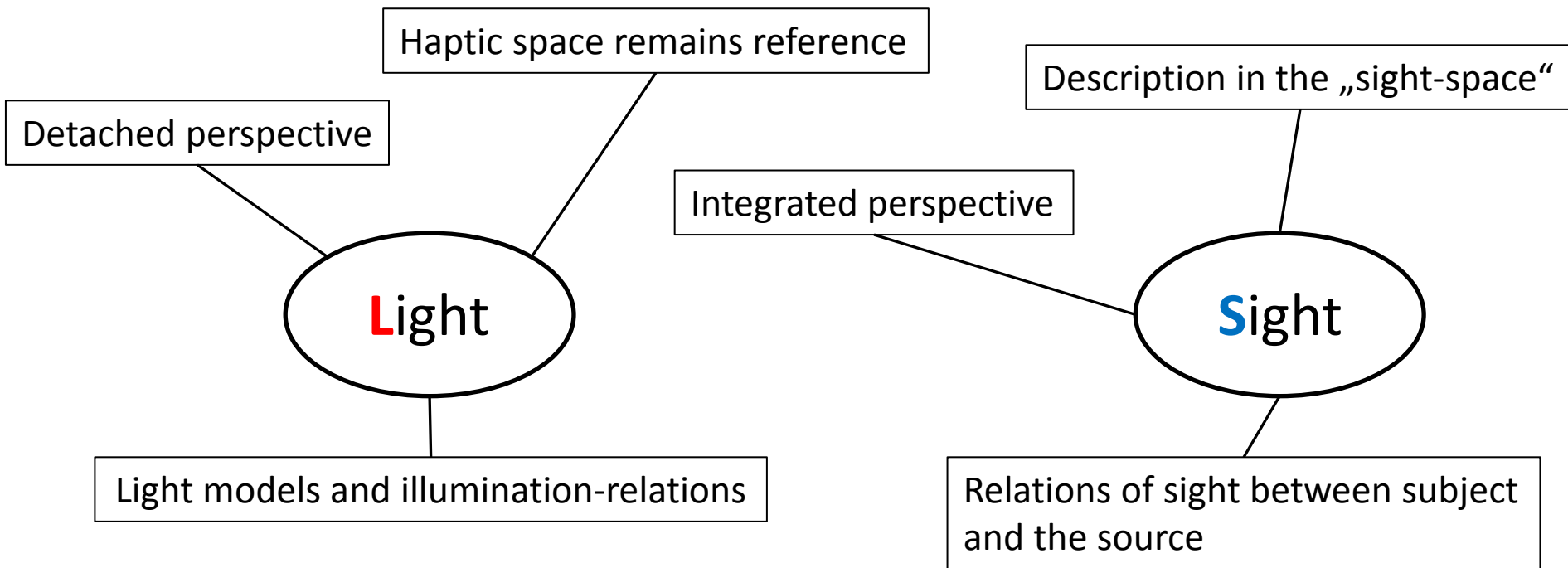
A tentative synthesis:
color between subject and object

„traditional physics“

- Explanation with models
- Elimination of the des subject

„phenomenological physics“

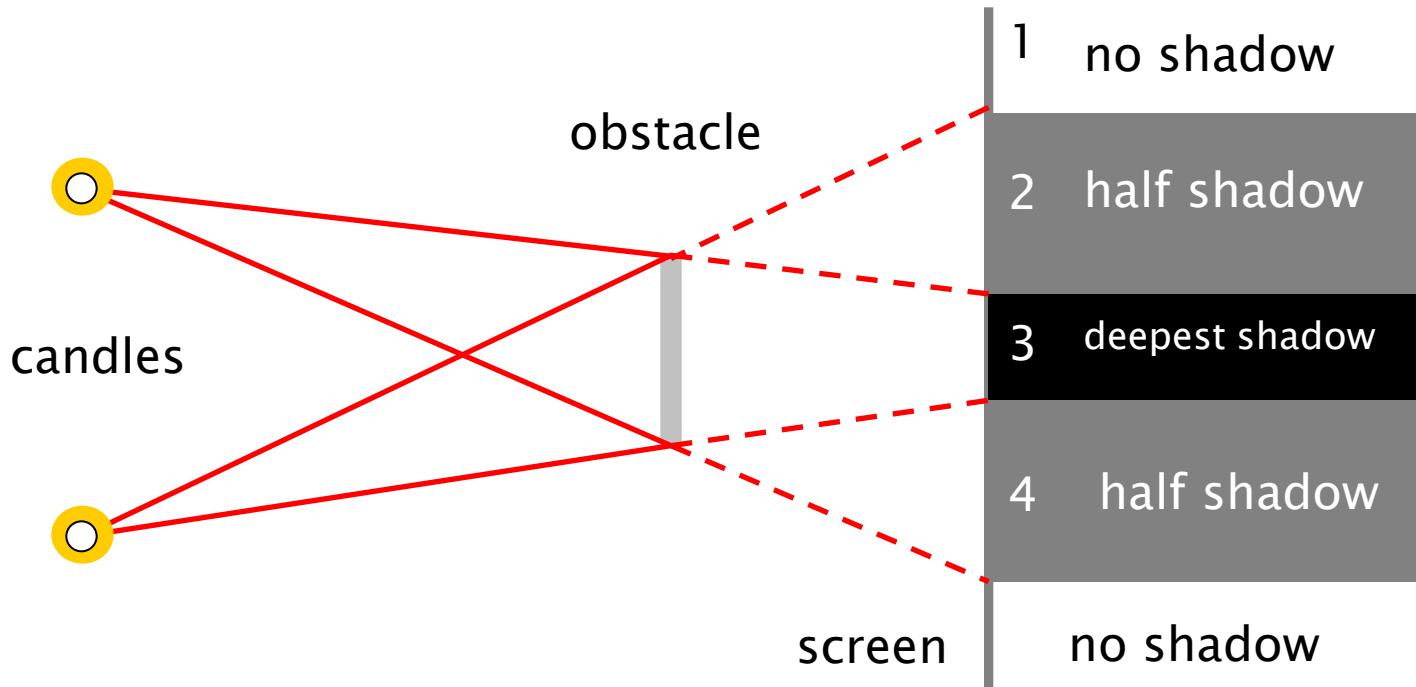
- Conditions of appearance
- Integration of the subject



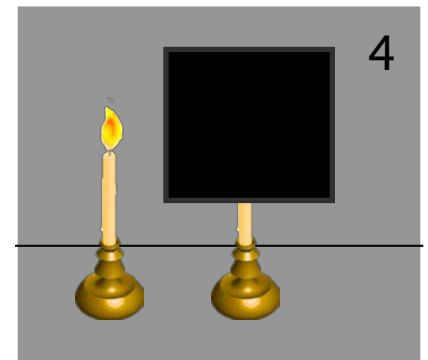
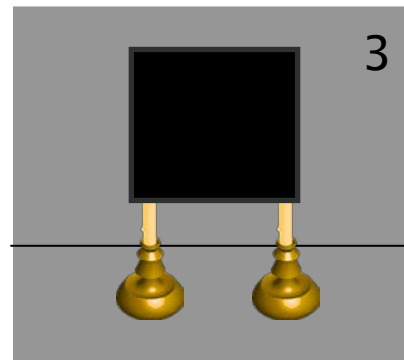
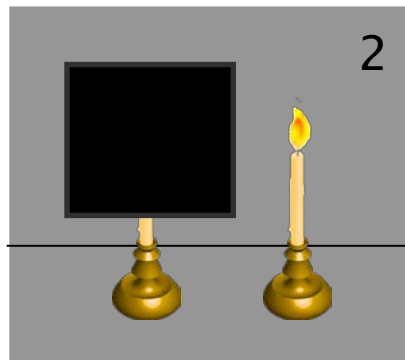
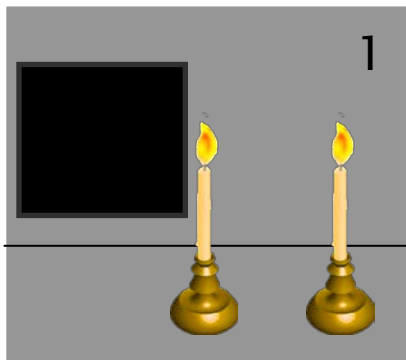
Mackensen, M und **H. Ch. Ohlendorf** (1998) „Modellfreie Optik“, Kassel, Pädagogische Forschungsstelle

Maier, G. (2003) „Optik der Bilder“, Dürna: Kooperative Dürna.

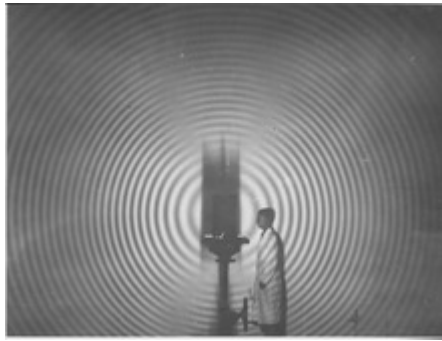
Detached and integrated perspective



The places are bright which are reached by the light. Shadow is the absence of light



The places are bright (dark) from which bright (dark) things can be seen.



EINFÜHRUNG IN DIE MECHANIK UND AKUSTIK



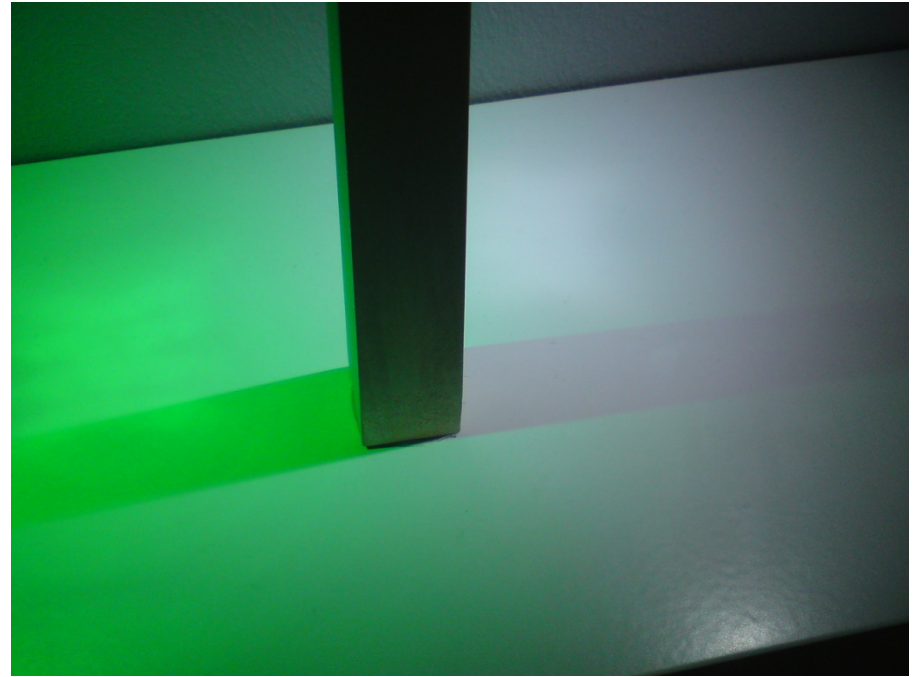
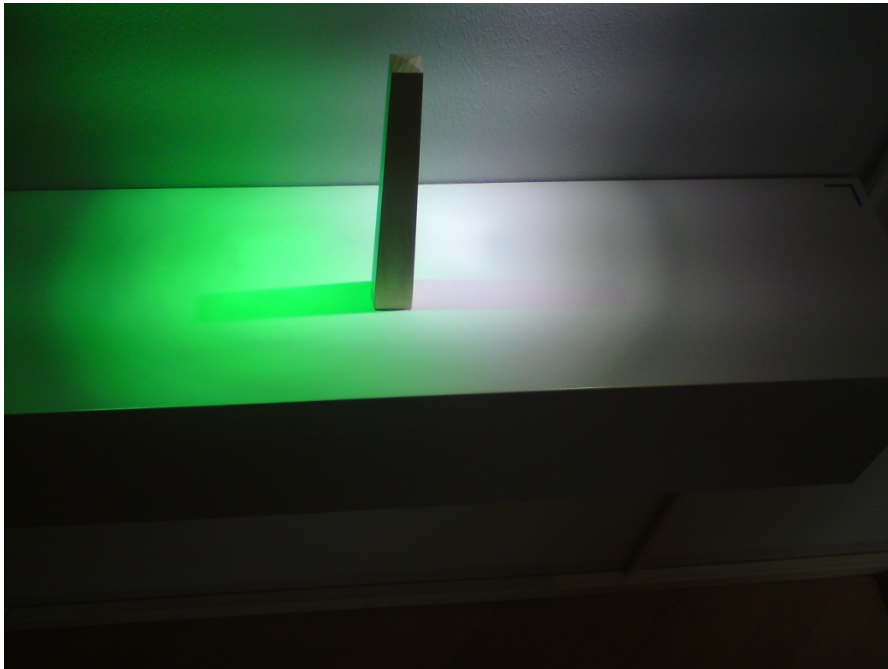
Robert Wichard Pohl
(1884-1976)

Bei tieferem Eindringen in die Physik erkennt man gar bald den Nutzen und die Schwäche des alten Einteilungsschemas und zugleich die Tendenz des physikalischen Fortschritts: Man sieht eine ständig wachsende, oft verblüffende Vereinheitlichung scheinbar ganz wesensverschiedener Dinge unter bewußter Ausschaltung aller menschlichen Züge. Der beobachtende und beschreibende Mensch tritt mehr und mehr in den Hintergrund. — Trotz allen Fortschritts in dieser Richtung steckt jedoch auch heute noch in unsern physikalischen Darstellungen mehr Subjektives, Menschliches, als der Anfänger annimmt.

Pohl, 1. Auflage (1930) , S. 1

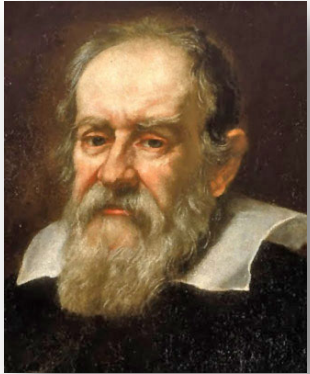
Die Physik ist eine Erfahrungswissenschaft. Ihre Grundlage bilden Beobachtungen, und zwar gelegentlich zufällige, meist aber planvoll angestellte. — Beobachten will gelernt sein, der Ungeübte kann leicht getäuscht werden. Wir geben einige Beispiele:

Pohl, 5./6. Auflage (1942) S. 1



“This experiment is very instructive: Colours are no proper subject for physics but for psychology and physiology only. The disregard of this has produced a lot of useless efforts.” R. W. Pohl

Secondary qualities since Galilei (until today)...



Galileo Galilei
(1564-1641)

Arguments from *Il Saggiatore* (1623) for the anti-realism of secondary qualities:

- Bodies can be imagined without the properties “sound”, “colour” or “odour” – but necessarily have the properties “location”, “number” and “shape”.



“However, I do not believe that in order to stimulate in us tastes, odors, and sounds, external bodies require anything other than sizes, shapes, quantity, and slow or fast motions. I think that if one takes away ears, tongues, and noses, there indeed remain the shapes, numbers, and motions, but not the odors, tastes, or sounds; outside the living animal these are nothing but names [...]”

G. Galilei in “*Il Saggiatore*” §7.2

→ economy postulate



Ernst Mach
(1838-1916)

Ernst MACH (1906): „*The analysis of sensation*“ (Dover publication, 1959)

“Bodies do not produce sensations, but complexes of elements (complexes of sensations) make up bodies.” (p. 29)



„Farben, Töne, Düfte des Körpers sind flüchtig. Es bleibt als beharrlicher nicht leicht verschwindender *Kern* das Tastbare zurück, welches als Träger der daran gebundenen flüchtigen Eigenschaften erscheint. **Die Gewohnheit hält nun den Gedanken an einen solchen Kern fest, auch wenn sich schon die Erkenntnis Bahn gebrochen hat, dass Sehen, Hören, Riechen und Tasten durchaus verwandt sind.** Hierzu kommt noch, dass dem Räumlichen und Zeitlichen infolge der eigentümlichen großen Entwicklung der mechanischen Physik eine Art *höherer Realität* gegenüber den, Tönen, Düften und Farben zugeschrieben wird. Dementsprechend erscheint das zeitliche und räumliche Band von Farben, Tönen, Düften *realer* als diese selbst. Die Physiologie der Sinne legt aber klar, dass Räume und Zeiten ebenso gut Empfindungen genannt werden können als Farben und Töne. Hiervon später.“ (aus §3 und 4 der „*Antimetaphysischen Vorbemerkungen*“)

“Colors, sounds, and the odors of bodies are evanescent. But their tangibility, as a sort of constant nucleus, not readily susceptible of annihilation, remains behind; appearing as the vehicle of the more fugitive properties attached to it. **Habit, thus, keeps our thought firmly attached to this central nucleus, even when we have begun to recognize that seeing hearing, smelling, and touching are intimately akin in character.** A further consideration is; that owing to the singularly extensive development of mechanical physics a kind of higher reality is ascribed to the spatial and to the temporal than to colors, sounds, and odors. Accordingly, the temporal and spatial links of colors, sounds, and odors appear to be more real than the colors, sounds and odors themselves. The physiology of the senses, however, demonstrates, that spaces and times may just as appropriately be called sensations as colors and sounds. But of this later.”
(MACH 1906 p. 8)



Erwin Schrödinger
(1887-1961)

Erwin SCHRÖDINGER's work on colour metric (≈ 1920) was apparently influenced by Mach.

- All observations are based upon sensations in the end...
- ... one should not claim „differences in reality“ between different subdomains of physics...
- “Three-dimensional colour-space has the same reality as the point-space of mechanics”

“Physics gives us no reason for taking colours as primary qualities [...] and the philosophical principle of economy of postulation then supplies a reason for not introducing supposedly objective qualities of kinds for which physics has no need.”

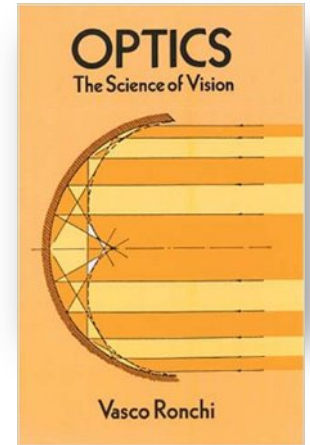
J. L. **Mackie** (1976) *Problems from Locke*, OUP, p. 20

“People universally believe that objects look colored because they are colored, just as we experience them. The sky looks blue because it is blue [...]. As surprising as it may seem, these beliefs are fundamentally mistaken. Neither objects nor lights are actually ‘colored’ in anything like the way we experience them. Rather, color is a psychological property of our visual experiences when we look at objects and lights, not a physical property of those objects or lights.”

S. K. **Palmer** 1999, p. 95

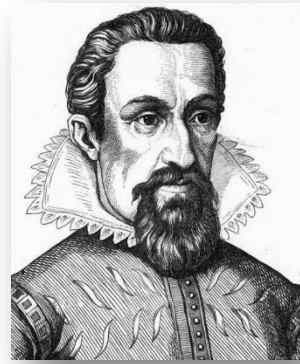
Physicalism → subjectivism about secondary qualities

The beginning of modern science

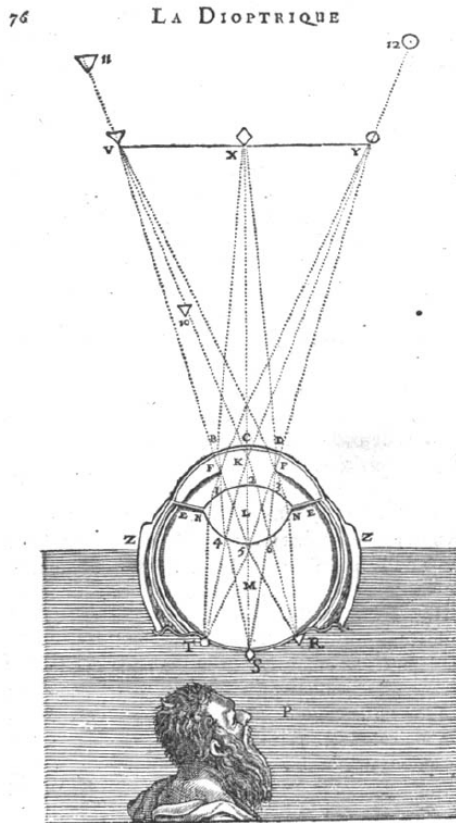


- Ancient physics was (until medieval times) anthropomorphic
- Until the late medieval times: **lux** denotes the sensation
- Since then this was recognized as representing a physical agent, called **lumen**
- With the advent of the heliocentric world picture such an anthropomorphic science lost all plausibility
- Modern physics sticks to the form of ancient science. However, its content is exchanged
- **Thesis:** modern optics speaks of „light“, refers to the late medieval „**lumen**“ and provokes the misconception of referring to „**lux**“ (Analogue with acoustics)

The beginning of modern optics with Kepler



Johannes Kepler
(1571-1630)



Founded geometrical optics in (almost) its current formulation

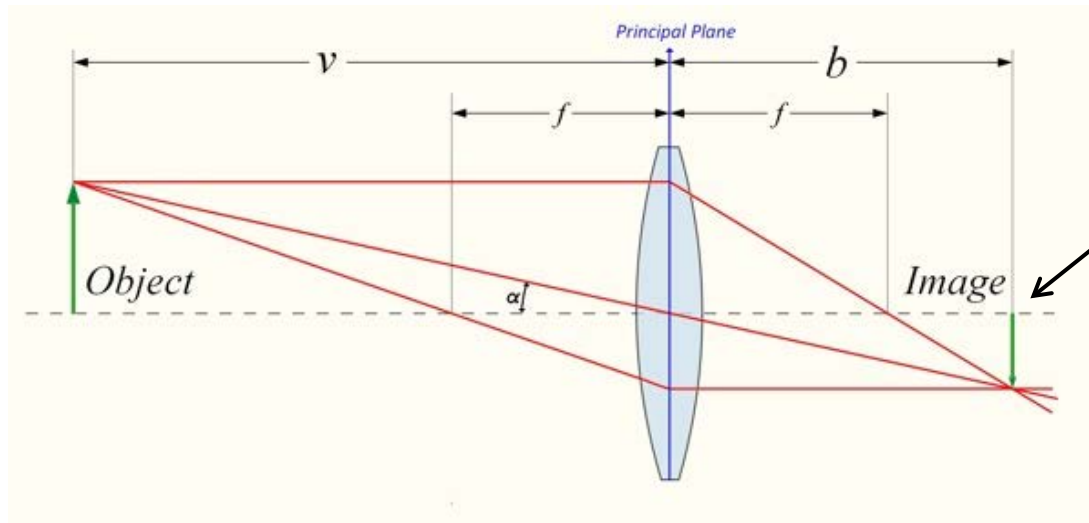
Explanation of the picture formation within the eye by a divergent light-bundle which gets evert by the eye-lens onto the retina.

The point of convergence on the retina corresponds to (spatial) position and size of the object.

However:

Kepler distinguished between the geometrical picture/mapping on the retina („**pictura**“) and the seen picture („**imago**“).

This corresponds to the **Lumen-Lux** distinction



„*pictura – imago*“
distinction get lost
Or rather: it degenerates
into the „real“ vs. „virtual“
picture distinction

Die auf Kepler folgende Entwicklung der optischen Wissenschaft wurde davon geprägt, dass man von der Wirklichkeit des Bildes als solchem absah und eine räumliche Abbildungslehre abgrenzte. In dieser bedeutet »Bild« so etwas wie »Konvergenzpunkt eines Lichtstrahlenbündels«.

Holtsmark (1976, S. 200)

Image = converging point of a light ray bundle

However:

Color is left out in this being „geometrized“ or „materialized“

Newton: A new Theory about Light and Colors (1672), Opticks (1704)

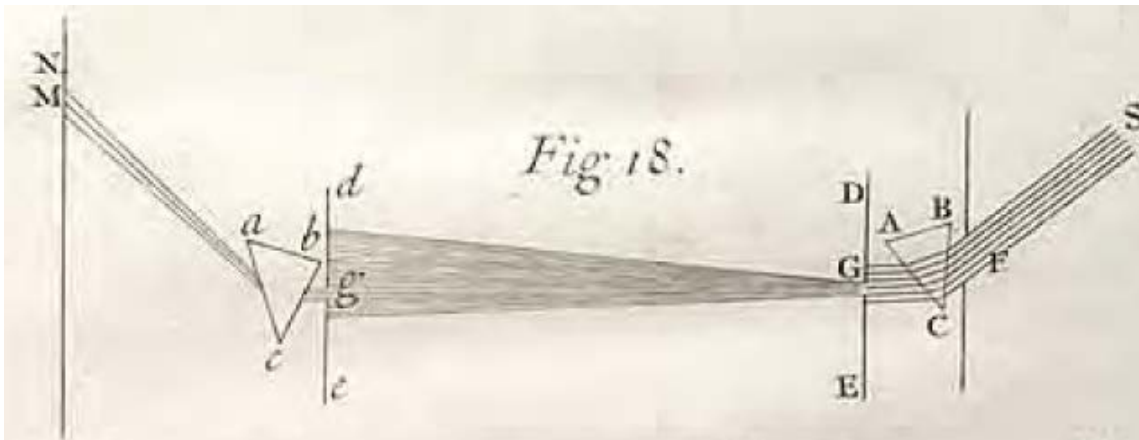
[90]

From all which it is manifest, that if the Senforium,

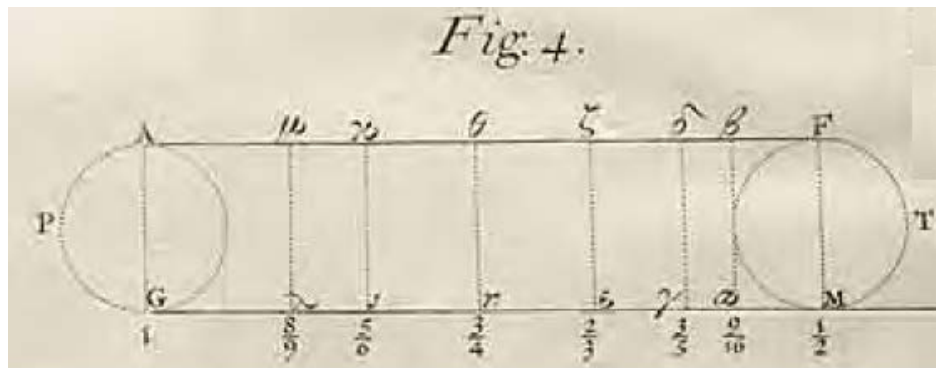
[91]

into the Sensorium, and

„For the rays to speak properly are not coloured. In them there is nothing else than a certain power and disposition to stir up a sensation of this or that Colour. [...] So Colours in the Object are nothing but a disposition to reflect this or that sort of rays more copiously than the rest; in the rays they are nothing but their disposition to propagate this or that motion into the Sensorium, and in the Sensorium they are sensations of those Motions under the forms of Colours.“



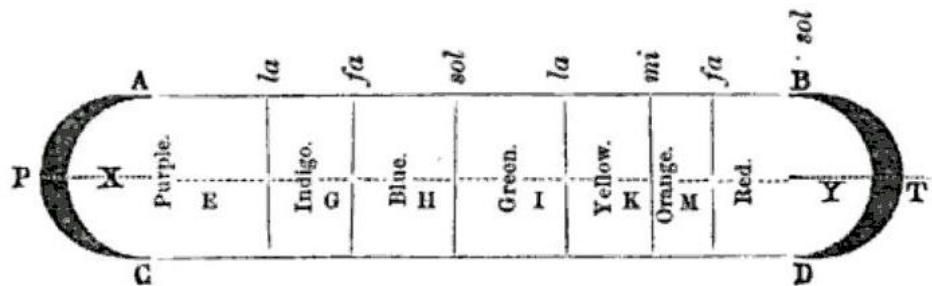
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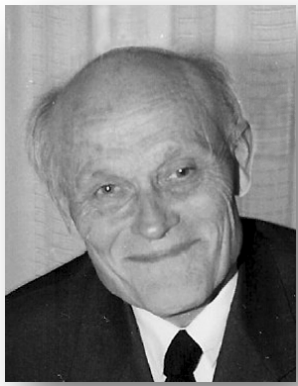
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Spectre: a) An apparition, phantom, or ghost, esp. of a terrifying nature or aspect, b) An unreal object of thought; a phantasm of the brain.

Oxford English Dictionary



Brewster, 1822



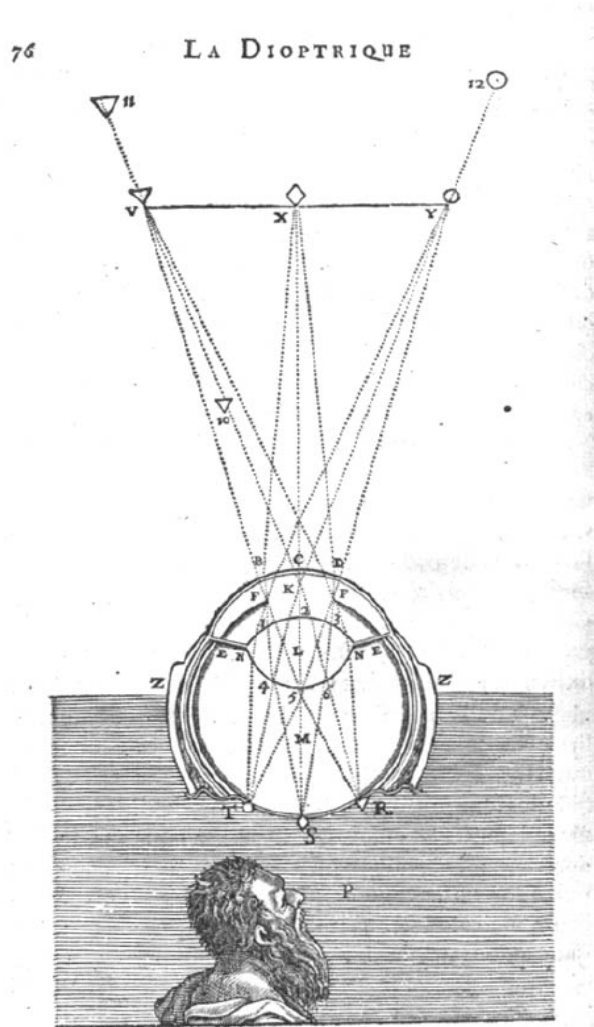
**Torger Holtsmark
(1924-2014)**

Durch die Wirksamkeit Keplers ist im Laufe der Zeit das »Bild« physikalisiert worden. Das Bild wurde in den Raum hinausgeschleudert. Durch das Werk Newtons wurde die Farbe aus dem Raum in das psychische Innere gestoßen, und dies geschah wohlgemerkt im selben Augenblick, als die Newtonsche Optik sich als die moderne Lichtlehre etablierte.

Holtsmark (1963, S. 148)

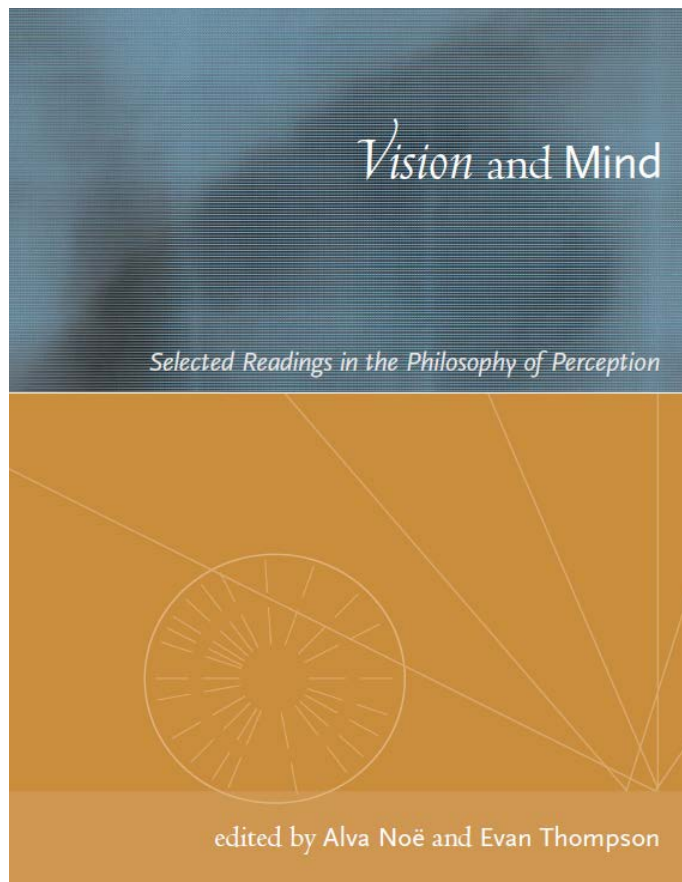
“The image become geometrized while color “immaterialized” (or “sublimated”). Optics was split in two parts!”

The camera obscura as metaphor for perception in Descartes



- DESCARTES (Dioptrik 1637, Chapter 5): Our eyes do not allow for a direct perception of the material world. They are only the place where there is a picture of it („Of the pictures in the eye “)
- „representational“ position – perception does not mean to look into the world but to look into oneself only.

The philosophy of perception is a microcosm of the metaphysics of mind. Its central problems—*What is perception? What is the nature of perceptual consciousness? How can one fit an account of perceptual experience into a broader account of the nature of the mind and the world?*—are problems at the heart of metaphysics.



WHAT IS IT LIKE TO BE A BAT?

Thomas Nagel

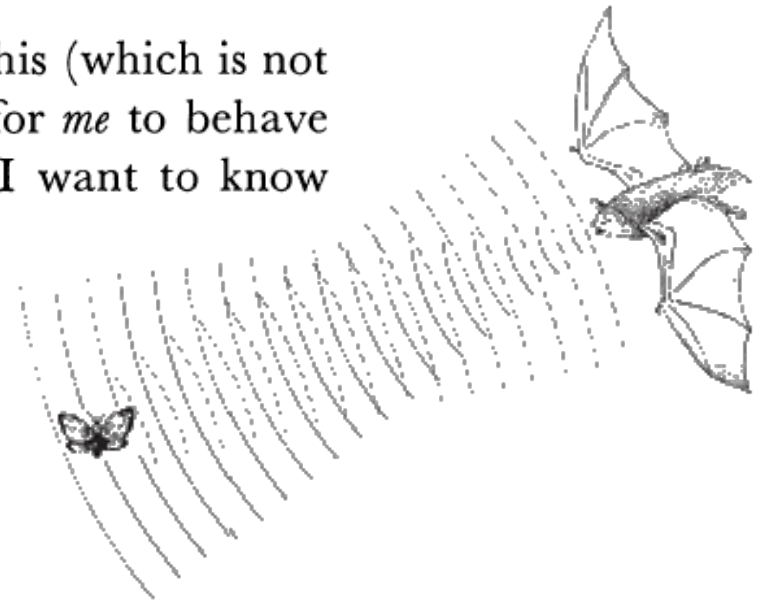
The Philosophical Review, Vol. 83, No. 4. (Oct., 1974), pp. 435-450.

CONSCIOUSNESS is what makes the mind-body problem really intractable. Perhaps that is why current discussions of the problem give it little attention or get it obviously wrong.

[...]

But fundamentally an organism has conscious mental states if and only if there is something that it is like to *be* that organism—something it is like *for* the organism.

In so far as I can imagine this (which is not very far), it tells me only what it would be like for *me* to behave as a bat behaves. But that is not the question. I want to know what it is like for a *bat* to be a bat.



Nagel on the reductionist program in the philosophy of mind

- Reductionist explanations are a move to more objectivity and to a more detached perspective
- „Experience“ does not fit this scheme; it is inherently subjective and depends on a specific perspective.

If the subjective character of experience is fully comprehensible only from one point of view, then any shift to greater objectivity—that is, less attachment to a specific viewpoint—does not take us nearer to the real nature of the phenomenon: it takes us farther away from it.

If we acknowledge that a physical theory of mind must account for the subjective character of experience, we must admit that no presently available conception gives us a clue how this could be done.

This should be regarded as a challenge to form new concepts and devise a new method—an objective phenomenology not dependent on empathy or the imagination.

[...]

But whether or not this guess is correct, it seems unlikely that any physical theory of mind can be contemplated until more thought has been given to the general problem of subjective and objective. Otherwise we cannot even pose the mind-body problem without sidestepping it.¹⁶

THOMAS NAGEL

Princeton University

Nagel et al.:

subjectivism about SQ $\rightarrow \neg$ (physicalism)

„Galilei“ et al.:

physicalism \rightarrow subjectivism about SQ

physicalism $\rightarrow \neg$ (physicalism)

Schrödinger, Mach:

Primary and secondary qualities are not strictly separated \approx objectivism about SQ



Nagel:

Subjectivism about SQ $\rightarrow \neg$ (physicalism)



But whether or not this guess is correct, it seems unlikely that any physical theory of mind can be contemplated until more thought has been given to the general problem of subjective and objective. Otherwise we cannot even pose the mind-body problem without sidestepping it.¹⁶

THOMAS NAGEL

Princeton University

John Hyman (2006): The objective eye

„Is an apple red **because** of the experience it produces in us when we see it, **or** does it produce this experience in us **because** it is red?“ (p. 53)



- Symmetry between **subjective** und **objective** stance
- The alternatives appear complete and disjoint

However:

- The first „**because**“ is analytic: the second part of the proposition explains the meaning of „being-red“
- The second „**because**“ is causal: The property “colour” is producing the sensation.

- Hyman twist: „neither– nor“
- Property and perception are in no relation of mutual explanation
- Both have the same cause: the microstructure of the skin etc. (→ subjectivism wrong)
- However, the der objectivism needs to be qualified. Colors...
 - are „logically“ independent from the perception
 - can not be identified with physical properties
 - are „epistemic“ dependent from the perception

We may be wrong with our color judgments – but we are the only persons who can be even wrong...

Hyman line of argument

Starting point: analysis of implicit assumption within our color statements and color judgments

An objects color is „part of its appearance“, this implies:

- „color“ can be only a property of visible things
- „color“ causally inert (except for the implications of being observed)
- „color“ falls under the „epistemic jurisdiction“
- ...
- These statements are no factual assumptions. They explicate the very meaning of our color statements (Quine: truth has linguistic and extra linguistic facets)
- The principle-of-economy argument becomes obsolete

Galilei: Without eyes, noses and ears (i.e. without sense-perception) color, odor and sound would be annihilated.

Hyman: Without color, odor and sound all sense-perception would be annihilated.

Take home message:

Object vs. subject

Detached perspective vs. Integrated perspective

Pictura vs. Imago

Lumen vs. Lux

subjectivism about SQ vs. objectivism about SQ

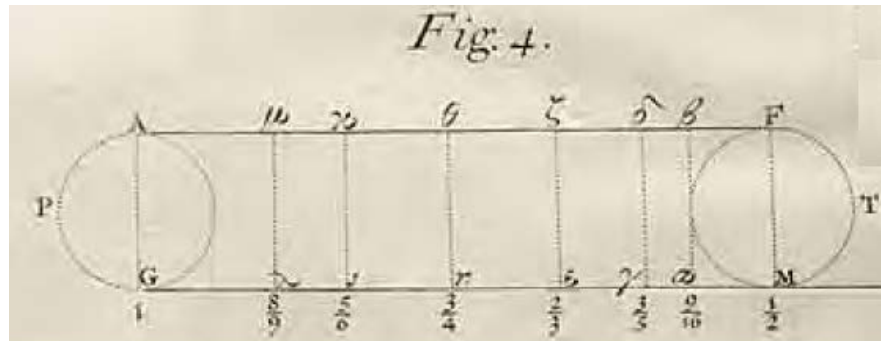
HYMAN: Colors are neither produced by our perception nor physical properties. →
Color objectivism and color subjectivism are wrong alternatives

→ an invitation to think the relation between these pairs anew?

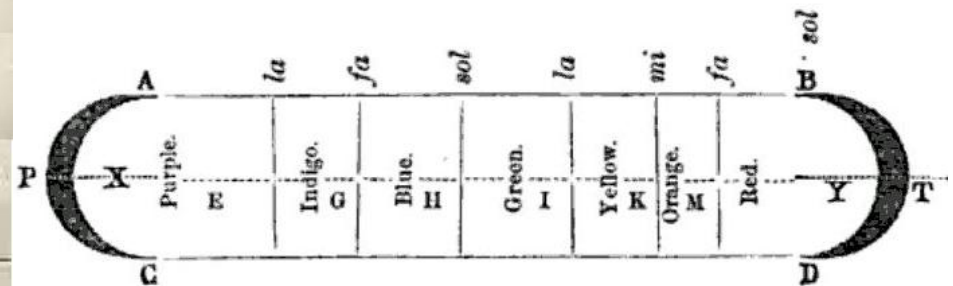
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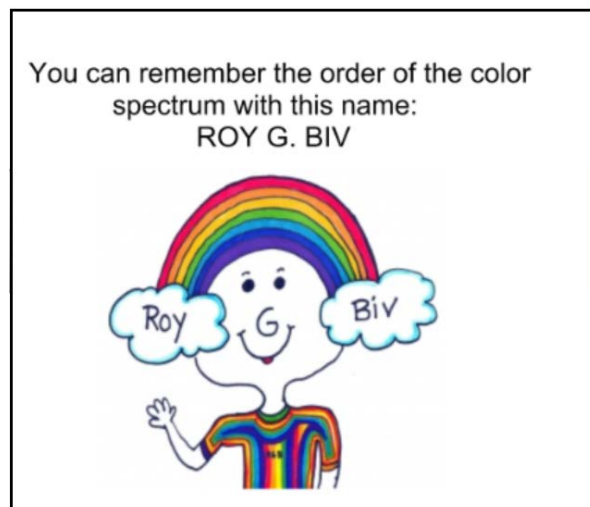
Vgl. Klaus Hentschel (2014) zur Wirkung der newtonschen Farbtaxonomie bis in das 19. Jhd.



Book I Part II Plate I



Brewster, 1822



Red Orange Yellow Green Blue Indigo Violet

Positionen der Farbphilosophie

- ***Eliminative Farbtheorien***

Gegenstände sind nicht farbig. Diese Eigenschaft wird fälschlich auf sie projiziert.

- ***Farb-Physikalismus***

Farben identifiziert mit Disjunktionen physikalischer Eigenschaften
(Jackson, Pargetter)

- ***Dispositionale Farbtheorien***

Farben identifiziert mit Dispositionen zur Hervorbringung ihrer Wahrnehmung

- ***Primitivistische Farbtheorien***

Farben supervenieren über physikalischen Eigenschaften und sind die kategoriale Basis für die Disposition ihre Wahrnehmung hervorzubringen