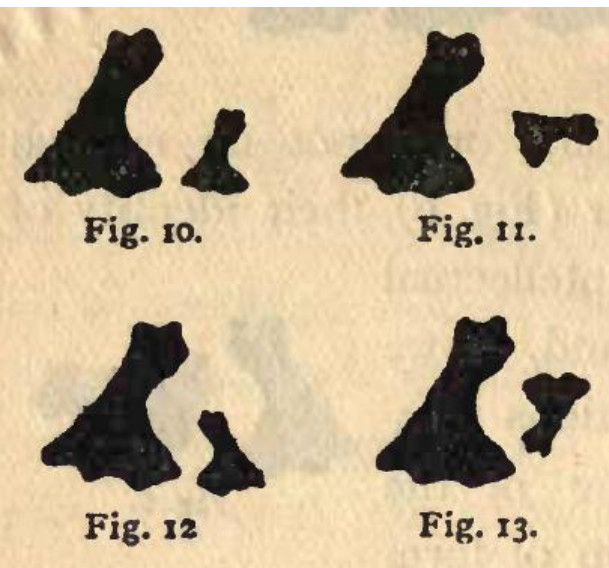


Ernst Mach, from Psychophysics to Gestalt and Erkenntnis-theory

“Some forty years ago [~1863], in a society of physicists and physiologists, I proposed for discussion the question, why geometrically similar figures were also optically similar. I remember quite well the attitude taken with regard to this question, which was accounted not only superfluous, but even ludicrous. Nevertheless, I am now as strongly convinced as I was then that this question involves the whole problem of gestalt seeing. That a problem cannot be solved which is not recognized as such is clear. In this non-recognition, however, is manifested, in my opinion, that one-sided mathematico-physical direction of thought [...].”

Ernst Mach



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Helsinki 28/09/2012

The Origin of “Gestalt”, Kaila’s Ideas and Finnish Science Education

- GTA and the Finnish Society for Natural Philosophy
- Kaila, Nevanlinna, Laurikainen, Kaarle Kurki-Suonio and Science Education
- 2009 idea of symposium on Kaila and Gestalt
- Cygnaeus and sensualism (Comenius, Froebel, Herbart)
- Mach, von Ehrenfels, Wertheimer & the origin of the new Gestalt concept
- Wertheimer’s articles

150 Years from Psychophysics to Gestalt

1863 Mach's lectures on psychophysics & intro
How did Mach get to the idea of Gestalt?

- Psychophysics
- Darwin's „Origin“, Genesis

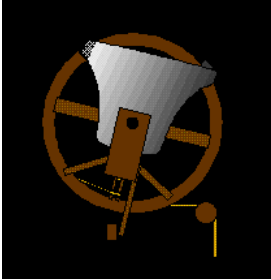


Ernst Mach's Psychology and Concept of Knowledge

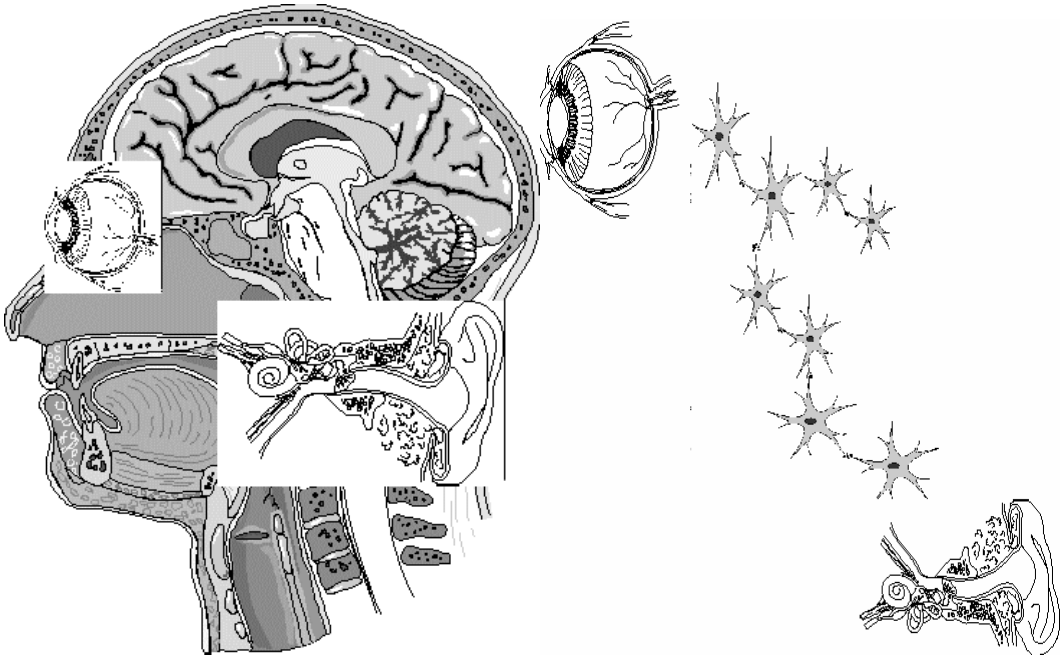
“In his essay *Transformation and Adaptation in Scientific Thought*, [Mach describes] one of the most characteristic ideas of modern science. [...] Knowledge is an expression of organic nature. The law of evolution, which is that of transformation and adaptation, applies to thoughts just as well as to individuals or any living organisms. A conflict between our customary train of thought and new events produces what is called the problem. By a subsequent adaptation of our thought to the enlarged field of observation, the problem disappears and through this extension of our sphere of experience, the growth of thought is possible. Thus the happiest ideas do not fall from heaven, they spring rather from notions already existing.”

Psychophysical sense elements

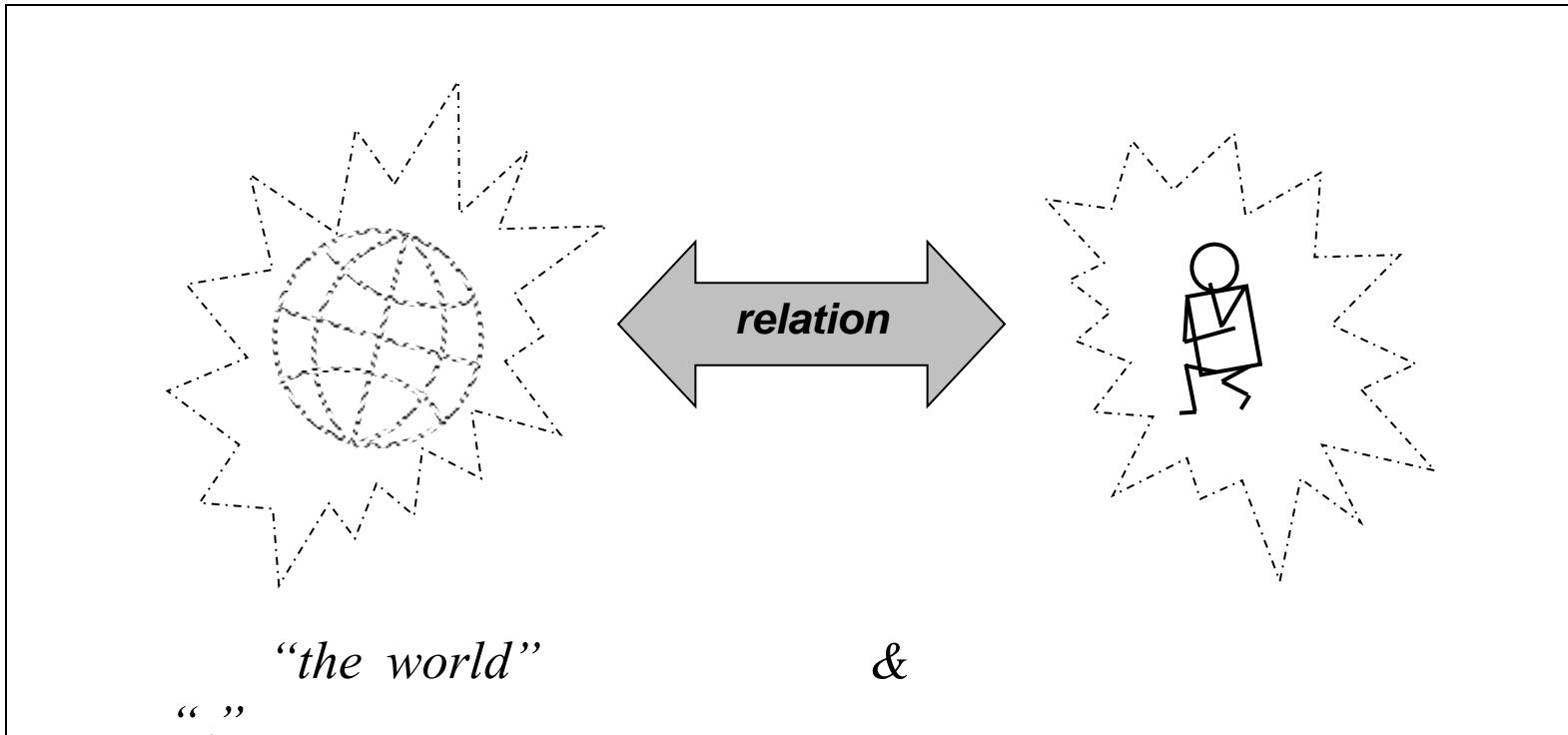
Physics - Somatosensorimotor Physiology – Psychology
→ no meaningful consistent “cut” possible



(training at central council of church bell ringers)



What do we really know?



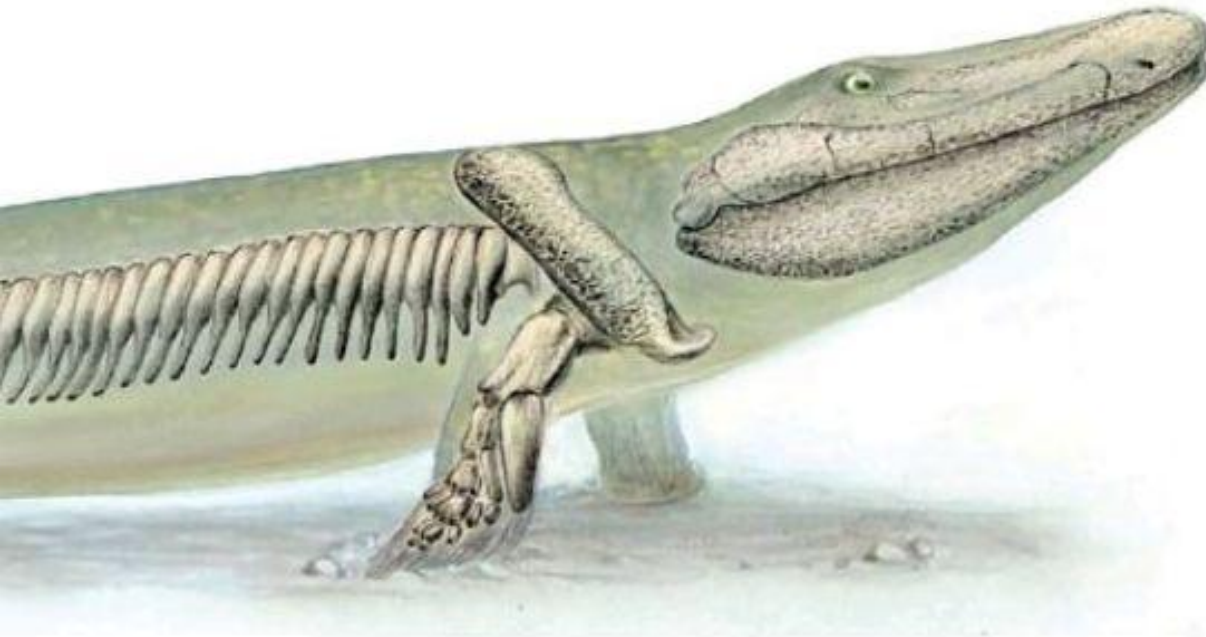
The Corollaries of Integrating Evolution into Science

1. Sensualism /perception as basis (no atomism, elements as Gestalts)
2. Thought economy (Gestalts)
3. Worldview / erkenntnis-theory (background)

1. Sensualism

Corollary of empiry: The adaptation of the thoughts to the facts and the thoughts to each other“
(Mach)

⇒ „Urbild“ like species (adaptation and transformation): Example Shubin’s „Inner Fish“
(the origin of push-ups)



1. Sensualism

⇒ Plasticity (therefore no invariants in Mach's interpretation v. Kaila's, similar to Planck)

Example I: Students -> no single Urbild, rake works statistically; use several Urbilder so that one will work (KHS)

Example II: Kaila and Charlotte Buehler researching on the „beginning“ of Gestalt



1. Sensualism

“Instinctive actions [of the suckling] are not excluded because the child does the imitational actions only rudimentary, namely laboriously, cumbersome and incompletely. Also other actions regarded as instinctual, such as the sucking, are initially produced laboriously and in conjunction with excess, wrong or even hindering co-actions.” (Charlotte Bühler 1934)

=> Neotony (humans are „stuck-in-youth“ apes; human reflexes are only rudimentary)

1. Sensualism

Example III: Kaila & Theater: Nature
answer me! (Research)

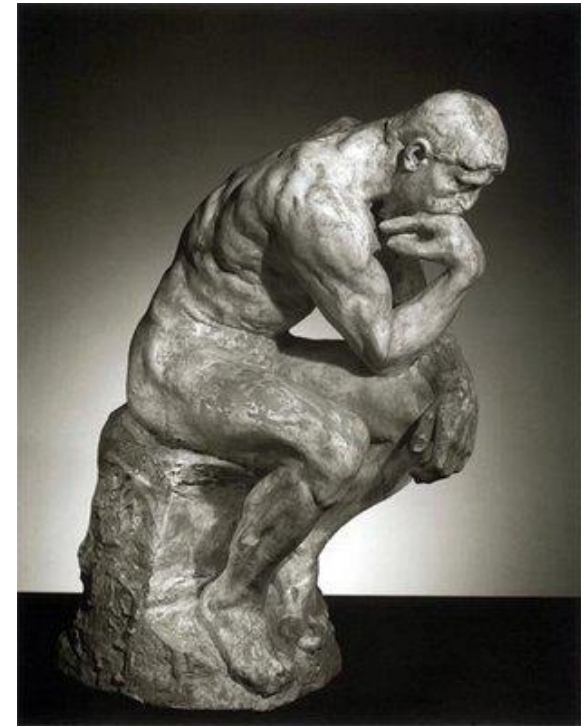


2. Gestalt

- like Darwinian species (not Goethe's holism)
- by Mach recursively defined (Gestalt-background)
- Economy of thought

Taken by von Ehrenfels, then Wertheimer

After a while intuitive, in memory
(Semon's meme)



2. Gestalt

Piano player metaphor from Mach



3. Erkenntnis-theory (Worldview)

-> Consistency of ideas (general background, methodological background)

Empiry vs. Metaphysics (adaptation of the thoughts to the facts and the thoughts to each other)

- discover artifacts and anthropomorphisms
- discover systematic errors
- discover systemic errors by multi-methodology

3. Erkenntnis-theory

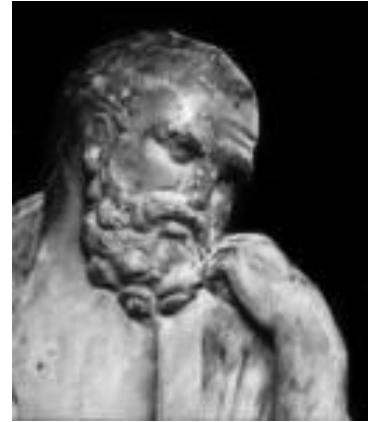
Greek genesis of ideas (brief version):

Anaximander's criticism of Homer's
human/anthropomorphic Gods

-> single God

How to perceive: invariances (vs. Heraclitus) between
perceptions and between humans (later developed into
Atoms)

Mach: Urbild not absolute; anthropomorphic invariables
Not signet-ring into wax (Plato and Aristotle);
after Darwin: transformation over time (species),
different signet rings for same imprint



3. Erkenntnis-theory

- ⇒ Erkenntnis-theory for forming consistent world view
- ⇒ But also for distinguishing metaphysics from empiry (there necessarily is much of metaphysics in physics, if not taken as psychophysical relation (perception as first approach))
- ⇒ Find anthropomorphisms/artifacts
- ⇒ Put Gestalts on a sensual basis (identify and reduce artifactual gestalts) and find out what is actually sensual (never absolute, but genetical)
- ⇒ Include erkenntnis-psychology and psychology of research

Conclusion

⇒ Sensualism, Gestalt and Erkenntnis-theory (and erkenntnis-psychology) are together (monistic) for Mach

⇒ Without, no consistent concept of Gestalt, no exponential learning possible

⇒ Gestalt result of psychophysics, i.e. psychophysics is the „background“ of the post-Darwinian Gestalt concept

Key concepts in comparison

	Mach	Kaila	KKS
monism /dualism	neutral monism	monism; de-facto empiry/philosophy divergence	unifying dualism
nature	nature “no trickster“	“nature answer me“	problem of posing the right question
basic unit of psycho-physical relation	sense elements	perceptions	perceptual approach
relation of logic and psychology in science	psychology before logical completeness and finesse in ST	(conscious primacy of logic; subconscious empiricism)	I don't know of any genius who would proceed logically

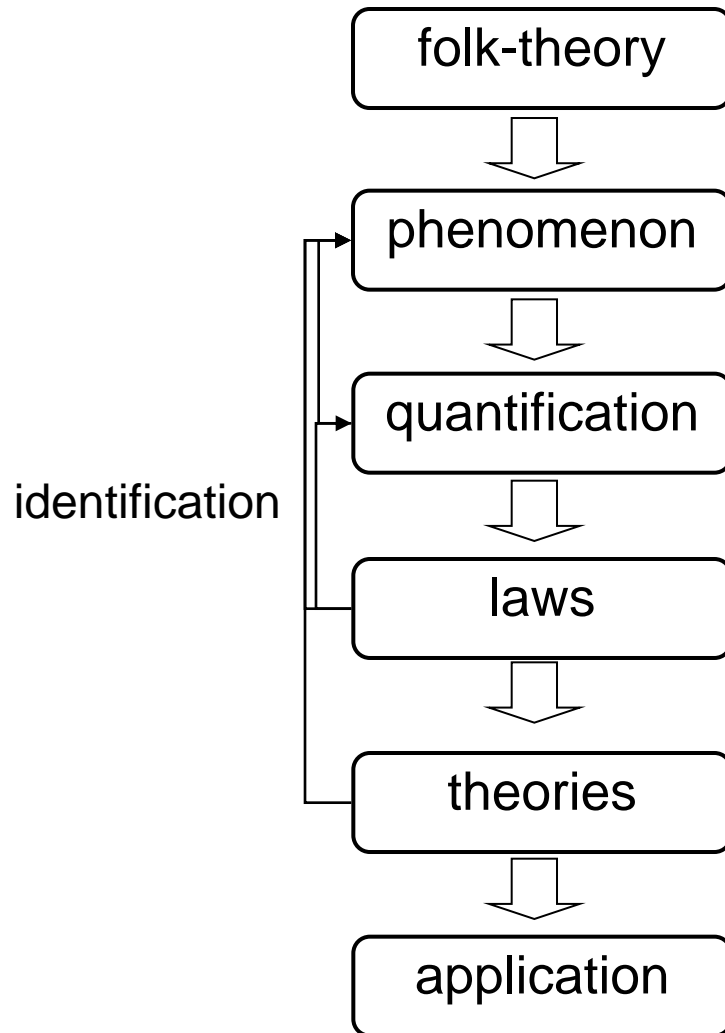
Ernst Mach's genetic view on education

- "Nobody who concerned himself with scientific thinking will state [suggestions based on a "subject matter model"]. Thoughts can be stimulated and fertilized, like a field is fertilized by sunshine and rain.
- Thoughts however cannot be rushed out and not drilled out, certainly not through recipes, by amassing subject matter and lessons. They want to grow voluntarily. Thoughts can just as little be accumulated above a certain measure in a head, as the yield of a field can be increased unlimitedly. I believe that the subject matter for an appropriate education, which jointly must be offered to all pupils of a preparatory school, is very modest [...].
- If a young human is not to come dulled to the university, if he is not to have spent his vitality in the preparatory school, which he thereat still has to collect, an important change here has to occur. Even if I refrain here from stating the harmful physical consequences of physical overburdening, already the disadvantages for the intellect appear to me equally horrible. I do not know of anything more terrible, than the poor humans, who have learnt too much." (Mach)

Examples of Kaarle Kurki-Suonio's Machian influences I

- **Gestalt Psychology:** “There is certainly no perceived Gestalt behind, if you take $F = ma$ as the starting point.” (also perceptions instead of sense elements as in Kaila's adaptation of Mach; no Piagetian age-stages)
- **Monism:** “Elementary particles have no individual, only species identity, it is a great misconception. They are the expression of ‘one’.” (ontological monism)
- **Genesis:** “The unrewarding, eventually impossible task of the physics' teacher is to help the pupil to uncover a secret, which even the teacher himself cannot know.”

Examples of Kaarle Kurki-Suonio's Machian influences II



(Adapted from Kurki Suonio)

→ Central issue between
Mach and Husserl

Examples of Kaarle Kurki-Suonio's Machian influences III: The concept of force

- Does “Force” exist?
 - Transformations of energy
 - Interaction (KKS)
 - Should we teach the concept of force in school physics?
- => Problem of Gestalt stability vs. crutches/scaffolding in mental models (+ final Gestalt)!**
- Only to be answered from a phenomenological or genetic point of view

Kaarle Kurki-Suonio from a Machian perspective: Central differences / open questions

1. The concept of genesis: missing / dimensions
 - History of science
 - Hapts/enacts
2. Consistency of epistemology
 - Classical vs. new physics
 - Observer vs. observation
 - “Intuitive” realism vs. “initial” realism
3. Psychology (mainly Gestalt psychology vs. “mythologies”)
4. Physiology
 - Concept of phenomena
 - Psychophysics

Open questions

1. What is the role of culture in science teaching?
2. How important is a theory (and its internal consistency) in education for the teachers who have to “apply” it?
3. Is “the child as scientist” a proper metaphor in science teaching?
4. Your question