Φ S, T, ST : Riemann, Helmholtz, Poincaré – Struc of Lecture

16 Dez 2015

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1) Riemann's mathematical achievements

a) topology, measure/magnitude concepts

b) metric – "Pythagorean" form postulated as simplest

c) ...

2) Helmholtz's analysis

a) mathematical results

b) physical analysis of possibility of geometry, necessary relation to possibility of 'free mobility of rigid bodies'

3) Poincaré's Conventionalism

a) geom not synth a priori, not exp'l fact, only possibility left are ~~...~~ conventions [he misses Riemann's insight – they are not purely experimental, but are determined and confirmed by the structure of physical theory in which they participate as substructure, in rep'g all physical phenomena that depend to any degree on spatial relations for their description]

and are not just descriptions of motions of ideally rigid bodies, but all physical interaction – and that it is not just sensory info that we have on the basis of which to make our choice of geom (correlative to 1st point about all geom characteristic of all phys'l interaction)

4) Conclude w/ Riemann's methodological and metaphysical sophistication:

1) no need for ∃ of perfect free mobility of perfectly rigid bodies – only approx, and that gives us only geometry for scale of those bodies

2) in realm of 'immeasurably small', we must

contra Helmholtz { i) be open-minded about possible sources of information about spatial struc at diff't levels

contra Poincaré { ii) our spatial notions, in so far as they are brought to bear in physics, have significance only as structural aspects of a more embracing structure: that of the possibility of physical interaction itself

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3) if spatial manifold is continuous, then metrical relations must be found outside the bare notion of space itself, in 'binding forces that act upon it'

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physical bodies as equilibrium configurations, means we must be ready to engage in analysis of what 'rigidity of body' means, wrt spatial relations, and not just analyze space upon unarticulated, primitive notion of rigidity –

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ΦS, TI, ST Lect: Riemann & Helmholtz

Riemann

- begins w/ assumption of quadratic form (explicitly notes it is simplest possible assumption) — study of metric rel'ns
- but really begins w/ characterization of ~~non-metrical~~ structure — topology, diff'l struc
  need to distinguish this from metrical struc (concepts like 'unbounded' versus 'infinite'; # of dims)
- deriving from this conditions needed for free mobility

Helmholtz

- Φ-l analysis of 'conceive/imagine' — profound advance from Kant for judgment of status of geometrical & spatial concepts & judgments
- free mobility assumed as pre-condition of consistency of measurement (rigidity of bodies, distant congruences)
- shows form of Riemann metric follows from this (but stronger: spaces of constant curvature)

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Starting Point: all our knowledge of space comes from observation of the properties of (approx) rigid bodies

[compare Poincaré's analysis, his observation that in a world w/ only fluids, → geometry]

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general properties of space deducible from conds necessarily satisfied by bodies (in motion) to be 'rigid'

→ conds expressed in terms of the motions themselves, viz., mappings of space to itself that take rigid figures to congruent figures

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Riemann's metrical form, postulated by Riemann as simply the 'simplest form' is *derived* now by Helmholtz

and much more strongly, derived w/ severe restrictions, that the spaces be constant curvature

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error: read from Howard, "Φ of Prehistory", p. 22

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13 Jun 2016

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1) geom not 'experimental' sci for Poincaré

2) def'n of convention: 'stipulated def'n'
- w/ clear, unambiguous application as ground of a form of reasoning
- not a priori fact
- not result of experimental reasoning
⇒ only possibility left: convention

} he misses a possibility: that matter and geom dynamically affect each other: GR

3) convention is chosen – a pragmatic act, "free"
- guided by, not determined by, experiment, experience
- no "true" geom (metaphys? epist?), only "more convenient, simpler": see my notes on p. 71 of "Space of Geom"

4) geom'l vs perceptual space
- diff perceptual spaces ⇒ no a priori geom'l space of cognition, but synthesis of diff't perceptual spaces
- no rep of geom space
- diff btwn rep of objects in perceptual space vs reasoning about objs (constructions, e.g.), in geom space

5) genesis of geom space
- change of state vs change of position
⇒ assumption of rigid bodies, necessity of possibility of our mobility, not just that of studied objs
⇒ isolated sensations cannot lead us to concept idea of geom space, but only study of laws by which sensations succeed each other

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6) nature of geom space
- complete reversal from Helmholtz:
possibility of displacement is no longer a precondition for (certain kinds of geom), although they are used in the development of the concept of geom space
⇒ when developed, geom becomes study of the laws of displacement of class of rigid bodies

7) choice of geom
- example of "thermally inhomogeneous space" purports to show that one can always make tradeoff between dyns and geom, to choose whatever geom one likes