

PEIRCE ABDUKTIOSTA

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Luennot abduktiivisesta päättelystä,
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CHARLES S. PEIRCE (1839-1914)

photo 1862

Harvardin yliopisto

isä matematiikan prof.

BENJAMIN PEIRCE

CHAUNCEY WRIGHT

luentoja 1864

Metafyysinen klubi

1872-74/WILLIAM JAMES



URAN VAIHEITA

- United States Coast and Geodetic Survey 1861-91
- Harvard Observatory 1869-72
- pragmatismien tunnustettu perustaja: "The Fixation of Belief" (1877), "How to Make our Ideas Clear" (1878)
- Johns Hopkins University 1879-84 (JOHN DEWEY, JOSIAH ROYCE)
- ei saanut koskaan pysyvää akateemista virkaa
- köyhä, eristäytynyt, katkera
- ei julkaissut yhtään teosta, paljon artikkeleita, valtava määrä luentoja ja käsikirjoituksia
- maineen nousu 1920- ja 1930-luvuilla
- *Transactions of the Charles S. Peirce Society* 1954-

LÄHTEITÄ

- *Chance, Love and Logic*, ed. by M. R. Cohen, New York, 1923. (Bison Books, 1998)
- *Collected Papers (CP) 1-6*, ed. by C. Hartshorne & P. Weiss, Harvard University Press, Cambridge, MA, 1931-35.
- *Collected Papers (CP) 7-8*, ed. by A. Burks, 1958-60.
- *Writings of Charles S. Peirce: Chronological Edition 1-6*, ed. by M. H. Fisch et al., Indiana University Press, Bloomington, 1982-2000.
- *The Essential Peirce 1 (1867-1893), 2 (1893-1913)*, ed. by N. Houser & C. Kloesel, Bloomington, 1992/1998.
- *Reasoning and the Logic of Things: The Cambridge Conference Lectures 1898*, ed. K. L. Ketner, Harvard UP, 1992.
- *Johdatus tieteen logiikkaan ja muita kirjoituksia*, suom. M. Lång, Vastapaino, Tampere, 2001.

TIETEELLINEN PÄÄTTELY

- kategoriaoppi, semiotiikka, merkitys, totuus
- Peirce oli ansiokas logiikan kehittäjä
 - relaatiot, kvanttorit, diagrammit, existential graphs
- Peirce tunnetaan todennäköisyyttä ja induktiota koskevista kirjoituksistaan
 - "The Doctrine of Chances" (1878), "The Probability of Induction" (1878)
- tieteen historia (Lowell Lectures 1892)
- evolutionaarinen metafysiikka 1890-luku (*The Monist*)
- "pragmaticism" 1905

PEIRCEN JÄRJESTELMÄ

- Peirce oli metafysiikassa objektiivinen idealisti, tietoteoriassa pragmatisti ja tieteenfilosofiassa kriittinen realisti
- tieteellisessä päättelyssä deduktion ja induktion lisäksi kolmas tyyppi: abduktio (hypoteesi)

VIITTEITÄ

- Tomis Kapitan, "Peirce and the Structure of Abductive Inference", in N. Houser et al. (eds.), *Studies in the Logic of Charles Sanders Peirce*, Indiana UP, 1997.
- I. Niiniluoto, "Peirce's Theory of Statistical Explanation", in E. C. Moore (ed.), *Charles S. Peirce and the Philosophy of Science*, U of Alabama Press, 1993.
- J. Hintikka, "What is Abduction? The Fundamental Problem of Contemporary Epistemology", *Trans. of C. S. Peirce Society* (1998) (myös: *Socratic Epistemology*, CUP, 2007)

PÄÄTELMIEN LUOKITTELU

- lectures at Harvard 1865 on the classification of inferences:
 - deduction, induction, hypothesis (ARISTOTLE, KANT)
- induction and hypothesis as inverses to deductive syllogism
- 'Deduction, Induction, and Hypothesis' (1878)
- 'A Theory of Probable Inference' (1883)

BARBARAN KÄÄNTÄMINEN

Barbara (deduktio)

$(x)(Fx \rightarrow Gx)$

Fa

Hence, Ga

singular hypothesis

$(x)(Fx \rightarrow Gx)$

Ga

Hence, Fa

induktio: Fa

Ga

Hence, $(x)(Fx \rightarrow Gx)$

SYYT JA VAIKUTUKSET

- deduktio tyypillisesti etenee syistä vaikutuksiin (selitys, "explanatory syllogism")
- deduktio analyyttistä (explicative), induktio ja hypoteesi synteettistä (ampliative) päättelyä
- induktio etenee yksityistapauksista yleiseen lakiin
- hypoteesi etenee vaikutuksista syihin ("inference of a cause from its effect"), päättelyä faktasta sen selitykseen ("inference to an explanation")
- vrt. HEMPEL: DN-selitykset 1948

YLEINEN PÄÄTTELY

- *Barbara* (deduktio) *general hypothesis*
 $(x)(Fx \rightarrow Gx)$ $(x)(Fx \rightarrow Gx)$
 $(x)(Bx \rightarrow Fx)$ $(x)(Bx \rightarrow Gx)$
 Hence, $(x)(Bx \rightarrow Gx)$ Hence, $(x)(Bx \rightarrow Fx)$

teoreettinen selitys (W 1:267): light (B) is ether waves (F), ether waves give peculiar fringes (G)

(SCHURZ: fact-abduction, law-abduction)

ESIMERKKEJÄ 1878

- turkkilainen mies hevossaattueessa ja katoksessa: siis alueen maaherra
- kalamaisia fossiileja kuivalla maalla, siis meri on joskus ulottunut alueelle
- lukemattomat dokumentit ja monumentit viittaavat Napoleon Bonaparten, siis NB on joskus ollut olemassa (CP 2.625)
- *retroductio* 1898: päättely taaksepäin ajassa
- "hypothesis frequently infers a fact not capable of direct observation" (CP 2.641) (PSILLOS: horisontaalinen ja vertikaalinen abduktio)
- "a weak kind of argument", "we only surmise that it may be so" (CP 2.625)
- hypoteesit tulee asettaa testeihin ("fair and unbiased tests") vertaamalla niiden ennustuksia havaintoihin (hypoteettis-deduktiivinen ja hypoteettis-probabilistinen menetelmä)

ANALOGIA

- “we find that in certain respects two objects have a strong resemblance, and infer that they resemble one another strongly in other respects” (*CP* 2.264), esimerkki hypoteesista 1878
- 1883 (*CP* 2.706): induktio ominaisuuksien suhteen (J. S. MILL)

DEDUKTIO JA TOTUUS

- deduktion yleinen semanttinen luonnehdinta ("On the Algebra of Logic", 1880), "P siis C", "every state of things in which a proposition of the class P is true is a state of things in which the corresponding propositions of the class C are true"
- deduktio on välttämättä totuuden säilyttävää (TARSKI on logical consequence 1935)

INDUKTIO JA TOTUUS

- JOHN VENN 1866: todennäköisyyden frekvenssitulkinta
- päättelyn totuusfrekvenssi 1867: "how often it carries truth with it", induktion todennäköisyys (vs. BAYES: uskomuksen asteet)
- induktio on itseäänkorjaava, toistettuna "leads to a result indefinitely approximating to the truth in the long run" (*CP* 2.781)

PROBABILISTIC REASONING 1878

- universaalinen premissi 'All F are G' korvataan tilastollisella 'Most F are G'
- probable deduction:
 - Most of the beans in this bag are white.
 - These beans are from this bag.
 - Probably, most of this handful of beans are white
- induction:
 - Most of this handful of beans are white.
 - These beans are from this bag.
 - Probably, most of the beans in this bag are white
- hypothesis:
 - Most of the beans in this bag are white.
 - Most of this handful of beans are white.
 - Probably, these beans are from this bag.

PROBABLE INFERENCE 1883

- simple probable deduction:
 - The proportion r of the Fs are G
 - b is an F
 - It follows, with probability r , that b is a G
- statistical deduction:
 - The proportion r of the Fs are G
 - b' , b'' , b''' are taken at random from among the Fs
 - Hence, probably and approximately the proportion r of the b 's are G

direct inference (CARNAP, LEVI)

PROBABILISTIC EXPLANATION

- probable deduction as explanatory statistical syllogism (cf. HEMPEL 1962; SALMON, FETZER)
- statistical deduction as probabilistic explanation of statistical facts
- Peirce as the true founder of probabilistic explanation (vs. SALMON's history)

INVERSIONS

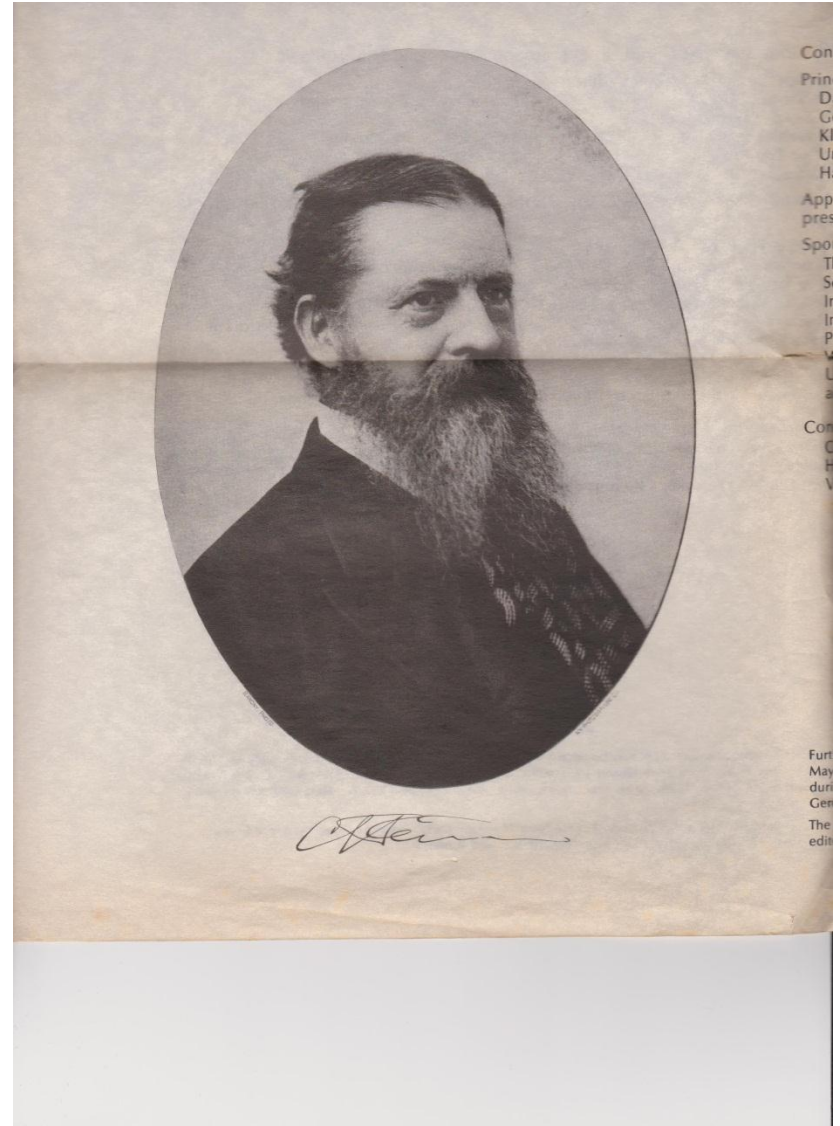
- inversion of statistical deduction gives *quantitative induction*
 - statistical generalization from a sample to a population, REICHENBACH's straight rule
 - simple probabilistic abduction
 - The proportion r of the F s are G
 - b is an G
 - Hence, b is a F
 - here the truth-frequency need not be r
 - inference to the probabilistic cause of Gb (SUPPES)

OTHER EXAMPLES

- discovery of Kepler's laws "the greatest piece of Retroductive reasoning ever performed" (1896, *CP* 1.74)
- perception as "an extreme case of abductive inferences" (*CP* 5.181-185).

PEIRCE

Kuva 1892



ABDUCTION 1898

If μ were true, π , π' , π'' would follow

But π , π' , π'' are in fact true

Provisionally, we may suppose that μ is true.

- induction is Aristotle's *epagoge*
- hypothesis or *abduction* is Aristotle's *apagoge*, indirect proof (*An.Pr.* II,25, palauttaminen)

1901-03

- new understanding of induction and abduction: abduction preparatory, first step, seeks a theory, induction concluding step, seeks facts
- INDUCTION: the operation of testing a hypothesis by experiment
- ABDUCTION: the first starting of a hypothesis and entertaining it, whether as a simple interrogation or with any degree of confidence
- testing a theory by new consequences vs. theory is found to explain some already known facts
- abduction infers only a may-be (*CP* 8.238)
- the only operation which introduces any new idea

ABDUCTIVE REASONING

The surprising fact C is observed

But if A were true, C would be a matter of course

Hence, there is reason to suspect that A is true
(*CP* 5.189)

Here A may be a theory: theoretical abduction

INTERPRETATIONS OF ABDUCTION

- abduction as a logic of *discovery* (HANSON 1958)
- reasons for *pursuing* and testing a hypothesis (LAUDAN, LEVI)
- *justification*
 - HARMAN 1965: inference to the best explanation (IBE)
 - SMOKLER 1968: abductive confirmation

PEIRCE'S TREATMENT

- reasoning and its truth-frequency: how often a mode of argument carries truth with it
- NEYMAN-PEARSON: significance tests in statistics
- GOLDMAN: reliability
- the truth-frequency of abductive arguments may have any value between 0 and 1, sometimes high