Renouncing the Bride: Karl Pearson on Causes and Inverse Probabilities

Inverted Spinozism, Idealism & Goodness-of-Fit

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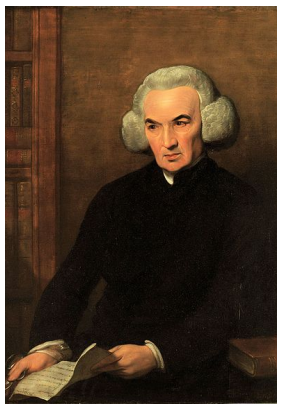
1135–1204


1632–1677


1702–61 / 1723–91

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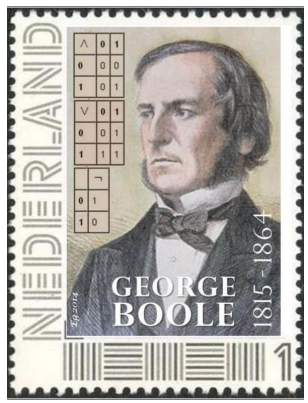
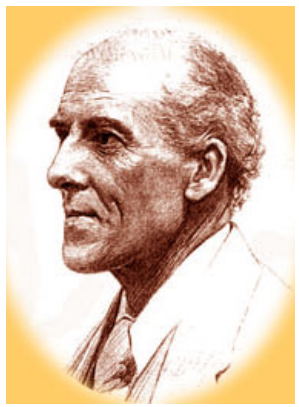


1815–1864


1857–1936

http://www.ime.usp.br/∼jstern/miscellanea/jmsslide/postat171.pdf

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This Presentation

I- Introduction – K.Pearson: Many roots, many branches;

IIa- Baruch Spinoza (1677) epistemological principles:
Mystic route – via Maimon, Abulafia & Gikatilla (1135–1305);

IIb- Karl Person's New Werther, by Locki (1880)
+ Maimonides and Spinoza. *Mind*, (1883):
– My interpretation: Love triangle between Arthur (K.Pearson), Raphael (Spinoza) & Ethel (Greek Sophia/ Hebrew Shekinah);

III- Empirical Science from Boscovich (1763) to Galton (1885)
– Ether physics (1884-1891), Grammar of Science (1892);

IV- Inverse Probabilities – Of Causes / In Parameter space:
Bayes (1763), Laplace, Boole, K.Pearson & Fisher (1912-35);
– Criterion that a given system of deviations from the probable...in a correlated system of variables...arisen from random sampling (1900).

V- Some Conclusions, Acknowledgments & Final Remarks;

VI- Many Questions.

Love and Sex (or lack thereof) in the New Werther

- Karl Person's New Werther, by Locki* (1880):
- My interpretation: Love triangle between Arthur (K.Pearson), Raphael (Spinoza) and Ethel ($\sigma o \phi \iota \alpha$ Sophia/ שְׁכִינָה Shekinah).
- Theodore Porter†, biographer: Homosexual affair drama.

– Based mostly on private letters and reports of difficult access, concerning friends at Cambridge & the *Women's club* activities.

- Are these interpretations mutually exclusive?
- If so, which one is more likely to be correct?
- If not, can they be mutually supportive‡ or complementary?

* Mother/father of Sleipnir, Jörmungandr, Fenrir, Hel.

† K.P. – The Scientific Life in a Statistical Age (2004).

‡ In the human soul ($\psi \upsilon \chi \eta$), sex, love & thought ($\epsilon \rho o \varsigma$–$\phi \alpha \nu \eta \varsigma$) and its representations are deeply intertwined§, and it should not be surprising to see them emerge together in K.Pearson's spiritual quest.

§ M. Idel (1988). *Studies in Ecstatic Kabbalah.* (2005) *Kabbalah and Eros.*

Baruch Spinoza epistemological (& mystic) principles

(1) *Deus sive natura*;
(2) *Cognitione causae* and *Leges naturae universales*;
(3) *Amor Dei intellectualis*.

- *Ethica – Ordine Geometrico Demonstrata* (1677):

– K.Pearson (1880). Pollock's Spinoza. *Cambridge Review*.

- K.Pearson–Raphael alternative (historical, short-cut) route: Principles' origins in Jewish medieval philosophy & mysticism.*

– K.Pearson (1883). Maimonides and Spinoza. *Mind.*

I was in the library, looking for a copy of Maimonides, to whom my study of Spinoza had led me, when I found a queer-looking person busily reading in a corner the very book I wanted. He had a distinctly Jewish face, and yet beneath his raven-black and straggling locks there was an apostolic nobility and depth. He seemed to know by inspiration what I had come for, and with a salutation offered me the book. New Werther, by Locki (1880, p.22)

*Stern (2015). Jacob's Ladder: Logics of Magic, Metaphor and Metaphysics. Narratives of the Unconscious, the Self and the Assembly.
+Fraenkel (2006), Harvey (2007), Idel (2000).

(1) Deus sive natura

- Moshe ben Maimon (1135-1204): In the world we live, הפעולות האלוהיות, *ha-peʿulot ha-ʾelohiyoth*, 'actions of God', are הפעולות הטבעיות, *ha-peʿulot ha-tebʿayoth*, 'actions of nature'.

- Abraham Gikatilla (1248-1310) sylleptic argumentation:
טֶבַע, *teba*, (substantive) means nature or substance;
טַבַע, *tabʿa*, (verb) means sank, stamped, coined, formulated;
מַטְבֵּעַ, *matbeʿa*, type, formula; מֻטְבָּע, *mutbʿa*, stamped, imprinted;
טְבִיעוּת־עַיִן, *tebiyoth-ʿayn*, intuition (literally eye-impression).

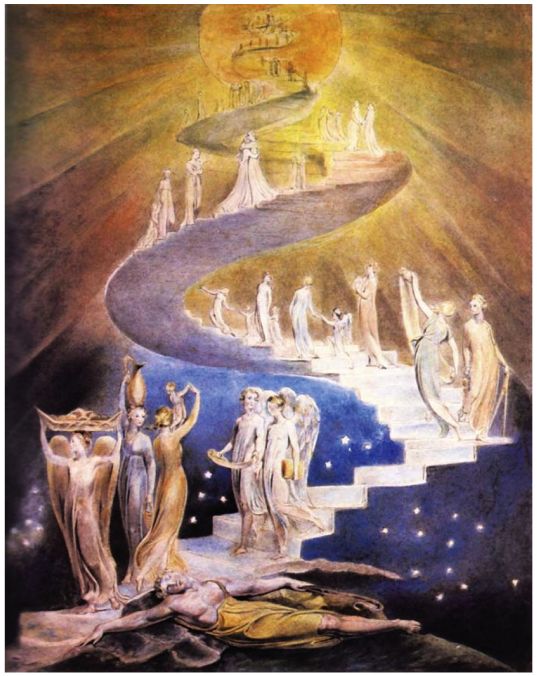
causare, causa – Latin words etymologically related to *cudere, cusum*, to strike, to hammer, to forge, to stamp, to coin; suggesting an analogy that parallels Maimonides formulation and its interpreters up to Spinoza. Same analogy repeated in *causa/ cousa*, Portuguese (Spinoza 1st language) words for cause (of something)/ (some)thing (caused).

(2) Cognitione causae and Leges naturae universales

Ratio igitur seu causa, cur Deus seu natura agit et cur existit, una eademque est. ... Aeternum namque illud et infinitum ens, quod Deum seu naturam appellamus, eadem, qua existit necessitate agit. ... Effectus cognitio a cognitione causae dependet et eandem involvit. ... atque adeo una eademque etiam debet esse ratio rerum qualiumcumque naturam intelligendi, nempe per leges et regulas naturae universales. Spinoza, Ethics (1677, Part I, Axiom 4; Pref. for Part III & IV).

So, the cause or reason why God, or nature, acts, and the cause or reason why He exists, are therefore one and the same. ... The eternal and infinite Being, which we call God or Nature, acts by the same necessity as that whereby it exists. ... The knowledge of an effect involves and depends on the knowledge of its cause. ... and therefore, one and the same should be the method of understanding the nature of all things whatsoever, namely, through nature's universal laws and rules.

(3) Amor Dei intellectualis



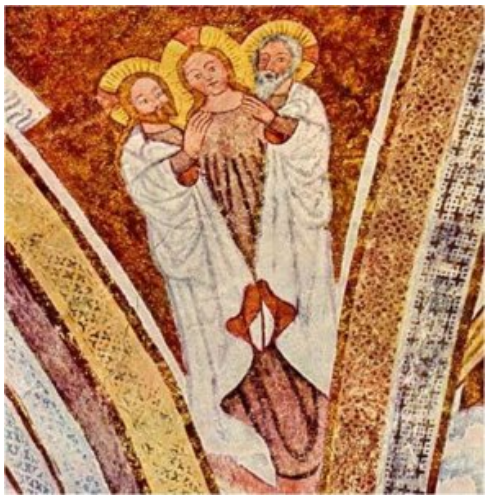
Can mankind, even if in approximate form, access this kind of knowledge? Kabalistic exegesis gives affirmative answer based on Genesis 28:12:

וַיַּחֲלֹם וְהִנֵּה סֻלָּם מֻצָּב אַרְצָה וְרֹאשׁוֹ מַגִּיעַ
הַשָּׁמָיְמָה וְהִנֵּה מַלְאֲכֵי אֱלֹהִים עֹלִם וְיֹרְדִים בּוֹ׃

He [Jacob] had a dream, a ladder was set on the earth with its top reaching to heaven; and behold, the angels of God were ascending and descending on it.

סֻלָּם, *sulam*, ladder (hapax leg.), from סלל.
Verbal forms סִלְסֵל / סֻלְסַל, *silsel / sulsal*, mean:
(1) paved (a high-way), lifted, elevated;
hence: הִסְלִיל, *hislil*, made a path, led, guided;
(2) curled; hence: סְלִיל, *selil*, coil, screw, spiral;

(3) Amor Dei intellectualis



Abraham Abulafia's אוֹר הַשֶּׂכֶל (1285), *Or ha-Sekhel*, Light of the Intellect: Nature of the ascending/ descending (e)motion at Jacob's ladder is love! Love of divine insight meeting the love of human understanding, אַהֲבַה אֱלֹהוּת \ אֱנוֹשׁוּת שִׂכְלוּת *ahabah elohut / enoshut sikhlut.*

ספר חיי הנפש, Life of the Soul (1275): Like the תַּעֲנוּג, delight, of *ha-chathan ve-ha-kalah*, the groom and the bride: חוֹתֵן, to marry, (semitic: join, connect); כַּלָּה is derived from the root כלל, to complete, perfect, generalize; כְּלָל general rule, principle, law.

*Holy Trinity as Father, Son & (female) Sophia; St. Jakobus Kirche, Urschalling, Bayern.

Renouncing the Bride: K.Pearson's Inverse Spinozism

Let us show... ...that the inexorable laws under which science asserts that the universe must for ever roll on, are not empiric, but deducible from pure reason... Let us prove... that Deity is not a cause outside and separate from material man; that the cause must not be sought outside, but rather in the effect nay, perhaps, is that effect itself. With this end, best of friends [Ethel, Sophia], have we renounced each other. (NW, p.11).

Do you not feel, said I [Arthur (KP) to Raphael], on a night like this [Walpurgis Nacht], a titanic fire burning in your soul; that Nature is, for the moment, your slave; that the Spirit of the Universe is at hand, and that you can compel it to raise its veil?

Raphael [Spinoza]: But how can you, who believe in the pantheism of Spinoza, allow that the part can possibly compel the whole; that man, an infinitesimal portion of the Godhead, can command the Spirit of the Universe? (NW, p.26).

Renouncing the Bride: K.Pearson's Inverse Spinozism

I [Arthur, K.Pearson] have determined to read those German reasoners, and then again to discuss the matter with Raphael [Spinoza]. The morning was cool, yet my head felt on fire. It seemed to me as if someone had told me I had wronged you, Ethel [Sophia]; and I knew it was not true. (NW, p.28-29).

The spirit, to be an 'I', must have a nature of its own; a nature denotes constancy; constancy we term a law. The 'I', in order to exist, must follow this law; ...the permanency of forms which this law gives to our perceptions we term space and time. The thought-law which dictates permanency to the perceptions, compels us to look upon space and time as infinite and eternal. Thus we see how Eternity and Infinity... are but the necessary creations of our own inner nature. Pearson (NW, p.39).

Renouncing the Bride: K.Pearson's Inverse Spinozism

We require in fact a kind of inverted Spinozism, a Spinozism modified by Fichte. ... There is no need of the pre-established Harmony ... The outer world, as we conceive it, is the production of the conceiving 'Ego', not an objective reality enforcing its laws upon the subjective sensitive centre. When we talk about a law of physical nature, we only mean a necessary law of thought, any such law is only an intellectual law, the necessary method in which we are compelled to view our sensations. They are [refer to] nothing independent of ourselves but intellectual constructions, necessary to simplify the complices of sensation.***

*Pearson (1896), Philosophy of Natural Science;
**Pearson (1880), Pollock's Spinoza, p.95.

– Raphael & Ethel lovers in Paris! Arthur suicide!
Locki (as Mephistopheles in Goethe's Faust):

– Ich bin der Geist, der stets verneint!
Und das mit Recht; denn alles, was entsteht,
Ist werth, dass es zu Grunde geht.

– I am the spirit that denies! And rightly so;
For everything created, at last to its end will go.

Pearson's Rejection of Causes/ Causal Explanations

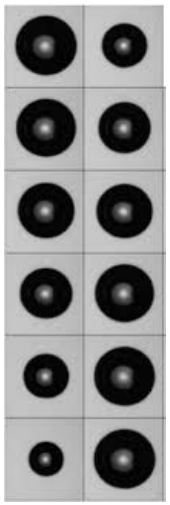
Mr. Balfour speaks contemptuously of those who regard the Universe as a "mere collection of hypostatised sense-perceptions"... He wants "ideas of wider sweep and richer content"...*

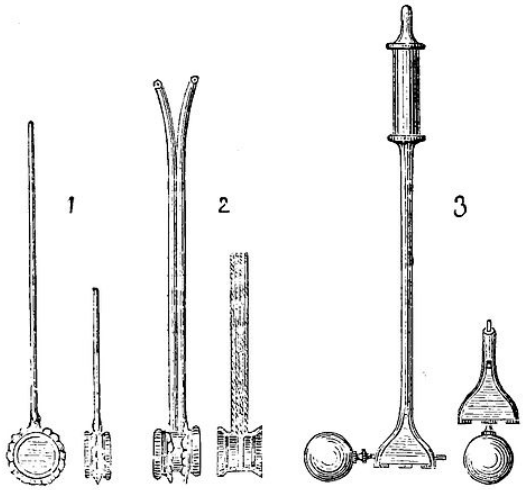
[T]he mission of Science is not to explain but to describe; to discover a descriptive formula which will enable men to predict the nature of future perceptions; such descriptive formulae are, in the only consistent sense of the word, knowledge, they form that 'economy of thought', which is the name happily devised by a philosophical physicist to describe and define Science.

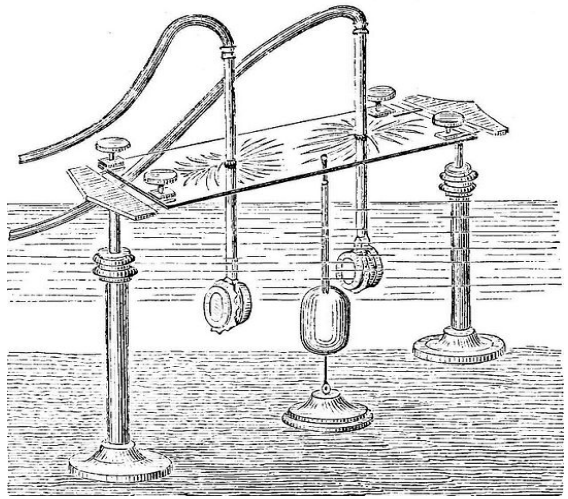
*Cause is scientifically used to denote an antecedent stage in a routine of perceptions. .. In this sense force as cause is meaningless. We may talk, if we please, about the forces [causes] ..but.. such phrases do not introduce an iota of new knowledge, but too often a whole alphabet of obscurity. We hide the fact that all knowledge is concise description, all cause is routine.***

* Pearson (1897, p.200); ** Pearson (1892, 1911, p.133, 150) – The Grammar of Science; Ch.IV, Cause and Effect.

C.Bjerknes & K.Pearson on Fluid & Ether Dynamics







Two spheres immersed in an incompressible fluid, and which pulsate (change in volume) regularly, exert on each other (by the mediation of the fluid) an attraction, determined by the inverse square law, if the pulsations are concordant, and [likewise] exert a repulsion, if the phases of the pulsations differ by half a period.

– E.Whittaker (1953). History of the Theories of Aether and Electricity. pp.284-285.
– Popular Science Monthly (1882), V.21, June. Hydrodynamics and Electricity.
– K.Pearson (1884). On the Motion of Spherical and Ellipsoidal Bodies in Fluid Media.
– K.Pearson (1885, 1888, 1889). On a Certain Atomic Hypothesis.
– K.Pearson (1891). Ether Squirts. American Journal of Mathematics, 13, 4, 309-362.
– W.Hicks (1879, 1880) On the Problem of Two Pulsating Spheres in a Fluid.
– W.K.Clifford (1878). Elements of Dynamic. pp.212-219, Squirts, Whirls & Vortices.
– V.F.K.Bjerknes (1906). Fields of Force. NY: Columbia.

Clifford & K.Pearson on Ether Physics

[KP] hypothesis may be briefly summed up in the statement: An atom, ultimate element of ponderable matter, is an ether squirt.

...vortex theory of matter reduces the ether to a perfect fluid, and endeavors to build up matter by some form of motion in this fluid. The infinite variety of motions which a perfect fluid is capable of, suggest all sorts of rotational or irrotational forms which may account for matter. The great beauty of all such fluid motion solutions is their reduction of the physical universe to a single imponderable medium; they avoid dualistic explanations of natural phenomena. [energy/ matter, continuous/ discrete]

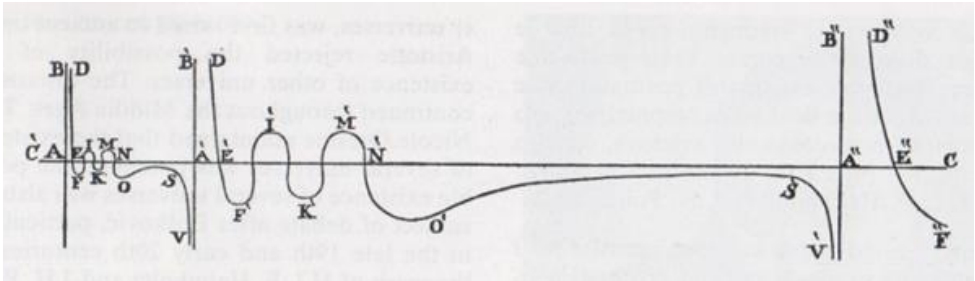
...the action of one group of ether squirts upon a second group leads to equations the complexity of which seems quite capable of paralleling any intricacy of actual Nature.

...[the model] possesses, besides, all the singular merit of the Boscovichian atom, i.e. it is for theoretical purposes a mathematical point. Pearson (1891, p.309-313).

Bošković & K.Pearson on Phenomenological Physics

[Ruđer Bošković - Philosophiae Naturalis (1763)] *...theory was presented in as a hypothetico-deductive mathematical scheme "concerned with facts not causes", its validity to be judged by its elegance and fertility*. Whyte (1957, p.284).

What is Boscovich's essential contribution in his theory of natural philosophy? It is the building up of a qualitative scheme leading to a completely new view of the composition of matter. The emphasis is not on a special system of forces which represents or "explains" the observed phenomena more or less well, but on the immense possibilities of variation and differentiation in the application of the scheme. Marković (1961, p.148).



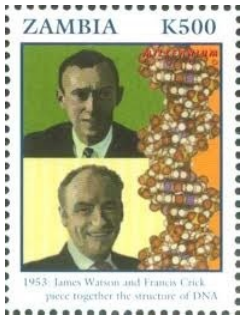
Bošković & K.Pearson on Dualistic Entities

- Material atoms and molecules render dualistic explanations of natural phenomena, mixing energy and matter, particles or discrete entities existing in continuous media, etc.
- K.P.$\Rightarrow$ such (dualistic) concepts should not be hypostatized or reified, & the corresponding parameters should be deprecated in the practice of science (and its mathematical models).

The physicist looks upon the atom in one or other of two different ways: either the atom is real, that is, capable of being a direct sense-impression, or else it is ideal, that is, a purely mental conception by aid of which we are enabled to formulate natural laws. It is either a product of the perceptive faculty, or of the reflective or reasoning faculty in man. It may pass from the latter to the former, from the ideal stage to the real; but till it does so, it remains merely a conceptual basis for classifying sense-impressions, it is not an actuality. Pearson (GoS p.96).

– G.Whitlock (1996, 1997, 1999) on Boscovich & Nietzsche; Y.Yovel (1988). Nietzsche and Spinoza – Amor fati and Amor Dei.

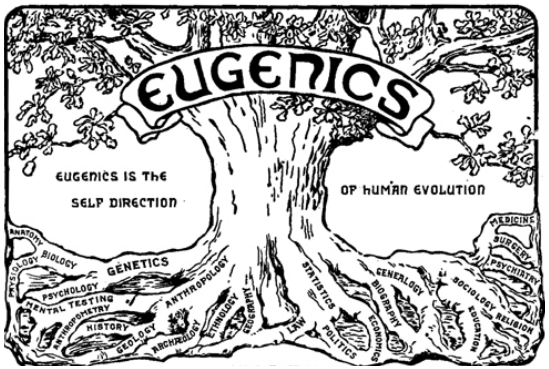
K.Pearson on Atoms & similar Causal Elements



- Atoms, Molecules and Genes are conceived as “real”, actual or existing causes for phenomena observed in disciplines like Physics (statistical thermodynamics), Chemistry (reactions) and Biology (expressed phenotypes, population dynamics, etc).
- Statistical parameters in such models directly relate to latent (i.e. hidden or unobservable) but actual or existing causes that give us valuable insight or explain the observed phenomena.
- K.P.$\Rightarrow$ such (causal) concepts must be deprecated & corresp. parameters avoided/ de-emphasized in mathematical models.

– A. Einstein (1905), J. Perrin (1911), G. Mendel (1866), H. de Vries (1889), J.Watson F.Crick (1953), etc. took XX cent. science in the opposite direction of K.Pearson’s wishes. Quantum Mechanics and complementarity models rely on extreme forms of dualistic explanation!

Galton, Natural Inheritance, Genetics, Eugenics



- F. Galton Natural Inheritance processes

- Reversion (1877): Unidirectional (forward in time), by genetic causal mechanisms:

...the tendency of that ideal mean filial type to depart from the parent type, reverting towards what may be roughly and perhaps fairly described as the average ancestral type.

- Regression (1885): Bidirectional & symmetric, driven by statistical *co-relations*:

...the further his genealogy goes back, the more numerous and varied will his ancestry become, until they cease to differ from any equally numerous sample taken at haphazard from the race at large. Their mean stature will then be the same as that of the race; in other words, it will be mediocre.

* Gorroochurn (2015)

K.Pearson: A Statistical Project for Galton's Ideas

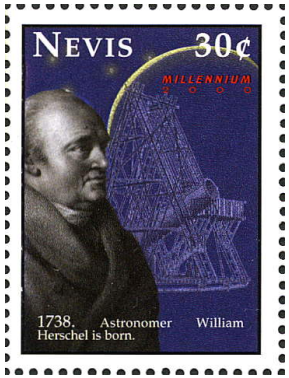
The present memoir will be devoted to the expansion and fuller development of Mr. Galton's ideas, particularly their application to the problem of bi-parental inheritance...*

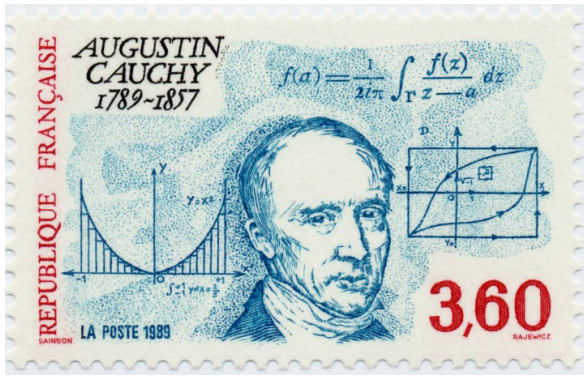
The causes in any individual case of inheritance are far too complex to admit of exact treatment; and... the classification of the [pertinent] circumstances... has made but little progress.

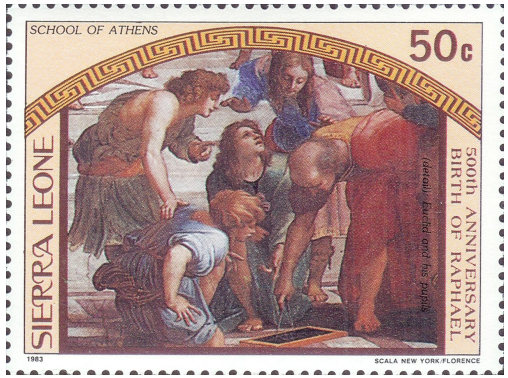
This is largely owing to a prevalence of almost metaphysical speculation as to the causes of heredity, which has usurped the place of careful collection and elaborate experiment by which alone sufficient data might have been accumulated with a view to ultimately narrowing & specialising the circumstances under which correlation was measured.

Shortly, we must proceed by the method of statistics, rather than by the consideration of typical [causally related] cases.
Pearson (1896, p.225).

K.Pearson: 'Regression' by Least Squares Method







- K.Pearson uses Least Squared errors to optimally & easily fit Galton's linear 'regression' constants (correlation coefficients).
- Why LS, L^2, Euclidian norm? • Why not Meth. of Moments?
- A-OK, goal is good-fit! • How well does this idea fit in History?

– K.Pearson (1896, p.225). Mathematical Contributions to the Theory of Evolution: Regression, Heredity, & Panmixia. (1901) On Lines and Planes of Closest Fit to Systems of Points in Space. (1903) On a General Theory of the Method of False Position. (1920) Notes on the History of Correlation.
– C.F. Gauss (1823). Theoria Combinationis Erroribus Minimis Obnoxiae.
$\neq$ J.F.W. Herschel (1850). Quetelet on Probabilities. *Edinburgh Rev.* 92, 1-57.
$\neq$ J.C. Maxwell (1860). Illustrations of the Dynamical Theory of Gases.
$\neq$ J.M.Stern (2011). Symmetry, Invariance & Ontology in Physics & Statistics.
$=$ Eisenhart (1961) on Boscovich (1757) L^1 method

Bayes on Probabilities of Causes given Events

The purpose, is to shew what reason we have for believing that there are in the constitution of things, fixed laws according to which events happen, and that, therefore, the frame of the world must be the effect of the wisdom and power of an intelligent cause; and thus to confirm the argument taken from final causes for the existence of the Deity ...
It will be easy to see that the problem solved in this essay is more directly applicable to this purpose; for it shews us, with distinctness and precision, in every case of any particular order or recurrency of events, what reason there is to think that such recurrency or order is derived from stable causes or regulations in nature, and not from any of the irregularities of chance.

– Rev. Thomas Bayes, by Rev. Richard Price (1763).
An Essay Towards Solving a Problem in the Doctrine of Chances. *Phil. Trans. Roy. Soc. London*, 53, 370-418.

Laplace on Probabilities of Causes given Events

I am particularly concerned to determine the probability of causes and results, [la probabilité des résultats et des causes] as exhibited in events that occur in large numbers, and to investigate the laws according to which that probability approaches a limit in proportion to the repetitions of events. ... the investigation is one that deserves the attention of philosophers in showing how in the final analysis there is a regularity underlying the very things that seem to us to pertain entirely to chance, and in unveiling the hidden but constant causes on which that regularity depends [dévoilant les causes cachées, mais constantes, dont cette régularité dépend].

– Pierre-Simon, marquis de Laplace (1811, OCv12, 360-361)

* The name 'Inverse Probability' for 'Probability of Causes' was not yet in use; see S.E.Fienberg (2003). When Did Bayesian Inference Become "Bayesian"? Bayesian Analysis, 1, 1, 1-37.

Boole: Probabilstic Connections of Causes & Effects

George Boole (1854, Laws of Thought; Ch.XX – Problems Relating to the Connexion of Causes to Effects, p.320):

So to apprehend in all particular instances the relation of cause and effect... is the final object of science.

From the probabilities of causes assigned à priori*, or given by experience, and their respective probabilities of association with an effect contemplated, it may be required to determine the probability of that effect;* [Problem X]

On the other hand, it may be required to determine the probability of a particular cause, or of some particular connexion among a system of causes, from observed effects, and the known tendencies of the said causes, singly or in connexion, to the production of such effects. [Problem IX]

- Boole LoT, sec.20, p.363-365: Problem X is easier than IX, not requiring Insufficient Reason Principle + Integration operations. » – see also G. Boole (1862, p.227-228).

K.Pearson vs. Inverse Prob. & Insuf. Reason Princ.

- K.Pearson's positions in philosophy of science and statistical practice imply the rejection of causal analyses, hence the rejection of inverse probabilities, i.e. probabilities of causes.
- He reinforced his position with bitter arguments against the Principle of Insufficient Reason in Bayesian inference, etc.

Statistical workers cannot be too often reminded that there is no validity in a mathematical theory pure and simple.
Bayes' Theorem must be based on the experience that where we are à priori in ignorance all values are equally likely to occur.
...indiscriminate use of Bayes' Theorem is to be deprecated.
It has unfortunately been made into a fetish by certain purely mathematical writers on the theory of probability, who have not adequately appreciated the limits of Edgeworth's justification of the theorem by appeal to general experience.

– Soper, Pearson ea (1917, p.359), answering Fisher (1912). On an Absolute Criterion for Fitting Frequency Curves.

K.Pearson Computational Solutions for Problem X

The series (5) and (6) [asymptotic expansions used to compute the p-value] admit of fairly easy calculation, and give sensibly the same results if n be even moderately large. [1900, p.159]

The accompanying [p-value] table has been calculated, which will serve to give that probability closely enough for many practical judgments, without the calculations required by using the [asymptotic expansions] formulae. [p.174, table at p.175]

The row χ^2 and the column (n+1) [at p-value table] will give the value of P, the probability of a system of deviations as great or greater than the outlier in question. For many practical purposes, the rough interpolation which this table affords will enable us to ascertain the general order of probability or improbability of the observed result, and this is usually what we want. [p.160]

– K.Pearson (1900). On the Criterion that a Given System of Deviations from the Probable in the Case of a Correlated System of Variables is Such that it can be Reasonably Supposed to Have Arisen from Random Sampling.
– Plackett (1983). K.Pearson & the Chi-Squared Test.

K.Pearson Lakatosian Problem Shift: IX $\rightarrow$ X

- When asked to estimate the parameters given observations, give answer of "type X" (probability of effect given parameters*);
- Instead of Bayes rule, "Best Fit" estimation! [*curve spec.]

(i) [in Pearson (1900)] I introduced the P [p-value], χ^2 test to enable a scientific worker to ascertain whether a curve by which he was graduating† observations was a reasonable 'fit'. On this account, and as a measure of success in graduation, I termed it a 'goodness of fit' test. [†modelling]

(iii) I have shown both theoretically & experimentally that there is a high correlation between the 'goodness of fit' of a graduating curve to a sample, and the 'goodness of fit' of that curve to the parental population from which the sample has been drawn. Accordingly, if the sample be large, the graduating curve may be taken as representing reasonably the parent population.

–K.Pearson in Inman (1994). Fisher on Statistical Tests: A 1935 Exchange from Nature, p.6-7. also Pearson (1920) on LS Meth.

K.Pearson Lakatosian Theory Replacement

(vi) From my point of view, tests are used to ascertain whether a reasonable graduation curve has been achieved, not to assert whether one or another hypothesis is true or false.*
The fact is that all these descriptions by mathematical curves in no case represent 'natural laws'. They have nothing in this sense to do with 'hypothesis' or 'reverse of hypothesis'.*
They are merely graduation curves, mathematical constructs to describe more or less accurately what we have observed.

(vii) The reader will ask: "But if they do not represent Laws of Nature, what is the value of graduation curves?"
He might as well ask what is the value of scientific investigation! A good graduation curve – that is, one with an acceptable probability – is the only form of 'natural law', which the scientific worker, be astronomer, physicist or statistician, can construct. Nothing prevents its being replaced by a better graduation; and ever bettering graduation is the history of science.

* Hence, perform χ^2 test on "H": $\theta = \theta^* =$ best-fit.

Fisher and the Language of Frequentist Statistics

Corresponding to any pair of values, θ_1, θ_2, we can find the value of $p(x|\theta_1, \theta_2)$, and the inverse probability system may be represented by the surface traced out by a point at a height $p(x|\theta_1, \theta_2)$ above the point on a plane, of which θ_1, θ_2 are the coordinates. ... The most probable [most likely] set of values for θ_1^*, θ_2^* will make $p(x \mid \theta_1, \theta_2)$ a maximum. Fisher (1912).

It turned out to be one of the most influential errors in terminology in statistics, for it led directly to his [Fisher's] first quarrel with Pearson, who did not look beyond the phrase to Fisher's account and subsequent use of the method, which was non-Bayesian. Edwards (1974)

- Karl Pearson and Ronald Fisher had several bitter quarrels over what could be accepted as philosophically and mathematically sound methods of inference, and what would be the most appropriate terminology.* Their hard-fought compromises defined the proper (and rigid) bounds of Frequentist Statistics!

* Fisher (1922). On the Mathematical Foundations of Theoretical Statistics. [def. Likelihood function, MLE, etc.]

Fisher vs. Neyman-Pearson Hyopthesis Test

- χ^2 test for H: $\theta = \theta^*$ or H: $\theta \in \Theta_H$? [1935 quarrel]
- Using (n-1) or (n-h-1) degrees of freedom? $h = \dim(\Theta_H)$

...it is certain that the interest of statistical tests for scientific workers depends entirely from their use in rejecting hypotheses which are thereby judged to be incompatible with the observations. ...

It is certain, too, from many passages which could be cited from Prof. Pearson's† own writings, that he has himself used the χ^2 test, not only in connection with the graduation of frequency curves, but also as a means of testing the truth of theories or hypotheses. ...

It would, therefore, add greatly to the clarity with which the tests of significance are regarded if it were generally understood that tests of significance, when used accurately, are capable of rejecting or invalidating hypotheses, in so far as these are contradicted by the data; but that they are never capable of establishing them as certainly true. In fact "errors of the second kind" are committed only by those who misunderstand the nature and application of tests of significance.

Fisher (1935), in Inman (1994, p.5). K.P.† 1936.

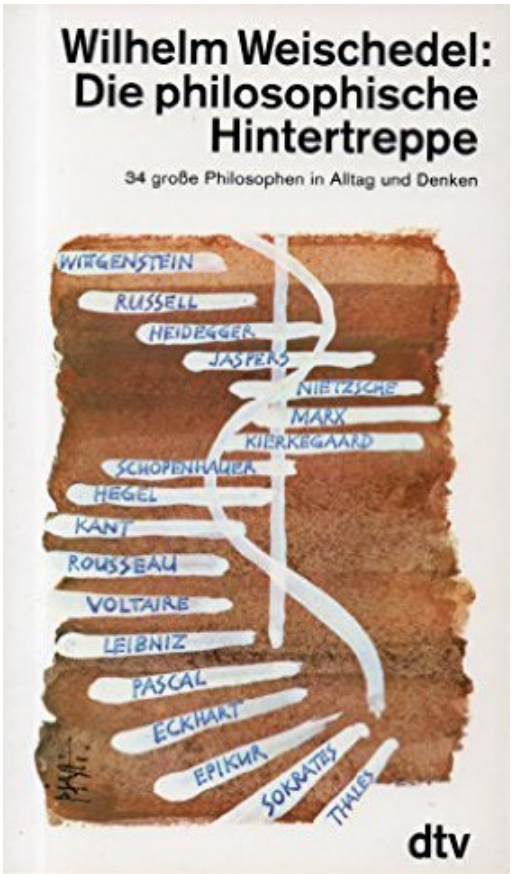
Theoretical Fusions & Epistemological Hodgepodges

Although the debate continues among statisticians, it was silently resolved in the 'cookbooks' written in the1940s to the 1960s, largely by non-statisticians, to teach students in the social sciences the 'rules of statistics'. Fisher's theory of significance testing, which was historically first, was merged with concepts from the Neyman–Pearson theory and taught as 'statistics' per se. We call this compromise the 'hybrid theory' of statistical inference, and it goes without saying that neither Fisher nor Neyman and Pearson would have looked with favor this offspring of their forced marriage. Gigerenzer (1989, p.106)

– Frequentist "feijoada" made of parts provided by Karl Pearson (1857-1936), Ronald A. Fisher (1890-1962), Egon S. Pearson (1895-1980), Jerzy Neyman (1894-1981), Karl R. Popper (1902-1994) and many other donors.

– Oscar Kempthorne challenge to Carlos Pereira (1978): *Give me a Bayesian significance test for (composite) sharp hypotheses that works as well as Fisher's [heterodox] solution, for that is what the working scientists demand.*
» Delivered! FBST (1999...), GIS São Paulo.

Conclusions: Pearson's 180° Epistemological Turn



- K.Pearson: Pivotal name in Statistics, turning it away from Causal Explanation and into Phenomenological Description. (Q: parallel +radical Logical Positivism?)
- The fulcrum point of his work is the New Werther, including all its embedded mystical* language and argumentation.

**This, of course, is a myth. But this is the great surprise: For all its development, philosophy never detached itself from it. In a sense, as the reader will see, philosophy is the narcissus, myth is the lake.*

Isto, é claro, é um mito. Mas esta é a grande surpresa: por mais que se tenha desenvolvido, a filosofia nunca se desprendeu de todo dele. Em um certo sentido, como o leitor verá, ela é o narciso, e o mito é a água.

* O Arco-íris, o pote de Ouro, e o Lago. (Foreword) Nicolau Sevcenko (1999).

(Re)Turning to more Comprehensive Frameworks

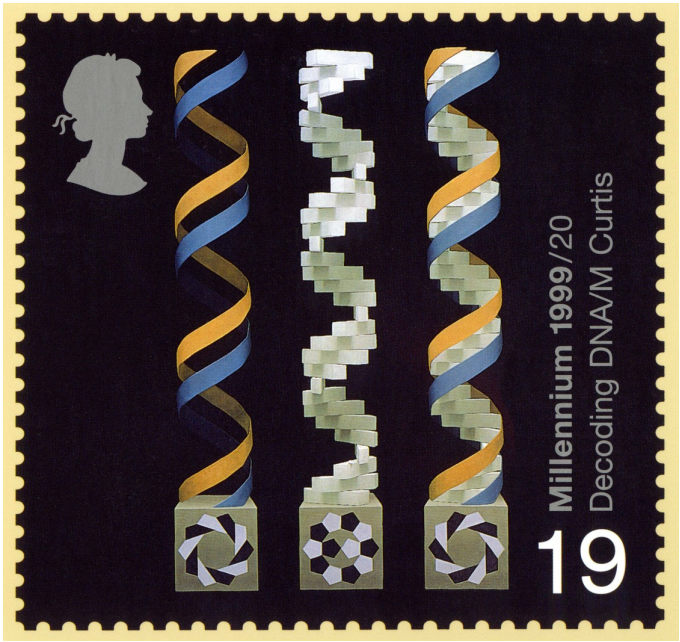
- Significance measures for composite sharp hypotheses:
- Frequentist school: K.P. goodness-of-fit test +Neyman-E.P. theory +heterodox (Fisher) significance measures mishmash.*
- Improvised solutions for real, unfulfilled intellectual demands,

– Incoherent operational-theories & pedagogic-epistemologies.
[$\sim$ Bayesian oxymora like non-zero-measure artificial-priors for sharp H]

- Need: Coherent statistical analyses for causal explanations (answers to questions asking Why things are the way they do).

[at the time of the prophets] *such *syncretism was frowned upon, and acrid discussions among the standard-bearers of rival cults lasted far into the night. ... It occasionally happened, as one moved away from the seat of prophecy in Paris, that the distinctions between doctrines which seemed so crucial to rival disciples – like the struggle of adjacent plants fighting for nutrients from the same soil – became blured, specially when knowledge of the theories was derived from hearsay or secondary sources.* Manuel (1962, p.3). Prophets of Paris: Turgot, Condorcet, Saint-Simon and Comte.

Acknowledgments



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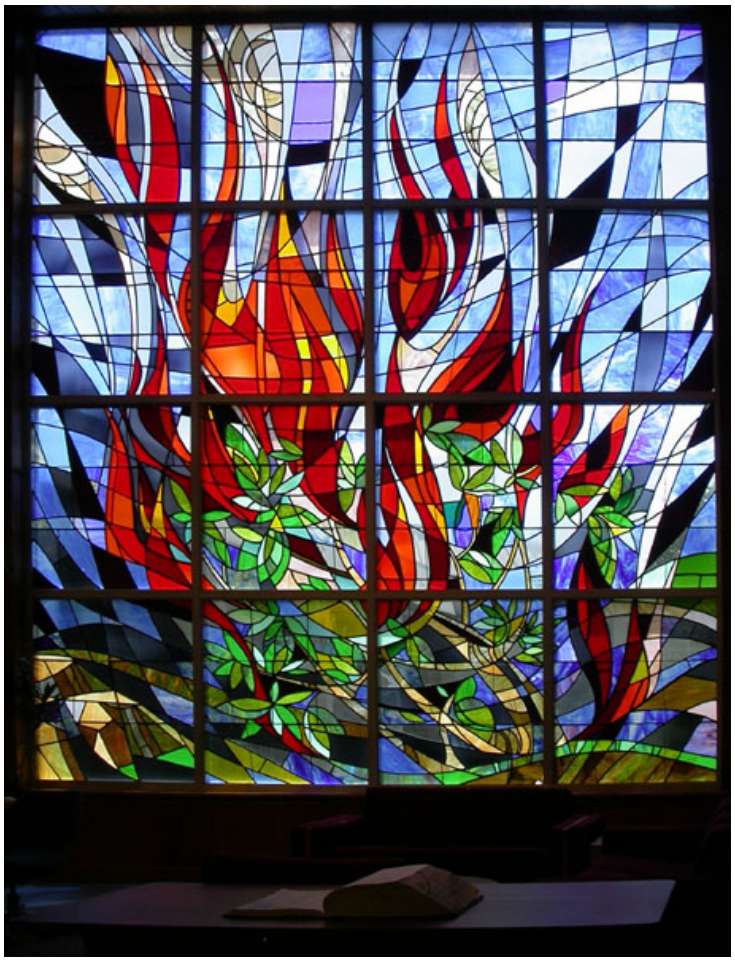
Adeus! Goodby! Auf Widersehen! שלם!



Smith Hall, University of Kansas

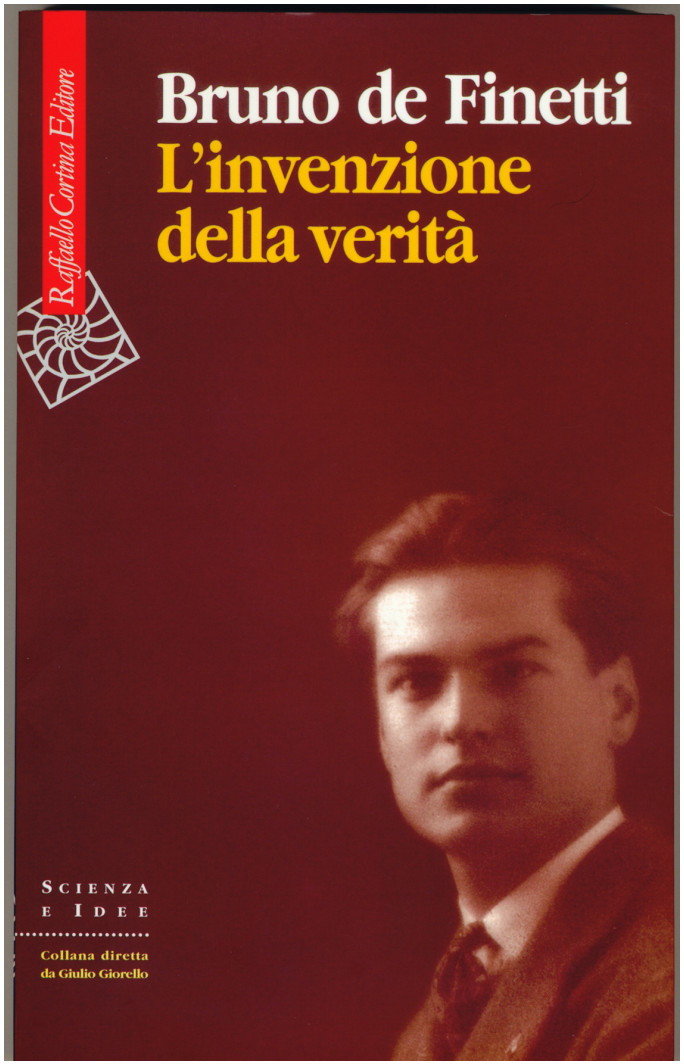
לְכָה דוֹדִי לִקְרַאת כַּלָּה
מֵרֹאשׁ מִקֶּדֶם נְסוּכָה
סוֹף מַעֲשֶׂה בְּמַחֲשָׁבָה תְּחִלָּה
בּוֹאִי כַלָּה בּוֹאִי כַלָּה

Lekhah dodi, liqr)at kallah
Mer)osh miqedem nesukhah
Sof ma(aseh bemachshavah techilah
Bo)i khalah, Bo)i khalah!

Let's go, beloved, let's meet the bride;
Before the beginning she was anointed;
Created at the end, planned from start.
From ancient times she was chosen,
Last created, but first planned.
Come oh Bride! Come oh Bride!

XVI century Jewish song, by
Rabbi Shlomo Halevi Alkabetz.

Q1: de Finetti: Probabilistic Operations w Parameters



- de Finetti reintroduces and operates with Inverse Probabilities as probabilities in the Parameter Space;
see de Finetti (1974) Probability Theory.

- However, de Finetti stays very close to Pearson's Idealistic framework:

However, if one wanted to interpret the requirements of the operational point of view only within the framework of the external world, in a way which could be called positivistic, I think that the goal of making all our ideas clear could never be completely attained. Finetti (1937, p.109), Forsight: Its Logical Laws, Its Subjective Sources.

Q1: de Finetti: Subjective Probabilities & Predictivism

- Subjective probability (and Idealized* parameters):

We are sometimes led to make a judgment which has a purely subjective meaning, and this is perfectly legitimate; but if one seeks to replace it afterward by something objective, one does not make progress, but only an error. Rather than by seeking to bring everything back to the objective, one can attain clarity by reducing any such concept systematically to the subjective; the value of a concept would then result from the analysis of the deep and essential reasons which have made us, perhaps unconsciously, introduce it, and which furnish us with the explanation of its usefulness.* Finetti (1937, 1980, p.109).

- What is the usefulness of probabilistic/ statistical models?

We only apply the notion of probability in order to make likely predictions. Finetti (1937, 1980, p.110).

*see Stern (2008) Decoupling, Sparsity, Randomization & Objective Bayesian Inference. - deFinetti critique of *Dinge an sich* & QM

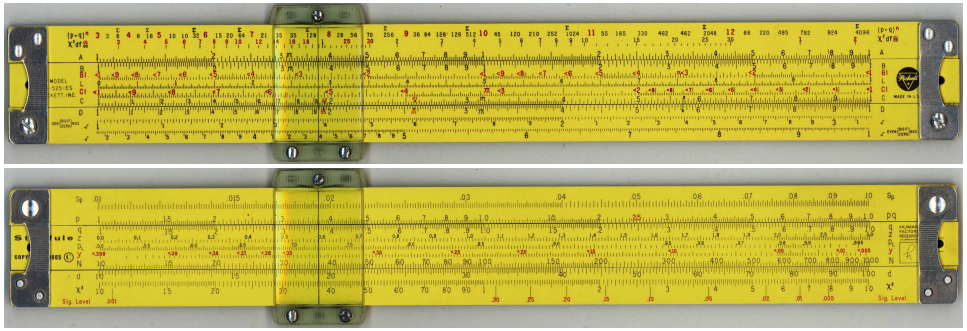
Q1: Neo de Finettian parameters as dummy variables

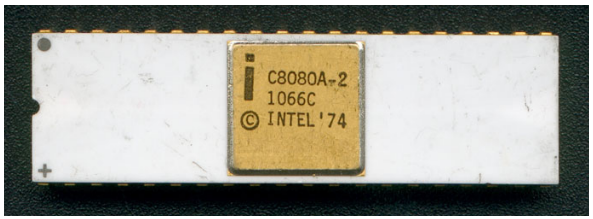
Since the family of probability density functions $f(x \mid \theta)$ is indexed by possible values of the random variable θ, this variable is called a parameter of the family. DeGroot (1970, p.29)

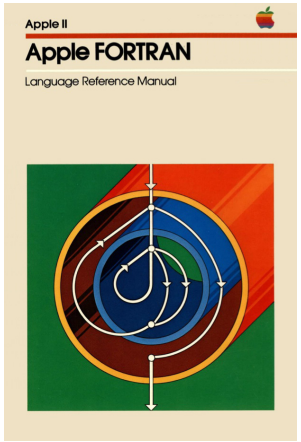
Predictivist Representation (de Finetti Theorem):
A subjective judgment on exchangeability, or a subjective confession of indistinguishability concerning draws of a coin, is equivalent to the Bernoulli model mixed by an (a priori) rate parameter, that is sometimes interpreted as the "objective" probability of heads for this coin. From this integral representation, the parameters – in a very cold interpretation – are reduced to mere integration variables. Wechsler (2005, p.36).

Mathematically, the parameters of a distribution are only abstract concepts, or 'fictional' quantities. These parameters are not directly observable, so in that sense, they are fictional. To ask experts to provide fictional numbers is rarely useful.
Apostolakis and Wu (1993, p.317)

Q2: Computing Tools for Boole's problems X & IX







Pickett N525-ES Statistics Sliderule, 1965. Scales for Binomial + Normal derived distributions, like χ^2_d , etc.

Intel 8080, 1974, 2MHz, 4.5K Transistors, 6K nm.
Intel 8C-i7, 2014, 3GHz*, 2.6G Transistors, 22 nm†.
*$\lambda \approx 30cm$, †100 silicon atoms

Apple II, 1977, MOS6502, 48KiB RAM, 113KiB disk.

Flops $\times 10\wedge$p by Linpack100‡:
8080 (1974): 1; 8086 (1979): 2;
8087‡ (1980): 4; i486§ (1989): 6;
Pentium ... P4 (93-2004): 6 ... 9.
§ MCMC in statcs, Robert (2012)
Hammersley & Handscomb (1964)

Q3: K.Pearson vs. Paul Volkmann's Constructivism

Arch bridges: compressive/tensile strength of stone, cast/wrought iron, steel+concrete

- *...there is a need, in the physical sciences, for an iterated cycle of knowledge. The reason can easily be seen in the form of emergence & internal operation of the physical sciences: The conceptual system of physics should not be understood as a system that is constructed in the manner of a building, from the bottom-up. Rather, it should be understood as a system of cross-references that is constructed like a vaulted dome or the arch of a bridge. In this way, it is a system that demands various mutual and reciprocal references, in which future results should be known from the start and, on the other way around, several previously stipulated conditions must be sustained retrospectively. Physics, in short, is a conceptual system that is retroactively consolidated.* P.Volkmann (1896, p.113-114).

Q3: K.Pearson vs. Paul Volkmann's Constructivism

- P.Volkmann on scientific epistemology:
1> Scientific logic: Mutually supported system of theoretical concepts and empirical experiences.
2> *...the logic in us has its origin in the regular happenings of things outside us, the external necessity of the natural events actually is our genuine and true instructor.* Good theory:
3> *The necessities of nature outside us, nowhere contradict the necessities of thought inside us.*

- P.Volkmann's proto-constructivism is far from naïve realism, but still unacceptable, KP (1896):
1> K.P. objects assuming an "external" world!
2> *...apparently [there is] a pre-established harmony the source of which is accounted for in a manner which the writer tells us is "The core of my epistemological studies concerning the foundations of natural sciences." [P.V. gives us] no description of the process by which such harmony has been established!* $*^{(p.11)}$