How can we get new knowledge?

Frank Hampel
Seminar für Statistik
ETH (Swiss Federal Institute of Technology)
Zürich, Switzerland
ISIPTA'09, Durham, July 14, 2009

Personal Introduction

1968	Ph.D. in Statistics, Univ. of California, Berkeley
1968-1974	Oberassistent, University of Zurich
1974-2006	Professor, ETH Zurich
2006	Emeritus

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Main interests

(1) Data analysis and consulting,
mainly for biologists (cf. FH 1987),
but also, e.g., in weather modification (Federer et al. 1986)

(2) Robust statistics = stability theory of statistical procedures
(FH 1968, 1973, FH et al. 1986), including
– rejection of outliers (FH 1985),
– high breakdown point methods (FH 1975),
– small sample asymptotics as a technical tool
(FH 1973, Field & FH 1982),
– violation of the independence assumption
(Graf et al. 1984, FH 1987, Kuensch et al. 1993).

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(3) Philosophical foundations of statistics (FH 1993),
developing a frequentist(!) epistemic(!) theory using
upper and lower probabilities (1998),
enlarging and building a bridge between Neyman-Pearson
and Bayes theory (2001), and
working out a new interpretation of Fisher's theory,
especially the corrected version of
Fisher's fiducial probabilities (2006)
which find their proper place in my theory.

Cf. also some historical aspects of nonadditive probabilities (2009).

Sketch of present paper

Example (cf. FH 2007):
Normally, we take many things for granted,
as our empirical "background knowledge".
But every once in a while, there will be a surprise observation,
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The new observation may also mean
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Many theories (such as Dempster-Shafer, but also Bayes theory)
update past "background knowledge"
by means of new observations.

But what, if full contradiction between the two? (No answer.)
This occurs sufficiently often to be of interest,
the more so as it often entails important changes or discoveries.

And what, if "nearly" full contradiction?
Usual answer: "renormalizing";
but is essentially same situation as above!

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Attempt to sketch new framework, based on
observation of everyday reasoning and of nonroutine science.

Tentative observations:

(i) We have to change "background assumptions"
(such as model assumptions...)

(ii) Exact quantitative valuations are often immaterial
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an ordered discrete qualitative scale is often sufficient
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(iii) The "background assumptions" exist in layers:

- (a) "most plausible"
- (b) "quite possible"
- (c) "unlikely"
- (d) "extremely unlikely"

  (and for logicians: (e) "impossible")

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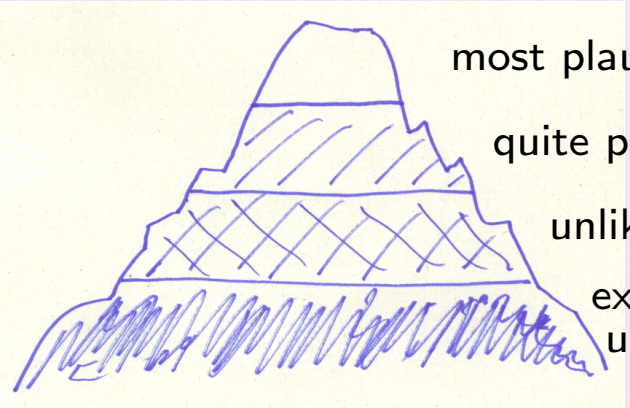

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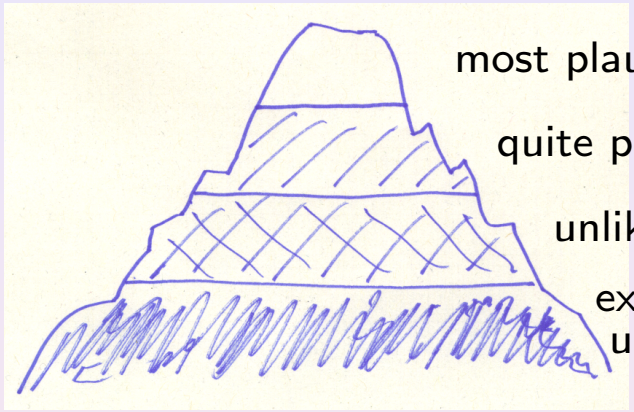

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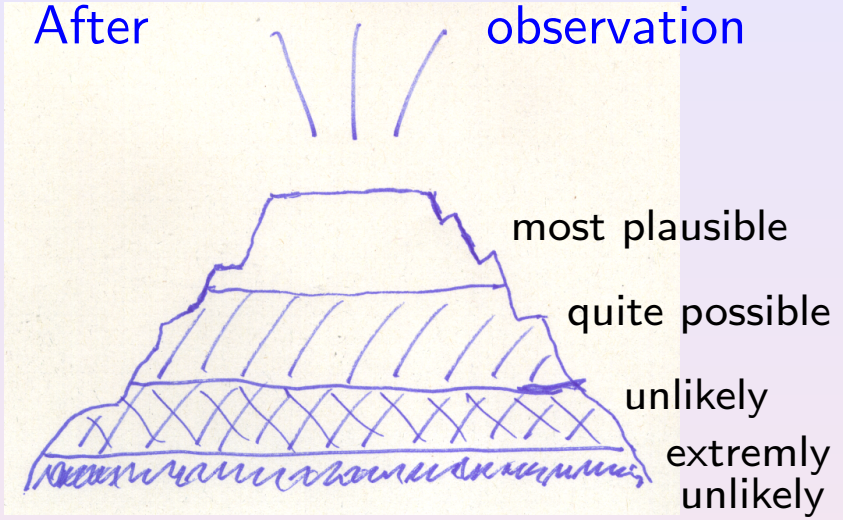

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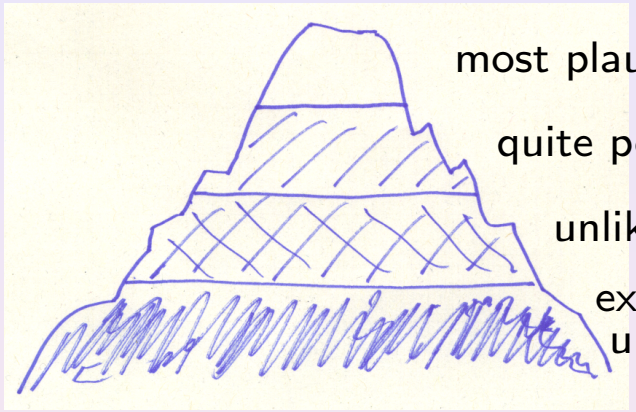

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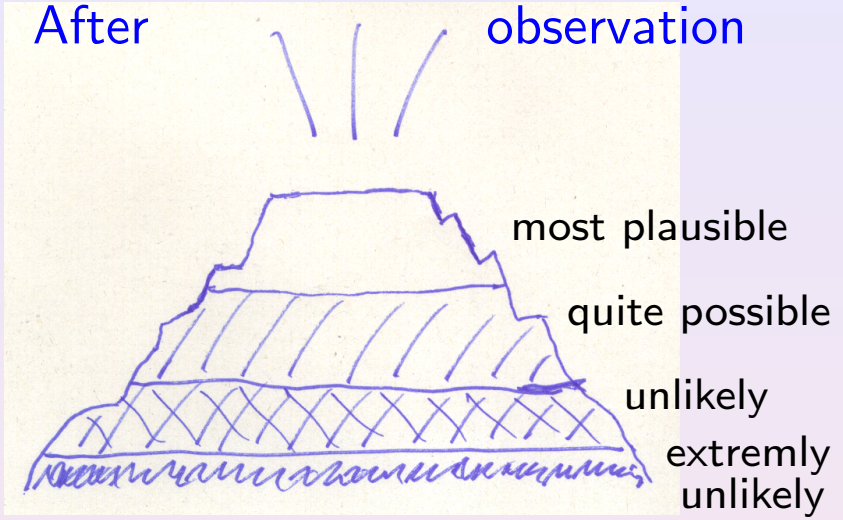

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