

**Error in the Sciences:
Diagnosis, Prognosis, and Rectifying Measures**

A workshop

**Organizing committee: Marcel Boumans, Giora Hon, and Arthur Petersen
24 October – 28 October 2011
Lorentz Center, Leiden, the Netherlands**

The aim of the workshop is to explore various practices of dealing with error to attain reliability, and to gain a deeper understanding of what error in science and its treatment entails. While the daily practice of empirical research, in and outside the laboratory, is dominated by dealing with all kinds of errors to increase the reliability of the results, there exists no general cross-disciplinary framework for dealing with errors. Various sophisticated procedures for the systematic handling of observational and measurement errors, and procedures for data-analysis were and still are being developed, but they all are fragmented and mainly developed to address specific epistemological and methodological problems within a particular scientific domain. The reason that a more general account is – still – lacking is that the kind of error to be corrected differs from case to case and depends upon the effects of many different conditions peculiar to the subject under investigation, the research design, a

The evaluation of uncertainty is neither a routine task nor a purely mathematical one; it depends on detailed knowledge of the nature of the measurand and of the measurement. The quality and utility of the uncertainty quoted for the result of a measurement therefore ultimately depend on the understanding, critical analysis, and integrity of those who contribute to the assignment of its value. (*Guide to the Expression of Uncertainty in Measurement*, ISO, 1993, p. 8)

The workshop will use case studies of research practices across a wide variety of scientific and practical activities, and across a range of disciplines (including experimental physics, econometrics, environmental science, climate science, industrial engineering, measurement science, and statistics), with the aim of integrating epistemologies and methodologies of treatments of error in scientific discourse. Such integration may be achieved through cross-disciplinary transfer of diagnosis, prognosis, and ecanh hefy ay ure(u)-13.9969(g)16.849(a)1.96388(n)-3.71712(h)-13.9956(e)12.2438((r)-1.637o(a)-18.59

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Research (Springer, 2009). The proposed workshop can be considered an extension of this conference in the sense that it now also will include non-experimental research to which also practitioners will contribute. Hon was also co-organiser (with Vincent Icke and James McAllister) of the Lorentz workshop 'Symmetry as a Modern Scientific Concept: Historical and Philosophical Perspectives' (11–14 March 2008). Since his

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DAY 1 Monday:

[I] Historical and Philosophical Perspectives on Error in Science

Traditionally history and philosophy of science has been concerned with practices that claim to attain (scientific) knowledge. Although always presents, error as an object of inquiry has been neglected, considered unproductive. This attitude is now changing. There is a growing interest in the concept of error, in its ramifications, and in the wider meaning of uncertainty. Day 1 will have two distinct parts: an introductory session to open the workshop and a focused discussion on handling error in experimentation. The introductory talk will map the problem of error in a historical and philosophical context. Different perspectives and topics will be presented in an overview: error in experimentation, error as historiographical problem, error statistics, and the like. A plenary session will follow in which contributors will present themselves with very short prepared statements of their contributions and the goals of the workshop will be discussed. The workshop will then continue with a session on error in experimentation. Like any goal-oriented procedure, experiment is subject to many kinds of error. They have a variety of features, depending on the particulars of their sources. The identification of error, its source, its context, and its treatment shed light on practices and epistemic claims. Understanding an error amounts, *inter alia*, to uncovering the knowledge generating features of the system involved—the very features that are the object of study of the historian-philosopher when it comes to evolving systems in scientific practice.

09.00 – 10.00 Arrival and registration

10.00 – 10.15 Introduction by the Lorentz Center staff and the organizing

committee: **Marcel Boumans, Giora Hon, and Au262(n)-3.71693(d)-3.73.28149(0)-**

Confounding Variables

17.30 – 19.00 Wine and cheese welcoming party

DAY 2 Tuesday: Measurement Errors

Measurement results are generally not considered as reports directly about the state of the object under measurement, but on our knowledge about this state. Measurement shifted from a truth-seeking process to a model-based one in which the quality of the measurement is assessed by pragmatic aims. As a result of the epistemological shift, the quality of measurement is not reported in terms of accuracy, an expression of closeness to the true value, but in terms of uncertainty. This has also had implications on calibration strategies: instead of expecting that reference values are true they are required only to be traceable. On Day 2 these shifts will be discussed by focusing on key issues: the shift from error to uncertainty, the shift from accuracy assessment to quality assessment and the shift from standards as prototypes to standards as instrumental set-ups.

09.15 – 09.30	Marcel Boumans (Chair of the Day): <i>Introduction to today's topic</i>
09.30 – 10.30	<i>Uncertainty Instead of Error</i>
10.30 – 11.00	Coffee break
11.00 – 12.00	<i>Quality Assessment</i>
12.00 – 13.30	Lunch break
13.30 – 14.30	<i>Standards</i>
14.30 – 15.30	European Fusion Development Agreement (EFDA) Report of the working group on data analysis: diagnostics
15.30 – 16.00	Tee break
16.00 – 17.00	Plenary discussion led by the Chair of the Day

DAY 3, Wednesday: Communicating Uncertainties

In science the need to communicate with decision makers about the uncertainties in the relevant models has become acute. Interdisciplinary work has been done in this domain to arrive at commonly agreed upon typologies of uncertainty. This includes efforts to widen the concept of reliability, since it is often not possible to establish the accuracy of the results of simulations or to quantitatively assess the impacts of different sources of uncertainty. On Day 3 recourse will be made to qualitative assessment of the different elements used in the research (e.g., data, models, expert judgments and the like) and determine their “methodological reliability”, given the purpose of the relevant model.

09.15 – 09.30	Arthur Petersen (Chair of the Day): <i>Introduction to today's topic</i>
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09.30 – 10.30

Chaos and Model Uncertainty in Forecasts and Projections

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