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Research Agenda:
- Exploring facticity as a measure for meaningful information
- Achieving a unified theory of entropy, computation and information

The basic question that fascinates me as a scientist and philosopher is: Why is the world learnable at all? My original research program focused on the application of Kolmogorov complexity to the study of machine learning and data mining algorithms: learning as data compression. In the past few years the focus has shifted somewhat in the direction of fundamental questions in philosophy of information. Central research questions are: what is the formal connection between various measures of information and entropy (Fisher, Shannon, Kolmogorov, Gibbs etc.)? Is a unified theory possible? What is the interaction between information and computation? What is a good measure for meaningful information?

As far as this last question is concerned my visit to the Info-metrics institute in 2010 has been particularly fruitful. A couple of years ago I proposed the notion of facticity as a measure for meaningful information but I was not really happy with the formal treatment. Discussions with Duncan Foley at the Institute and consequently with David Oliver helped me to clarify these ideas considerably. I now define facticity as the length of the model code in a two-part code variant of Kolmogorov complexity. A new publication is in preparation. These ideas seem to have wide application and I hope to work out some of the consequences for such diverse domains as physics, biology, economics and esthetics in the near future.

Another breakthrough in 2010 was that I finally, after groping in the dark for a couple of years, managed to formalize my ideas over the interaction between computation and information and time. Deterministic computation per definition does not create any new information. Processes that create Information (evolution, game playing, design, forms of learning) inherently have a random component. In a recent paper, Peter van Emde Boas and I formulated an adequate framework for the study of the interaction of information and computation. This confirmed our intuitions that computational processes that create and discard information can be seen as each other’s mirror images in time. A deterministic program on a Turing machine that erases information in positive time is a non-deterministic program that ‘creates’ information in negative time and vice versa. I see this work as a piece of the puzzle we have to solve to get a unified theory of entropy, computation and information. This is ongoing work.

To my surprise I find that the questions concerning measures of entropy and information that are in the focus of interest of the Info-Metrics institute are very close to the problems that I like to study. The interdisciplinary atmosphere at the Institute is quite stimulating and the field seems to be developing rapidly. In 2011 we plan to organize amongst other initiatives a workshop on Philosophy of Information in which we hope to deepen our understanding of the central questions.