

# Randomness? What randomness?

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## Abstract

Randomness is an elusive concept, even inside mathematics. After a general survey of possible meanings of the term, we focus on the failure of probability theory to capture the notion of a random sequence, and explain the way out proposed by Kolmogorov and others in the 1960s, based on the idea of algorithmic complexity. Though brilliantly conceived, this idea is self-defeating because of Gödel-style theorems showing that (almost) no random sequence can be proved to be random. This makes it very hard to certify e.g. (quantum) random number generators through the algorithmic notion of randomness.

## Biography

Klaas Landsman is Professor of Mathematical Physics at Radboud University Nijmegen. He works on the foundations of quantum mechanics and general relativity theory. His interest in randomness comes from the former. His recent books are *The Challenge of Chance* (Springer 2016, with Ellen van Wolde, edited volume), *Foundations of Quantum Theory* (Springer, 2017), and *Naar alle ONwaarschijnlijkheid: Toeval in de wetenschap en filosofie* (Prometheus, 2018, in Dutch). He is one of the founders of DIEP, the Dutch Institute for Emergent Phenomena ([www.d-iep.org](http://www.d-iep.org)) and is a member of the KNAW.

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