

MAKE YOUR BETS! WHEN MATHS STEPS IN

From 6 December 2016 to 27 August 2017

at the Palais de la découverte

Press release

August 2016

“Probability-related mathematics can be rather tough. Here, we are taking on the challenge of making it not just understandable, but entertaining too, so that the public can grasp its principles and discover its numerous applications in the everyday world. The Palais de la découverte is the perfect museum to do this, since it has been attracting the curious for nearly 80 years now!”

Bruno Maquart, chair of Universcience

What is chance? What tools can mathematicians use to describe and even make use of it? The exhibition *Make Your Bets! When Maths Steps In*, programmed at the Palais de la découverte from 6 December 2016 to 27 August 2017, takes an entertaining, interactive approach to randomness, providing visitors with a better grasp of this supremely useful concept. The exhibition examines the role of chance, probability and chaos in everyday life, games, culture and even cryptography.

The idea of chance has fascinated humanity since time out of mind, but serious study of it only began quite late on in the history of mathematics. Naturally. What could genuinely be said about events which seemed inherently impossible to predict? Moreover, in many cultures – ancient or not – chance has been associated with magic and gods, factors that are difficult to integrate in a rational approach.

Yet for nearly two centuries now, the idea of chance has played a key role in many areas of scientific research. Tools developed by mathematicians have become essential to all scientists, since they can be used to make predictions that will almost certainly prove accurate.

So how can we calculate the probability of an event occurring? How can we mine data from a large number of random events? What do we mean when we refer to ‘chance’?

Probability

The largest section of the exhibition is devoted to probability. How is it calculated? In the simplest situations, the answer is quite intuitive: we only have to calculate the number of ‘positive’ cases and divide it by the number of possible cases. So the calculation of such probabilities involves counting all positive cases precisely.

Yet the calculation of probabilities can bring surprises. Some very likely coincidences or even certainties seem extraordinary, while lotteries –with their mathematically infinitesimal chance of winning– continue to be remarkably successful!

▶ To explain probability, the exhibition presents dice used in an unexpected way, a game of mini-Monopoly, an application that can decipher a coded message and a lottery in which there is 1 chance in 14 million of choosing the right 6 numbers from a set of 49!

An exhibition created by the Mathematikum de Giessen (Germany) and adapted by Universcience in partnership with the Geneva Museum of the History of Science (Switzerland).



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Large numbers and statistics

The law of large numbers plays a key role in the study of chance. It states that when an experiment with a random outcome is repeated many times, the frequency of a given event will get ever closer to its theoretical probability of occurrence. For instance, if we play 'heads or tails' with a properly balanced coin, the more we toss it, the more the number of heads or tails will approach 50%.

Simply by knowing how many customers it will have, a casino can estimate its turnover quite accurately. Insurers take the opposite approach, setting premiums according to the calculated probability of an accident.

▶ In this section of the exhibition, the Galton plates next to a video of Ligeti's *Poème symphonique for 100 metronomes* help the public understand the law of large numbers and statistics. Visitors count the number of Smarties on a plate, crack a code and compare their height to that of other people.

Chaos

Chaos theory states that a phenomenon can involve chance even when it is simple enough for its development to be calculated.

A tiny difference in parameters at the start of an experiment can completely change its result. This can be observed by watching a ball bounce off the bumpers of a pinball machine. While it is impossible to predict where the ball will be 25 seconds after it is fired, we can still say that over 5 minutes, it will spend about 5 seconds in one area, 20 seconds in another, and so on.

▶ In this section, visitors play a game that illustrates the concept of percolation, compare the movements of two chaotic pendulums and play on a pinball machine.

Applications

While chance can be seen as limiting our prediction of certain phenomena, it can also help us do some calculations that would otherwise be very hard. Understanding chance is useful in the many approaches to cryptography, the production of virtual images and the study of how viruses move within a cell.

▶ Among other activities, this section of the exhibition allows visitors to compose their own piece of music by randomly choosing 16 bars from 176 available. What will the tune turn out to be?

RELATED TO THE EXHIBITION

Presentation

From chance to mathematics

Tails, heads, tails, tails, heads, tails, tails, heads, tails... and then what? Where chance is involved, probability and statistics provide answers. This presentation scheduled twice a day explores the issues raised by the exhibition, answering and even anticipating visitors' questions!



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Palais de la découverte

Avenue Franklin Roosevelt - 75008 Paris
Ⓜ Franklin Roosevelt or Champs-Élysées Clemenceau

Opening hours

Every day except Monday from 9.30 am to 6 pm
and Sunday from 10 am to 7 pm.

Admission

Standard rate €9, reduced rate: €7 (over 65s, teachers, under 25s, large families and students).

A supplement of €3 for the Planétarium.

Free for children under 3, job seekers and those in receipt of minimum social benefits, and the disabled and their accompanying person.

Information for the public

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