

[Numb3d by Numb3rs!](#)

‘For the things of this world cannot be made known without a knowledge of mathematics.’ (R. Bacon, 1266, Opus Majus). If Bacon’s words were true at the time, they are even truer today. One can see the importance of mathematics and probability – the math of uncertainty - in our society and in everyday life. And yet, math, probability and, more generally, data science are often not perceived as attractive subjects. Only few students decide to study Math, Informatics, Natural sciences, or Technology (the MINT disciplines) at university, despite the increasing demand for professionals working in these sectors.

With *Numb3d by Numb3rs!* we are trying to reverse this status quo. The mathematics that is on display in the exhibit is a broad concept that includes not only calculus, but also probability, statistics, and simulation. *Numb3d by Numb3rs!* is an interactive scientific exhibition revolving around the broad world related to numbers that, when placed in a context, become data. It offers the opportunity to engage in debate with a young audience (main target: aged 6-16), but also with a grown-up and more aware public.

The project aims first and foremost to communicate the passion and enthusiasm I, as a researcher in Statistics and Data Science, experience every day in my work with numbers and data. This might seem too ambitious, but I believe that, through a ludic and intuitive approach, we can attract even the youngest audience to this fascinating world, building on the ‘unlearned basic core of numerical competence’ that even infants are believed to possess.

Numb3d by Numb3rs! is an educational tool complementary to school: a space where to experience numbers through our body, their beauty, and the descriptive power they can express; a place where to dialogue on quantitative themes, as Pythagoreans probably did in the agora. I believe that if all citizens were to assimilate these themes into their background, this newly acquired Quantitative Literacy would help them become more knowledgeable and responsible actors in social life in the age of technology and information. The exhibition is articulated in a sort of 3D tour where the 3Ds are Digits, Dice and Data. With the same look of wonder of a child beginning to learn how to count on his fingertips (DIGITS) and having fun, we will also explore the world of numbers, which is often frightening, and its close relationship with human nature. Through magic and games like DICE, using intuition and reasoning, we will talk about probability, variability, uncertainty, decisions under risk and games of chance with a real roulette where to bet and then witness the gambler’s ruin thanks to an interactive simulation. Finally, we will show that we are swamped with DATA, but far from being numbed by them, we will try to make some sense of them, bringing data to life, interweaving them with our history and daily experience.

So, entering the exhibit the visitors start a 3D journey following numbers, from their origin through the theory of probability, and ultimately the role of numbers in the dynamic fields of statistical analysis and data science.

All the experiences are mediated by explainers, who will guide the visitors through the exhibition, adapt concepts to their background and interests and help them realize that “*The theory of probability is, at bottom, nothing but common sense reduced to calculus*” to use the words of Pierre Simon Laplace (Théorie analytique des probabilités, 1812).

Numb3d by Numb3rs! offers visitors an occasion to increase their knowledge about numbers and sharpen skills that are useful when dealing with today’s reality where uncertainty, percentages and data are increasingly present.

To achieve the project goals, I strongly benefitted of the collaboration with experts in science communication: L’ideatorio (USI), a regional chapter of the Science et Cité Foundation. The team of communicators has been popularizing science for years in Ticino and abroad, where they have created tools and built competencies. The project also relies on a wide network of local partners: from the Società Matematica della Svizzera italiana (SMASI) to the Swiss National Supercomputing Center (SCS-ETHZ), and

Ticino's main educational bodies and authorities like the Scuola Cantonale di Commercio in Bellinzona that has hosted the exhibit in 2019 and 2020 after its tour in Italy: from Genova (Science Festival) to the Universities of Pavia, Firenze, Palermo and Catania to the Golinelli Foundation in Bologna all the way to the Statistics Festival in Treviso. With the precious help of L'ideatorio and the main financial support of the Swiss National Science Foundation (under the call Agorà), *Numb3d by Numb3rs!* was born in Ticino and has been on display in Lugano, Ascona and Bellinzona in 2015-16. During this first year it has been visited by 284 classes of all school types and grades (each group participated in a 1h30'– 2h visit, guided by a scientific explainer), 5.340 students, 367 teachers, plus 2.072 visitors from the general public who were hosted during the weekends. A total of 7.779 people visited the exhibition in Ticino and approximately 9.000 people visited it during its Italian tour.

Now that *Numb3d by Numb3rs!* is back in Lugano (at Cadro, the new "house" of L'ideatorio, where it will be open until June 2023), we decided to add a new section on "*The data pandemic*" which is, like any pandemic, terribly infectious, possibly lethal. It flooded our lives during the Covid-19 emergency with tables, graphs and predictions, but for some time now we have been living immersed in data without hardly noticing it. How can we manage to stay afloat? How can we save ourselves from this invasion of data? And how can we find our sense of direction through numbers? To find answers to these questions and more, come to Lugano and get, together with us, comfortably numbered by numbers!

Few people have any idea how much mathematics lies behind the artifacts and accoutrements of modern life. Nothing we use on a daily basis — houses, automobiles, bicycles, furniture, not to mention cell phones, computers, and Palm Pilots — would be possible without mathematics. Neither would our economy nor our democracy: national defense, Social Security, disaster relief, as well as political campaigns and voting, all depend on mathematical models and quantitative habits of mind.

Lynn Arthur Steen, *Mathematics and Democracy*, 2001

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