The die is cast!
Chance and probability

English texts of the exhibition
The die is cast! Chance and probability is an original exhibition of the Musée d'histoire des sciences of Geneva, presented from the 1st of Fabruyry 2012 until the 7th of Januray 2013.

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Is it possible to predict the future and outwit chance? If it is, to what extent can we be sure of our predictions? These questions have perplexed people for a very long time. There are references in Antiquity and the Middle Ages especially in relation to games of chance such as the Roman dice-game, the *alea*, or the Arab *al-zahr*, the origin of our words aleatory and hazard.

From the end of the 17th century, the problem has become a field of mathematics. Mathematicians have developed a tool, the well-known calculation of probability, which does not eliminate uncertainty but estimates it. But the power of the technique to describe reality depends on reliable data hence the appearance of censuses, statistics and then surveys. Linking these together allows us to determine the risk, or the possibility, that an event will occur.

You can imagine that such analyses often required a very long time to calculate by hand and were vulnerable to errors. From the beginning of the 17th century, the invention of the first calculating machines, marvels of mechanical ingenuity, simplified the work considerably. The first, the Pascaline, invented by Blaise Pascal, opened the way for a whole series of machines some of which are in the museum’s collections and are shown in the exhibition. They enabled ever more complex calculations and led to the calculators and computers of the 20th century.

Because probability calculations were inspired by games of chance, we have set out to explore some of their characteristics through games: dice, heads or tails, roulette. We have left no stone unturned to show you this fascinating aspect of our daily lives.

Les jeux sont faits, rien ne va plus!
Loaded dice
[Les dés pipés]

To begin your visit, throw the two dice a few times and note your scores on the result counter.

The yellow die is normal so you can reasonably expect to have a one in six chance of throwing each number.

On the other hand, the blue die is loaded. It is not therefore possible to predict a priori your chances of throwing a specific number. The most efficient way to predict the behaviour of a loaded die is to throw it a very large number of times and then to calculate the proportion of times each number comes up. This is what we suggest you do.

**Instructions**

Throw the two dice and register the result for each die by dropping a counter into the corresponding cylinder.

Have a look at the results obtained by previous visitors.

Using the past results, can you estimate your chances of throwing a 6 with the blue die?

Faced with a situation in which the probability of an event is unknown (here, the chance of throwing a 6 with the blue die), there are three possible options:

- Study a very large number of results.
  This is what we suggested here.
- Carry out a detailed analysis
  If you give the die to a physicist you could hope to obtain better information about your chances of achieving a particular result because he/she would analyse the die in depth (distribution of mass, ballistic modelling, etc.).
- What the expert says
  You could seek the advice of a professional trickster who, having thrown the die a few times, would use his experience to give you expert advice.

In fact, when we are not dealing with a die but with a serious risk such as the probability of multiple breakdowns in a new aircraft, the three approaches are used in parallel. The engineer, test pilot and flight simulator all contribute to the assessment of the risk in order to reduce the likelihood of its occurrence.

Heads or tails
[Pile ou face]

Sylvie invites Catherine to play heads or tails:

«You toss the coin first:
- If it’s tails I win and the game is over.
- If it’s heads we throw the coin again. If heads comes up a second time, you win.
- However, if it falls on tails on the second throw, I win.»

To add a little spice to the game, Sylvie suggests that they place bets on the outcomes in the following ways:

«At each toss I will bet 2 francs and you bet 1 franc. The person who wins takes 3 francs.»

In order to reassure Catherine that her proposal is not a trick, Sylvie tells her the following:

«The game has three outcomes: tails I win, heads-heads you win, heads-tails I win. I will therefore win 2 out of 3 times on average. But I shall only win 2x 1 franc in 3 turns while you will win 1x 2 francs in 3 turns. So each of us will win 2 francs and lose 2 francs, on average, in 3 turns. The game is therefore fair.»

Catherine hesitates. Is the game really fair? Would you be willing to play the game according to Sylvie’s rules?

You can think about it, or you could play a few times in the roles of Sylvie and Catherine.

**Instructions**

Distribute the counters equally at each end of the rail (8 francs each side).

**Bet as follows:** Sylvie places 2 francs, Catherine 1 franc.

Spin the coin; the winner takes the stakes.

Play as many games as possible. If one of the players is bankrupt after a large number of games, it is very likely that the game is unfair.
Heads or tails

The answer

This game is not fair. There are indeed 3 outcomes but they will not occur equally. Sylvie will win 3x in 4 and not twice in 3. It is true that tails has one chance in 2 of occurring at the first toss of the coin. The heads-tails outcome, which is a winning toss for Sylvie, will occur 1x in 4. Sylvie will therefore win 3 times in 4 \((1/2 + 1/4)\). To make the game equitable, Sylvie would have to put in 3 francs and Catherine 1 franc.

This is a case of equiprobability. When we are comparing events, we should always check the respective probability that they will occur. Take 2 dice: the chances of throwing 12 are not the same as those for throwing 7. A double 6 will only be thrown once in 36 throws on average while 7, which can be composed in 6 different ways, will occur 1 in 6 throws on average. It is knowledge which makes all the difference between a good and a bad Backgammon player!

The village children

Marcel is the mayor of a small village in which there are 10 children. He has just received the results of the census which shows that couples in the country have, on average, 2 children.

Being sceptical by nature, Marcel decides to test the result, which he thinks is too low, in his village. He sets out to do the following: he will visit each child and ask «How many brothers and sisters are there in your family?».

He will add up the 10 responses and then divide the total by 10 to arrive at the average number of children per couple.

Is Marcel right to address the problem in this way? Will his result be the same as the census result?

You can think about it, or you could copy Marcel’s method with the help of the children and families shown below.

Instructions

Have a look at the families and then note on the panel the reply that each child would give to the question «How many brothers and sisters are there in your family?».

Do the addition and division as shown on the panel to reach the result obtained by the mayor.

Then simply count the number of children you can see and divide the total by the number of families.

Have you got the same result?

Before leaving, don’t forget to mix up the numbers on the panel for the next people. Thank-you!
The village children
The answer

No.

Marcel will get a figure that is higher than the actual number of children per family in the village. Children who have many brothers and sisters will be over-represented.

In the example below, the 4 children of the Tantmieux family will reply 4 times: « We are 4 brothers and sisters ».
However, the only child of the Tantpis family will reply once: « There is only one child in my family ».

So the replies of the Tantmieux children will be counted 4 times more often than those of the Tantpis family.

Even worse, the Ru486 couple, who do not have children, are not included at all because no child would reply « There are no children in my family ».

You will not obtain the correct average for the number of children per couple by using this method. The correct way is to ask each couple how many children they have. You will have 5 responses which, added together and then divided by 5, will give 2.

Marcel had not taken into account a statistical artefact: the magnifying effect. The effect is related to the way in which statistics are collected and calls for considerable caution when analysing certain results.

Shazam’s dice
(Les dés de Shazam)

Pierre-Alain loves playing games. His friend Marc has an impressive collection of dice and he invites Pierre-Alain to play a game. He selects 3 dice from his collection; the 6 faces are shown here. Marc tells Pierre-Alain than the rules of the game are as follows:

« We each choose a die and throw it. The person who gets the highest score wins. As this is the first time you have played you can choose the die first and I will choose from the two which remain ».

Pierre-Alain examines the 3 dice and notices that there are a total of 24 faces. He has the impression that some are more likely to win than others. As Marc has kindly allowed him to choose first, he tells himself that there is no risk.

Is he right? Would you agree to play with Marc?
You can think about it, or you could play the game with a friend in the role of Pierre-Alain.

Instructions

Ask a person with you to choose one die:
- if he/she chooses blue, you take the orange one
- if he/she chooses yellow, you take the blue
- finally, if he/she takes the orange die, you choose the yellow

Play several times.

Do you think that the game is equitable? Do you have the impression that you win
Shazam’s dice
The answer
This game is not equitable and the person who chooses first is very likely to lose.

In fact, each die is better than one other and less good than the third.

The yellow die has 2 in 3 chances of winning against the orange die but has 2 in 3 chances of losing against the blue. The orange die will win 5 times in 9 against the blue but will lose 2 times in 3 against the yellow. The blue die will win twice in 3 throws against the yellow but will lose 5 times in 9 against the orange. By allowing Pierre-Alain to choose first, Marc can be sure that he will always choose a die which has a greater chance of winning. You can compare this to the probabilities of a game of «stone, paper, scissors.» If you choose first you have an obvious advantage.

Have you ever heard of transitivity?
It is a property relationship in mathematics. One of the simplest examples is «to be taller than ...». If Aline is taller than Pauline, and Pauline is taller than Micheline, then Aline must be taller than Micheline. «To be taller than ...» is called a transitive relation.

In the game we are talking about here this is, precisely, not the case. The relation «has a greater chance of winning than ...» is not transitive. Why? The blue die has a greater chance of winning against the yellow, and the yellow a greater chance against the orange, but this tells us nothing about the chances of blue winning against orange.

Russian roulette
[La rouette russe]
Paul has been condemned by a court of law to play Russian roulette.
The executioner has told him that he can choose between two different methods:
«Either I put two bullets in the barrel and you play once, or I put only one bullet in the barrel and you play twice. Choose!» (It is understood that if Paul plays twice with one bullet, he must spin the barrel between the two tries).

If you were in his place, which game would you choose? You know, of course, that you must never play Russian roulette!
You can think about it, or you could simulate a few games with the two chambers provided here.

Instructions
Stand in front of the barrel on the right-hand side and turn it twice.
Stand in front of the barrel on the left-hand side and turn it once.
Repeat the actions as many times as you like.
Do you feel that you are more likely to lose on the right or on the left?
Russian roulette
The answer

It is better to play twice with one bullet.

With two bullets and one game, the chances of losing are 2 in 6, that is, one third. Playing twice with one ball, the chance of losing is only 11 in 36 which is a little less than one third. If you have tried the game here, where the difference between the two strategies is only 1 in 36, you will probably not have noticed a major difference. You would need to play many games to observe a clear difference.

To find an answer without having to do a calculation, you could imagine what would happen if you increased the number of bullets to the maximum. With 6 bullets in the chamber at the same time, you would lose, while playing 6 times with one bullet, you would have a chance of survival. We can see that it is indeed better to choose several games with one bullet.

It is better to play twice with one bullet because whether you lose once or twice (impossible!) makes no difference in Russian roulette. Playing roulette at the casino, however, the chances of winning if the same number is played on two successive turns, are no fewer than if two numbers are played at the same time. There are fewer chances to obtain at least one winning number but, on the other hand, there is a chance of choosing a winning number twice. In this particular case, the two strategies are exactly equal.

Opening of the fishing season
[L’ouverture de la pêche]

Nicole is the fisheries officer at Sansfond lake. In order to establish the fishing quota for the forthcoming season, she needs to know how many fish there are. Obviously, she cannot empty the lake and count all the fish.

However, Nicole recently carried out some work which she thinks may help. She caught 20 fish in order to check their health. She then marked each of them and released them back into the water. It occurred to her that she could apply a statistical sampling method using this information and the likelihood of catching 20 fish again:

«Amongst all the fish in the lake, 20 are marked ... If I fish 20 fish ... ».

Are you able to argue on the same lines as Nicole? You can think about it, or you could go fishing at the display below.

Instructions

The Plexiglas globe represents the lake. The balls represent the fish, the orange balls being the marked fish.

Turn the globe and stop when the white frame inside the globe is at the bottom.

Look in the mirror; the balls trapped in the sheet represent a catch of 20 fish. Count the number of marked fish (the orange balls) amongst the 20 that you have caught. Repeat the procedure several times.

Are you able to estimate the total number of fish in the lake?
Opening of the fishing season

The answer

There are 100 fish in the lake.

By catching 20 fish several times, you will have noticed that you catch 4 marked fish (orange-coloured balls) on average each time, that is, 1/5 of your catch. Thus, if 20 fish account for 1/5 of the population in the lake, there must be a total of 100 fish.

This statistical method is used to estimate wildlife populations. It is also used to check the reliability of industrial products which can only be used once. For example, the classic case is that of detonating fuses. The only way to test these is to burn them to the end, but this of course destroys them. Not all the fuses can be tested but it is of utmost important to show the reliability of the product one is selling, especially in the case of explosives.

The search for a sock

(La quête de la chaussette)

Stéphane is not very tidy. For example, he does not sort his clean socks into pairs but just throws them all together into a drawer.

This morning Stéphane has a problem: he is late for an appointment and the light in his bedroom is not working. He knows that he has 10 black socks and 10 blue socks in his drawer. He doesn’t mind which colour he wears but he does want them to be the same. He therefore just pulls socks out of the drawer at random.

What’s the minimum number of socks that Stéphane has to bring into the light to find a matching pair?

You can think about it, or you could pull socks at random out of the cupboard below.

Instructions

Put your hand into the drawer and, without looking, bring out a sock. Keep it in the other hand and then do the same thing again for as many times as necessary to find a pair of the same colour. Before you leave, don’t forget to replace the socks in the cupboard for the next person. Thank-you!
The search for a sock
The answer
You must pull out 3 socks.
The first sock is either black or blue. The second is either the same colour as the first, in which case you have a matching pair, or it is the other colour. The third sock taken out must be the same colour as one of the first two and you have a pair of the same colour. Some of you may have been a bit too hurried and you may have taken all 11 socks out. However, this is the right answer to another very similar question: «What’s the minimum number of socks Stéphane would have to take out in order to be sure to have at least one miss-matched pair ?». Perhaps some of you replied – 12 socks – which is the correct answer to the question «What is the minimum number of socks he must take out to be sure of having at least one black pair ?».
Although this formulation appears to be a probability problem, in fact it is not. Logic is the way to arrive at the right answer. Probability is often no help at all when we are looking for certainty.

A mother’s love
(Le coeur d’une mère)
Muriel lives in Nyon. She has two sons one of whom lives in Geneva and the other in Lausanne. Whenever she can, she goes to see them. Muriel, of course, loves each of her sons as much as the other and tries to distribute her visits equally. She does not, however, relish waiting too long for the train. She has noticed that one train leaves Nyon for Geneva and for Lausanne each hour. As Muriel works irregular hours, she has come up with the following strategy:
«Whenever I can, I will go to the station and take the first train to arrive whether it is going to Lausanne or Geneva. As there are the same number in each direction, I will be sure to see each of my sons the same number of times.»
Is Muriel correct ? Will she see her two sons the same number of times by following her plan?
You can think about it, or you could test her plan using the equipment provided.

Instructions
Turn the handle smoothly and keep an eye on the trains passing through Nyon as well as on the clock.
Are you sure that you have 1 chance in 2 of leaving for the two destinations?
A mother’s love
The answer
No.

Muriel will visit her son in Geneva 5 times out of 6. While the number of trains is certainly one per hour in both cases, the interval is different. The train for Geneva leaves at 10 minutes past the hour while the train for Lausanne leave at 20 minutes past the hour. Therefore, there are only 10 minutes in each hour when, having arrived at the station, the next train leaves for Lausanne. On the other hand, there are 50 minutes during which, having arrived at the station, Muriel can take the train to Geneva.

This puzzle introduces time. In Muriel’s case, it’s not too difficult to understand her mistake but time is a concept which we find very difficult to comprehend. In the field of logic, several problems related to time are considered insoluble.

Birthdays
(Les anniversaires)

Lucas usually dislikes school. Today, however, he is happy to go because Isaline and Gilles have their birthdays and the teacher has made two cakes. But Lucas is puzzled. There are 23 pupils in his class and he is sure that there are 365 days in a year. It seems to Lucas that the likelihood of two of his classmates having a birthday on the same day must be very small.

Is he right?

Do you think that, in a class of 23 pupils, the likelihood of at least two having their birthdays on the same day is greater or less than 1 in 2?

You can think about it, or you could do the exercise.

Instructions

Turn the two wheels in order to select a date at random. Mark the date on the calendar with a peg.
(If the result is a non-existent date such as the 29 February, 31 November, etc. spin both the wheels again (not just one). We apologise to visitors who have a birthday on 29 February, leap years are not taken into account in this demonstration.

Turn the wheels a number of times until a date you have already pegged comes up again.

Count the number of pegs (i.e. pupils) there are. This will show you how many pupils are needed for two birthdays to occur on the same date. Are there more or fewer than 23?

Before leaving, don’t forget to clear the calendar by pulling the handle. Thank-you!
Birthdays

The answer

In a class of 23 pupils, there is a little over 1 chance in 2 that pupils will have their birthday on the same day.

This probability rises to nearly 9 in 10 in a class of 40 pupils. You probably underestimated the probability of 2 pupils having their birthday on the same day in a class of 23. This is because we find it difficult to work out probabilities involving a number of actors. It is in fact easy to calculate that, of 23 people, one will have a birthday on the same day as you. It is clearly less than a half (it is around 6%). But for the problem presented, you have to show that 23 dates chosen at random are not all different from each other. You need to do a calculation.

The bees’ challenge

(Le défi des abeilles)

Two bees, Alice and Bobinette, are responsible for feeding the larvae. They find the work boring so they change it into a game.

Taking turns, they choose a cell and put the food into it trying to create a path from one side of the hive to the other. Alice is working on a north-south path and Bobinette an east-west path.

Do you think that there will always be a winner and a loser?

A subsidiary question: if I now toss a head or tails for each cell to determine whether I fill it with a blue or orange pawn, will I be sure to create a blue east-west path and an orange north-south path?

You can think about it, or you could play a few times with a friend.

Instructions

Each of two players selects counters of one colour and must create a path linking the compass points of the same colour.

Toss to see who places the first counter. You can put your counters in any free space.
The bees’ challenge

The answer

There is certainly a winner and a loser.

Once all the cells are filled, the only way in which an orange path is prevented from linking north to south, is if there is a blue path which links east to west. Conversely, an orange path linking north to south excludes the possibility of an orange path linking east to west. The same situation holds for the subsidiary question. By randomly choosing the colour of the pawn to put into the cell, we can be sure that there will be as many orange as blue cells when we have finished but, using the same reasoning as before, we can show that whatever the number of cells of each colour, the absence of a blue east-west path means the presence of an orange north-south path (and vice versa).

The game presented here aims to give you an idea of the questions which are explored in a field of mathematics called percolation theory. In particular, the subsidiary question is typical of this field of research. For his work on percolation and the Ising model, Stanislav Smirnov, a Professor at the University of Geneva, won the Fields Medal (sometimes called the «Nobel Prize for mathematics») in 2010.

The die is cast !
[Les jeux sont faits]

Loren and Shaula are playing roulette. They each have 10 francs to spend and intend to double their stake. When they have won 20 francs they will stop playing. Being cautious, they decide not to play all the numbers but only those which allow them to double their bet: black/red, odd/even and low/high.

Loren decides to play 1 franc each turn.

Shaula opts for a more complicated strategy. She sets 10 successive goals for 11, 12, 13 .. to 20 francs. She plays the sum required to reach her goal each time.

- She is starting with a total stake of 10 francs but after the first turn she aims to be holding 11 francs. She will thus bet 1 franc
- If she wins, her new objective will be to win 12 francs so she will bet 1 franc again.
- If she loses in the first round, she will have 9 francs left, but her goal remains 11 francs. She will therefore bet 2 francs. If she loses again, she will have 7 francs left. She will then bet 4 francs to reach her goal of 11 francs.

(When she no longer has enough money left to reach her objective, she will play everything she has left until she has accumulated enough money to start her strategy again).

Who do you think has the greatest chance of leaving the game with 20 francs in her pocket?

You can think about it, or you can play using Loren’s and Shaula’s strategies in turn.

Instructions

Take 10 counters and begin to play according to one strategy or the other. As the Museum does not employ a croupier, we trust you to pay yourself the correct amounts!

Which of the two strategies do you think has the greater chance of reaching the 20 franc jackpot?
The die is cast!

The answer

Shaula has the best chance of leaving the table with 20 francs. Loren has only nearly 1 chance in 4 of not bankrupting herself. Shaula, on the other hand, has over 2 chances in 5 of reaching her objective. The irony is that they both have a lower chance of reaching their 20 franc goal than a player who put all her money on the first round (18 chances in 38 or 47.37%).

It’s normal!
[C’est normal !]

Michael is bored. He passes the time by playing heads or tails like this: he throws the coin 14 times consecutively and counts the number of times tails comes up. There are 15 possible results ranging from 0 to 14. After a number of games he notices that he obtains 7 heads and 7 tails much more often than 14 heads or 14 tails. He asks himself what the pattern would be if he were to play a very large number of games.

He asks himself another question too: if the coin has been altered so that there is a greater chance that it will fall as tails rather than heads, would the distribution pattern be different? In your opinion, which of the curves gives the best picture of the distribution over 100 games? If the coin has been rigged, will the distribution be different?

Instructions
Tilt the board and let the marbles run down. Unblock them with the styluses provided.

By tilting the board towards the orange side, each marble simulates 14 tosses for heads or tails with a normal coin.

By tilting the board towards the blue side, each marble simulates 14 tosses for heads or tails with a rigged coin.
It’s normal!

The answer

The red curve shows the best distribution over 100 games. This curve, bell-shaped or like Napoleon’s hat, is named the Gaussian curve after the scientist who discovered it.

A rigged coin does not change the form of the distribution curve but its centre would shift to either the left or the right.

Who wants to win a car?

(Qui veut gagner une voiture ?)

John has just won a television contest.

The host of the show tells him that, in order to get his prize, he must choose one of 3 doors without opening it. If he chooses the right one he will be able to take home the luxury car hidden behind it.

After John has chosen one door, the show’s host then opens one of the 2 remaining doors which he knows will not reveal the car. John is therefore faced with 2 closed doors; the one he has chosen and one other. The host tells him to open one of the two doors, the one he has already chosen or, if he wants to change his mind, the other one.

John decides to stick to his choice and to open the door he first chose.

Was John right? Wouldn’t he have had a greater chance of winning the car if he had changed his mind?

You can think about it, or you could try it yourself with a friend in the role of the host.

Instructions

The host turns the cylinder in order to position the car behind one of the three doors. He asks you to choose a door and then opens one of the other two doors where he knows there is no car. He then asks you to open one of the two remaining doors.

Play several times using each of the two strategies:
- stick to your original choice
- or change it.

Do you win more often with one of the strategies?
Who wants to win a car?

The answer

It is better to change the choice.

By maintaining your initial choice you have 1 chance in 3 to win the car; by changing your choice, you have 2 chances in 3.

To convince you, here is the reasoning: «If I had chosen the right door at the beginning, the host would have the choice of opening either one of the 2 others. But if my first choice had not been the right one, the host would be faced with an empty space behind one door and the car behind the other. In this case, he would not have had a choice and would have had to open the door which did not hide the car. He would therefore reveal in the negative which door was hiding the glittering prize. This second possibility, in which I had not initially chosen the right door, would occur twice out of 3 attempts. I should therefore have assumed that I made a mistake in my first choice and allowed the host to show me the right door. I would then have won the car twice in every 3 attempts».

This conundrum was perhaps the most famous probability puzzle of the 20th century. After a paper on it was published in the 1990s, its author received 10,000 critical letters some of which were from university professors. Some maintained that whichever solution was chosen by the candidate he still had 1 chance in 3 of winning the car. Others thought that with both strategies his chances were 1 in 2. It took some time before everyone finally agreed that it is better to change the choice.

The week of four Thursdays

The Director of Education of the town of Calvinville wants to increase the number of school hours per week. He is worried when he hears of a project in favour of a week of 4 Thursdays (that is, 4 days holiday). He therefore asks two well-known local survey institutes, Jedevinetout and Predictable, to investigate the opinion of the population on the matter.

The two institutes select a sample of 50 people who they hope are representative of the population.

Jedevinetout approaches the work this way: at midday its staff station themselves on the Grande Place, opposite the secondary school. They question the first 50 people who cross the square.

Predictable adopts a different strategy: its staff draw at random 50 portable telephone numbers which they then call, also at midday.

The two institutes’ results are nearly exactly inversed: Jedevinetout finds that 80% of people are in favour of a 4-Thursday week while Predictable’s results show that 70% are against.

How can such a large difference be explained? Which institute do you think used the better sampling method?

You can think about it, or you could do your own survey with the help of the equipment below.

Instructions

The total population of Calvinville is represented by the 400 pieces on this giant chessboard. Each piece equals one inhabitant: the blues support the project, the yellows are the opponents.

The orange frame represents the random sample selected by Predictable.

The blue frame represents the people present on the Grand Place in the Jedevinetout sample.

Place the two frames on the chessboard one after the other and count the number of people in support of the proposal (the blue pieces). Multiply the number by two in order to obtain the percentage calculated by each institute.
The week of four Thursdays
The answer

Neither of the two institutes selected the sample properly. Jedevinetout’s method has without any doubt the least chance of obtaining an opinion representative of the total population. They chose to interview people when schools were closing for lunch and it can be safely assumed that the majority of people crossing the square were pupils. They would certainly be more likely to support a week of 4 Thursdays than the population as a whole.

This rather extreme example was inspired by an historical event. During the 1948 presidential election in the United States, telephone surveys of the population by a number of polling institutions, predicted a comfortable victory for Dewey, the Republican candidate, over the Democrat Truman. In spite of this, the election was won by Truman. In 1948, telephones were a luxury only accessible to a rich, upper class minority whereas the working class (without private telephones) massively voted for Truman.

And one for the road
(un dernier pour la route)

Now it’s your turn to provide a statistic. Take the die in your hands, estimate its weight and enter it on the touch screen. Then have a look at all the estimates made since the opening of the exhibition.

Instructions

Pick up the die and guess its weight. Enter the weight on the touch screen. If you want some help, you can lift the reference weights first. You can compare your estimate with all the others made since the beginning of the exhibition.