

Using numbers to surprise learners



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Why numbers can surprise us

Our intuition about numbers is not always reliable

Estimation

We often guess numbers, and our estimates can be wrong.



Guess the % of global flights that are delayed.

Most people guess
~20%

Actual figure is usually much lower (typically 2-5%).

Probability

We struggle to understand how likely things really are.



The chance of two people sharing the same birthday is much higher than most people think:

50.7%
in a group of 23

Anchoring

The first number we see can influence our answer.



If you see an estimate of 500 first, you might guess **400**.

If you see 50 first, you might guess **100**.

The same question, different answer, because of the anchor.

Scale

Our sense of what is "big" or "small" can be misleading.



1,000 incidents sounds like a lot.

But across 100 million passengers that is just

0.001%

Pattern recognition

We see patterns, even when they are random.



A short run of incidents might look like a trend.

For example:

5 incidents in a week **does not always mean an ongoing increase.**

Framing and context

The way a number we presented changes how we see it.

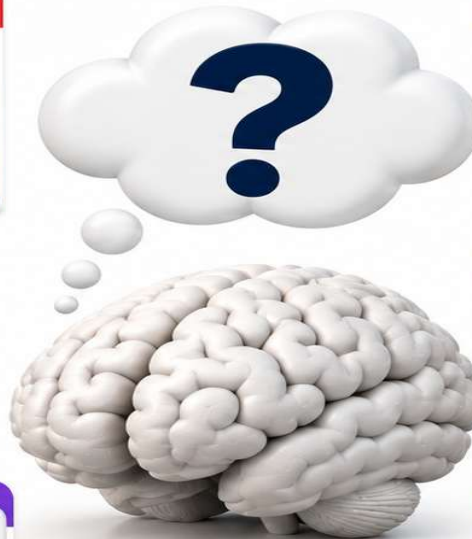


Both statements can be true:

Security incidents **increased by 20%**

Security incidents **decreased by 80%**

It depends on the time period, baseline and context.



For professional discussion and reflection • Illustrative, not prescriptive • Always consider context, source, scale and uncertainty when interpreting numerical information.



The 1089 surprise

A sequence of simple steps always gives the same results

3 Follow these steps

1

Think of a three-digit number where the first and last digits differ by at least 2

2

Reverse the digits

3

Subtract the smaller number from the larger number

4

Reverse the result

5

Add the two numbers together

317

Your number

→

713

Reversed number

−

396

Subtract (larger – smaller)

→

693

Reverse the result

+

1089

Add the two numbers together

What result did you get?

?

“Choose a 3-digit number where the first and last digits differ by at least 2.”





The anchoring effect

Can one number influence the next answer?



Key point: The first number we see can influence our next answer, even when it is unrelated. We tend to adjust from the starting point, rather than thinking completely independently.



Think of a number

A simple choice can produce unexpected results

1 The always-three trick

- 1 Think of a number
- 2 Multiply it by 2
- 3 Add 6
- 4 Divide by 2
- 5 Subtract your original number



Your answer will always be 3 (3)

2 Reverse the digits

- 1 Think of a two-digit number with different digits (e.g. 27)
- 2 Reverse the digits (e.g. 72)
- 3 Subtract the smaller number from the larger number (72 - 27)
- 4 Reverse the answer (45 → 54)
- 5 Add the two numbers together (45 + 54)



Your answer will always be 99 (99)

3 The 1089 surprise

- 1 Think of a three-digit number where the first and last digits differ by at least 2 (e.g. 317)
- 2 Reverse the digits (e.g. 713)
- 3 Subtract the smaller number from the larger number (713 - 317)
- 4 Reverse the result (396 → 693)
- 5 Add the two numbers together (396 + 693)



Your answer will always be 1089 (1089)

4 Double and halve

- 1 Think of a number
- 2 Double it
- 3 Add 10
- 4 Halve it
- 5 Subtract your original number



Your answer will always be 5 (5)

5 Triple route

- 1 Think of a number
- 2 Multiply it by 3
- 3 Add 45
- 4 Double the result
- 5 Divide by 6
- 6 Subtract your original number



Your answer will always be 15 (15)

6 Digit subtraction

- 1 Think of a two-digit number (e.g. 58)
- 2 Add the two digits together (5 + 8 = 13)
- 3 Subtract this total from your original number (58 - 13)



Your answer will always be a multiple of 9 (9, 18, 27 ...)



The missing number

Can learners detect what has changed?

Set 1

17	4	29	8	36
12	41	6	25	19
33	2	47	14	38
21	44	10	31	5

Set 2

17	4	29	8	36
12	41	6	25	19
33	2	47	14	28
21	44	10	31	5

1 Look at Set 1 for 5 seconds and try to remember the numbers.

Which number has changed?

2 Now look at Set 2. Can you spot the number that is different?



Which number represents the greatest risk?

They may look different, but are they?





The birthday paradox

In a surprising small group, a shared birthday is quite likely



1 Think

In a group of 23 people, what do you think is the chance that at least two people share the same birthday?

2 Make a guess

Choose a percentage that you think is closest.

- | | |
|------------------------------|------------------------------|
| ☐ 1% | ☐ 25% |
| ☐ 5% | ☐ 50% |
| ☐ 10% | ☐ 75% |

3 Discuss

- Why did you choose that percentage?
- Was it higher or lower than you expected?
- What might influence your judgement?

4 The answer

≈ 50.7%
(about a 1 in 2 chance)

With just 23 people, there is a 50.7% probability that at least two people share the same birthday.
(Assumes 365 equally likely birthdays and ignores leap day).

Numbers without context

The same number can mean very different things



Always ask:



**Out of
how many?**



Over what period?



Compared with what?



What is the relevant denominator?



The same number, different meaning

The number stays the same. The meaning comes from context



Quantity

42

Number of items



Identifier

42

Jersey number



Measurement

42°C

Temperature



Limit

42 km/h

Speed limit



Monetary value

£42

Amount of money



Time

10:42

Time of day



People

42

Number of people



Distance

42 km

Distance to destination



Check your assumptions

Numbers can be misleading if we do not question them



-  **20% of what?**
What is the denominator?
-  **Compared with when?**
Same period, season or year?
-  **How many incidents does 20% represent?**
Look at both the percentage and the actual number.
-  **Did exposure or activity also increase?**
More flights, passengers or staff?
-  **Is this one location or the whole operation?**
Local, regional or global?
-  **Is the source reliable?**
Check the data, method and possible bias.



Key point: Percentages can sound significant, but without context they can be misleading. Always ask: out of how many, over what period, and compared with what?





The same number, different perspective

Context changes how big or small a number feels

People



1,000 people

Equals 20 groups of 50 people

Time



1,000 minutes

Equals 16 hours and 40 minutes

Distance



1,000 m
= 1 km

Equals 1 kilometre

Money



£1,000

Equals 100 × £10 notes

Volume



1,000 kg

Equals 1 metric tonne of cargo

Data



1,000 pages

Roughly a large report or several manuals

Operations



1,000 flights

Around 2–3 flights per day for a year

Storage



1,000 containers

Equals a medium-sized container depot

People (workforce)



1,000 staff

A small to medium-sized organisation

Incidents



1,000 incidents

Serious issue or routine occurrence? It depends on the context.

1,000



The same number, different scale

Context changes how big or small a number feels



Which 50 represents the greatest operational significance?

You cannot answer from the number alone – it depends on the context.

People (passengers)



50

passengers

A relatively small number on a commercial aircraft.

People (workforce)



50

staff

Large for a small team, but a small proportion in a large organisation.

Aircraft



50

aircraft

A significant fleet for a small operator, but a small fleet for a major airline.

Vehicles



50

vehicles

Could be a large number for a single site or a small number across a country.

Containers / boxes



50

boxes

A small load on a cargo flight, but a large quantity for a small shipment.

Cabins / rooms



50

cabins / rooms

A small facility for a large airport, but a significant number at a remote site.

Distance



50 km

50

kilometres

A short distance for some operations, but a long distance in a remote area.

Time



50
days

A short delay for a long project, but a significant disruption for operations.



Key point:

The number 50 can feel **very large** or very small depending on the context, scale and impact. Always ask: 50 of what, compared with what, over what period, and what is the operational impact?



Key takeaways

Always seek context when interpreting a number.

