

How the Meter Was Made: The Complicated History of a Simple Unit

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Metric System

- **The meter is an extremely important unit of measurement.**

It's one of the seven base units used
in **the International System of Units.**

- We use name „Metric System“.
- The only three countries on Earth
that still officially use the Imperial System

Americans, Liberians, or Myanmarese:

“We don't use the meter! We use feet!”

The US government officially defines a foot as 0.3048...meters.

Where did the meter come from?

- Who decided how long a meter is?
How do we know something is exactly one meter?

**The story of this simple measurement is long,
incredibly over-complicated.**

People started to realize that these inconsistent and wildly imprecise measurements were making scientists' jobs a lot harder.

There began to be calls for a “universal measure.”

One measurement to rule them all.

Christopher Wren and pendulum

- One of the first ideas came from English architect Christopher Wren in the late 1600s.
He suggested that the new universal measure should be **the length of a “seconds pendulum.”**
- Unfortunately, a seconds pendulum varies depending **on where you are in the world**—not a whole lot, but enough that it couldn't be a “universal measure.”

The Metric System Is the Tool of the Devil

The French Revolution.

France ushered in what it hoped would be
a new age of science and knowledge.

As such, **the French Academy of Science** decided it was high time that this whole universal measure thing got settled once and for all.

After years of talk, they finally appointed a commission to actually get it done.

This commission was led by a man named **Jean-Charles de Borda.**

Jean-Charles de Borda (1733-1799)

- This man liked the **decimalization**.
That is, he liked things that could be divided evenly, and we can partially thank him for the fact
- that there are **1,000 grams in a kilogram,**
1,000 meters in a kilometer, etc.
- Now, if Borda had had his way,
we would have **100 minutes in an hour,**
100 seconds in a minute,
and **400 "grades" in a circle**



The decision of Borda's Commission

- His commission eventually settled on a way
to define the meter:

It should be *exactly*

**one ten-millionth of the distance
from the North Pole to the Equator.**

The distance from the North Pole to the equator

- In the late 18th century, measuring such a massive distance was no easy feat.
- **A plan was made up.**
Rather than measuring all the way, researchers would simply measure **the distance from Dunkirk, France to Barcelona, Spain.**
- **These two cities happened to be on the same longitude,** so if you knew exactly how far apart they were, you could calculate the distance from the equator to the North.

Pierre Mechain and Jean-Baptiste Delambre

- Two astronomers, **Pierre Mechain** and **Jean-Baptiste Delambre**, were hired to take the measurements.

Mechain headed down to Barcelona and Delambre up to Dunkirk, and they set about their business.

- But unfortunately, surveying that many miles was still an extremely daunting task.
- Plus, the aforementioned French Revolution ensured that chaos reigned in the countryside.
Not exactly the easiest environment in which to do tedious and precise calculations.

It was time to make a meter.

- The survey wasn't supposed to take very long, but it ended up lasting nearly seven years.
- Mechain and Delambre had to deal with the elements and finicky equipment... while also getting thrown into jail and threatened with death by revolutionaries every so often.
- In fact, the project eventually cost Mechain his life.

But by **1798**, after over six years of hell, **the two of them had a number.**



The Holy Meter = “one meter.”

Using Mechain and Delambre’s measurements, mathematicians managed to calculate the distance from the equator to the North Pole.

- They then divided that by ten million, and finally, we had it.

The meter. The universal measure.

With the magic number finally found, the Academy of Sciences had a physical object, **a bar made out of platinum,** built to that exact dimension.

From then on, that bar, known as the *metre des Archives*,

was the literal measuring stick for “one meter.”

The Mistakes

- The number that Mechain and Delambre had come up with?

It was *wrong*.

There were small mistakes in the calculations, which threw everything off.

- These mistakes would haunt **Mechain** for the rest of his life, and he ended up getting yellow fever and dying while back out in the field, trying to get the calculations right.

A "true" meter

- Now the number wasn't far off:
it was shorter than a "true" meter
by just **two-tenths of a millimeter**
(or eight-thousandths of an inch).

But remember, the whole point of this was to make a meter
that was *exactly*
one ten-millionth of the distance from the North Pole to the Equator.

Why go through all of that work just to get it wrong?
Why, you might as well have skipped all the surveying
and just made the *metre des Archives* some arbitrary length
and called that a meter.

Getting It Right

- People tried a few different methods of defining the meter over the years, but they all had their own shortcomings.

In fact, it was more than a century before we invented an ideal solution: **the laser.**

The laser allowed scientists to measure the distance traveled by light particles,

and since the speed of light is constant, we finally had a perfect way to define a meter.

A way that would never change or vary,

and that was replicable all over the world.

Changes in Definitions of Meter

- **1799**
Z provizorních platinových metrů byl vybrán Mètre des Archives, prototyp metru odvozený z délky zemského kvadrantu.
- **1889**
Byl schválen nový prototyp ze slitiny platiny a iridia, odvozen od skutečné velikosti Mètre des Archives.
- **1960**
Metr definován jako **1650763.73** násobek vlnové délky oranžovočervené čáry kryptonu.
- **1983**
Metr definován jako dráha, kterou světlo proběhne za
 $1/299\,792\,458$ sekundy.