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Why Julius Caesar's Year of Confusion was the longest year in history

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By Martha Henriques, Features correspondent, @Martha_Rosamund



The Roman Emperor Julius Caesar decided to reform the calendar to tie it to the seasons (Credit: Getty Images)

To tame a hopelessly disorganised Roman calendar, Julius Caesar added months, took them away, and invented leap years. But the whole grand project was almost thwarted by a basic counting mistake.

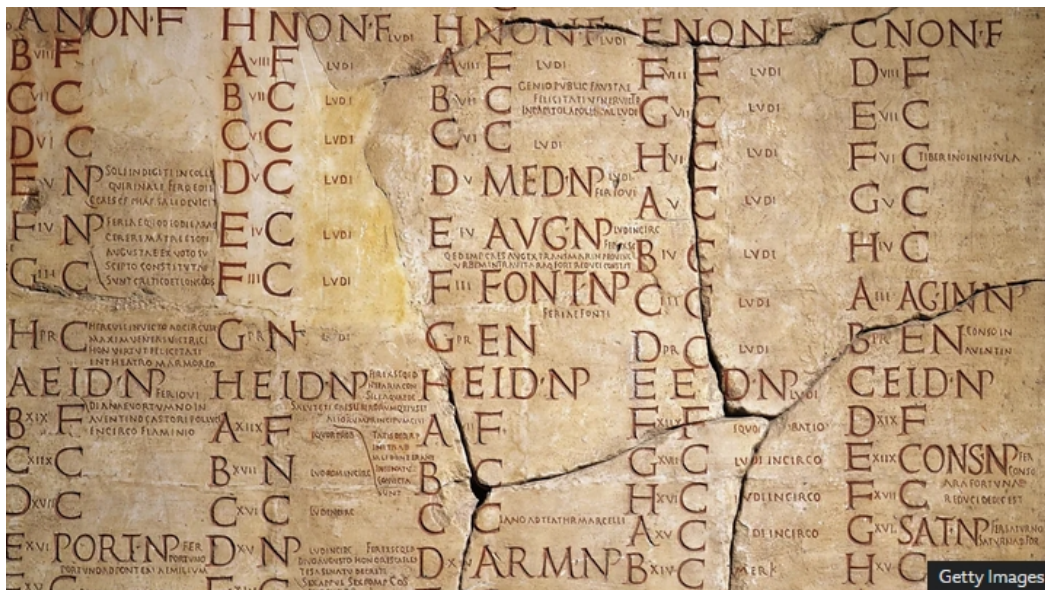
It was confusing enough when the harvest celebrations kept arriving in the middle of spring. It was the 1st Century BC and, according to ritual, there ought to be ripe vegetables ready for eating. But to any farm labourer looking around in the field, it was clear there would be many months before the harvest.

The problem was the early Roman calendar, which had become so unruly that crucial annual festivals bore increasingly little resemblance to what was going on in the real world.

This nonsensical system was something Julius Caesar wanted to fix. It was no small feat: the task was to heave the Roman Empire onto a calendar aligned with both the rotation of the Earth on its axis (a day), and its orbit of the Sun (a year).

Caesar's answer gave us the longest year in history, added months to the calendar, took them away, anchored the calendar to the seasons, and brought us the leap year. It was a grand project – and it was almost derailed by a peculiar quirk of Roman maths.

Welcome to 46BC, better known as the Year of Confusion.



Roman fasting days, feasting days and other important dates were subject to the whims of a calendar that changed from year to year in unpredictable ways (Credit: Getty Images)

It may have been a complicated year, but not as complicated as what came before, says Helen Parish, visiting professor of history at the University of Reading, UK.

The [early Roman calendar](#) was determined by the cycles of the Moon and the cycles of the agricultural year. Looking at this calendar with modern eyes, you might feel a bit short-changed. There are only 10 months in it, starting in March in spring, and the tenth and final month of the year is what we now know as December. Six of those months had 30 days, and four had 31 days – [giving a total of 304 days](#). What about the rest?

"For the two months of the year when there's no work being done in the field, they're just not counted," says Parish. The Sun rises and falls but, according to the early Roman calendar, no day has officially passed. "Which is where the complications start to come in."

[In 731BC, the second King of Rome, Numa Pompilius](#), decided to improve the calendar by introducing extra months to cover that winter period. "Because what's the point in a calendar that only covers part of the year?" Parish says. Pompilius' answer was to add 51 days to the calendar, creating what we now call January and February. This extension brought the calendar year up to 355 days.

If 355 days seems like an odd number for Pompilius to aim for, that was on purpose. The number takes its reference from the lunar year (12 lunar months), [which is 354 days long](#). However, "because of Roman superstitions about even numbers, an additional day is added to make 355", says Parish.

In this rejig, the months were arranged in such a way that all had odd numbers of days, except for February, with 28. "Therefore it's considered unlucky and the time of social, cultural and political purification," says Parish. "So that's the point at which you try and wipe the slate clean."

It's good progress, says Parish, but it's still around 11 days out from the Solar year of 365-and-a-bit days. "Even with this souped-up calendar from Pompilius, it's very easy for the calendar to get out of synchronisation with the seasons."

By around 200BC things had got sufficiently bad that a near-total eclipse of the Sun was observed in Rome on what we would now consider to be 14 March, but is recorded as having taken place on 11 July.

Because the calendar had by this point gone "so catastrophically wrong", Parish says, the Emperor and priests in Rome resorted to inserting [an additional "intercalary" month, Mercedonius](#), on an ad-hoc basis to try to realign the calendar to the seasons.

This did not work out very well. There was a tendency to add Mercedonius when favoured public officials were in power, for instance, rather than strictly to align the calendar with the seasons.

[The classical writer and historian Suetonius complained](#) that "the negligence of the pontiffs had long since so disordered [the calendar], through their privilege of adding months or days at pleasure, that the harvest festivals did not come in summer nor those of the vintage in the autumn".

Which brings us back to Julius Caesar. The year 46BC already had a Mercedonius planned, but Caesar's advisor [Sosigenes, an astronomer from Alexandria](#), on Egypt's Mediterranean coast, said Mercedonius wasn't going to be enough this time.

On Sosigenes' advice, Caesar added another two never-before-seen months to the year 46BC, one of 33 days and one 34, to bring the calendar in line with the Sun. The additions made the year the longest in history at 445 days long, with 15 months.

After 46BC, the two new months, Mercedonius and the practice of intercalary months as a whole were abandoned as, all being well, there would be no more need for them.

"So we're back to a calendar that looks a bit more like the one we recognise," says Parish. "Excellent! This is looking refreshingly familiar."



Agricultural events and religious celebrations were closely tied in the Roman era – but hard to keep track of without a robust calendar (Credit: Getty Images)

Unfortunately, getting the calendar to line up with the Sun is one thing, but keeping it that way is another. The issue arises from the inconvenient fact that there aren't a nice round number of days (Earth rotations) in a year (Earth orbits of the Sun).

"That's where the whole problem starts," says Daniel Brown, an astronomer at Nottingham Trent University, UK. The number of Earth rotations on a trip round the Sun is [roughly 365.2421897...](#) "and on it goes".

That means Earth fits in *almost* an extra quarter-turn every time it does a full orbit of the Sun. So adding an extra day every four years – in February – would help fix the mismatch, Sosigenes calculated.

And it would have worked quite well, at least for a while, if there hadn't been the problem of the idiosyncratic way the Romans counted the years.

"They look at the years and they count, one, two, three, four," says Parish. "And then they start counting again at four – so they count four, five, six, seven. Then they start at seven – so seven,

eight, nine, 10. So they're accidentally double-counting one of those years each time. It doesn't take long to realise that slippage is starting to occur."

[This was corrected in the reign of Augustus](#) and leap years happened every four years instead of every three, and then the Julian calendar was well on its way. "Julius Caesar is getting it almost bang on where the calendar needs to be," says Parish.

It might have been the only calendar needed for the job, if the Earth did in fact do a neat extra quarter-turn each year. But it's a little bit short – by about 11 minutes.

"That means slowly but surely we're still running out of sync," says Brown.



Even a small difference between the calendar and the movements of the Earth around the Sun will lead to a growing discrepancy (Credit: Getty Images)

The solution came much later, [in 1582 when Pope Gregory made further tweaks](#).

"That's what the Gregorian calendar reform then corrected for – noting this and adapting that calendar slightly more so, making sure that it is not only just every four years, but then every 100 years they make sure that they skip that rule," says Brown. "But then they noted that doesn't fully match – you've overcompensated. So every 400 years, you don't skip it."

That's why, for example, the year 2000 was a leap year: because it is divisible by both 100 and 400.

"That all sounds really neat and tidy," says Parish – but this is where politics starts to shape the course of time. "It's a calendar that's implemented by Papal decree and that actually doesn't have authority outside the Church and outside the auspices of the Bishop of Rome."

There were people who complained that the Pope effectively stole 10 or 11 days of their time by adjusting the calendar, says Parish. Nonetheless, over the centuries more and more countries adopt the Gregorian calendar. "But, gloriously, they don't all do it at the same time," says Parish. "So you've tidied up the calendar, but you've now got calendars in different countries that are running on very different models."

Read more about [the people who live in multiple timelines](#).

Because of this discrepancy, "you can have the most bizarre situation where a reply written in England to a letter that's arrived from Spain can look as though it was sent before the first letter from Spain arrived", says Parish. "Because England is running ahead of Spain on the calendar."

Once the Gregorian calendar was widely adopted and internationally synchronised, it had several millennia of accuracy built in. But it's still not perfect.

In fact, around the middle of the 16th Century, "somebody is going to scratch their head and say, 'Hang on a minute, it should be Monday, but it's actually looking like Tuesday'," says Parish. "I think that's probably a margin of error that we're going to end up accepting."

Until that Monday (or Tuesday), the Gregorian calendar has at least bought us a bit of time.

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