'Leaping' into the realm of science

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Murray Gibson (center), dean of the College of Science, says that without a leap day every fourth year, summer would drift out of sync about one month every 100 years or so. Credit: Mary Knox Merill

Yesterday was Feb. 29, the extra day we add to the calendar in leap years. But why do we need this extra day, and what is the science behind it? And what about the lesser-known leap second – which delegates from more than 70 nations recently debated whether to abolish? Northeastern University news office asked Murray Gibson, dean of the College of Science, to answer these questions – as well as how early scientists discovered the need to adjust the calendar.

What is the science behind the leap year? How would not having a leap year change the way we experience time and the world?

The problem is that there are three things we care about with the calendar – a day, a month and a year. A day is determined by the turning of the Earth on its axis. A month is determined by how long it takes the moon to rotate once around the Earth, and a year is determined by the Earth going around the sun, which is very close to (but not exactly) 365.25 days. From the earliest times, we have known that seasons, which are determined by the time of year, are most important for cultivation. If we didn't have an extra day every fourth year, summer would drift out of sync about one month every 100 years or so.

How did early scientists discover that an extra day needed to be added to the calendar?

In ancient times, civilizations spent much time trying to understand the solar year – Stonehenge and Chichen Itza were believed to be observatories to predict the seasons. In Roman times, they realized that adding one day every four years was pretty close. Much later, the Gregorian calendar introduced other corrections (like not every year divisible by four is a leap year). February being the shortest month is best suited for a leap day to better match the lunar month cycle.

What is the leap second? How does it relate to the leap year, and what would be the advantage or disadvantage of eliminating it?

We couldn't eliminate the leap day without the seasons starting to drift. But the leap second is a very fine correction introduced every now and then to get atomic clocks exactly in sync, and it would take almost a million years for this error to show up. Nowadays, people are more concerned about computer mistakes (like Y2K) that might unintentionally arise due to the leap second, and some have called for it to be abolished. None of this will cause any observable effect over our

lifetimes.

Provided by Northeastern University