The Maya Year Is Extremely Accurate!

In order to hit the solstice of 2012, the Maya needed to know the length of the year to within 45 seconds!

An essay by Thomas Razzeto

The gist of this essay is included in several of my other 2012 essays but this topic is so important that I want to go into more detail here. Many of you will get the main point right away and won't even have to finish reading the entire essay. But for those who do read it all, there are plenty of significant points to ponder. So let's get started.

But before we go into the question of how the Maya measured the length of the year, I want to show how they measured the length of the cycle of the moon. While the cycle of the moon does not come into play for 2012, I would like to offer it as an example of the level of precision that the Maya achieved by simply counting days. Let's check it out.

We all know that the amount of time that it takes the moon to go from a new moon to the next new moon is about 30 days. Our modern astronomers have measured this value to be 29.5306 days. In Copan, the Maya recorded that they observed over a period of about 12 years that the moon went through 149 of these cycles in precisely 4,400 days. When you divide this by 149, you get 29.5302 days. Excellent! This is about 99.999 percent correct! In this simple example, we see that the Maya were able to do some impressive work without telescopes, clocks or computers. It is very important to note that measuring time by just counting days worked great!

The Maya were only concerned with what they could see with their eyes and they measured time by counting days.

I cannot stress this enough. In this regard, we must not overlook the fact that the Long Count calendar itself inherently counts days! Okay, with this example in mind, let's take a look at how the Maya measured the length of the year.

An Extremely Precise Value for the Length of the Year

Our modern astronomers have measured the length of the year as 365.2422 days. This converts to 365 days, 5 hours and 48 minutes. Now let's imagine that the Maya knew the length of the year with an error of only 1 minute. Suppose they thought the year was 365 days, 5 hours and 49 minutes long.

Let's say they wanted to project 10 years into the future and exactly pinpoint the day that will include the moment of the winter solstice. (Yes, the winter solstice is a moment in time, not a whole day as some people incorrectly think.) When the Maya project out 10 years, their 1-minute per year error would accumulate into 10 minutes. But this would probably not be a problem since they only want to know the date that contains the moment of the winter solstice. Although they would be off by 10 minutes, they would probably still be on the correct date. Notice, however, that if the solstice turns out to be 5 minutes before midnight, they would incorrectly calculate it to be 5 minutes after midnight and they would therefore pick the wrong date. This effect will always be a minor concern, no matter how far they project, short or long, and no matter how precisely they know the year. But let's not worry about this and just continue.

Now let's consider projecting out 100 years. In this case, the total error would grow to 100 minutes and again, this would probably still be okay since it is an error of less than 2 hours. But since the Long Count calendar projects over 2,000 years into the future, the error would grow to 2,000 minutes or more, which is longer than the length of the day. This means that they would surely miss their target date. So we see that even an error of only 1 minute per year is too large! (The length of the day is 1440 minutes: 24 hours times 60 minutes per hour equals 1440 minutes.)

Now that you see the general problem, let's bring in more precision.

What we are doing is simply noting that our tolerance is a total error of one day for the entire 2,000-year period that started when the Long Count calendar was first put into use. We do not want to be one day too late or one day too early. We want to hit the exact date that contains the moment of the winter solstice.

To calculate our allowed error per year, all we need to do is divide 1 day by 2,000 years. If we want our answer in minutes, we should divide 1440 minutes by 2,000 years to get 0.7200 minutes per year. If we want our answer in seconds, we multiply this by 60 seconds per minute, which gives us: 43.20 seconds per year. I often round this to simply 45 seconds.

When I first did this calculation, I was so amazed that I could hardly get it out of my mind. For days, I would find myself pausing to say to myself, "45 seconds! 2012 points to the triple rebirth of the sun and the Maya needed to know the length of the year to within 45 seconds!"

But let's continue by putting this into a percentage. First we need to get the total number of days in our 2,000-year period. So we multiply 2,000 by 365.2422, which gives us 730,484.4 days. A one-day difference is what percentage of this value? Or, as I prefer, let's just trim one day off this total and see what percentage we have left. As most of us remember, to calculate a percentage, we multiply by 100 and divide by the total:

(730,483.4 x 100) / 730,484.4 = 99.99986, which I round to 99.9999 percent. Wow! The Maya needed to know the length of the year to a very precise level!

This is like measuring the width of the United States to within 20 feet or the distance from Los Angeles to Tokyo to within 40 feet! In my opinion, this is not merely remarkable; this is absolutely stunning!

It is so difficult to believe that the Maya could have had this level of precision that it is easy to understand why mainstream science denies them this knowledge and attributes the restart date to mere coincidence. But is this justified? Is the restart date landing on the winter solstice a coincidence?

If the Maya were Christian and the restart date was Christmas, would we be justified in stating that it was just a coincidence? Of course not! It would be obvious that it was intentional. And yet - in a way - the winter solstice plays a role similar to Christmas for the Maya. It was a very important day of the year! It is too much for me to think of this as just a coincidence.

You now know the heart of the matter but for those of you who may want more, let's continue.

The Maya are said to have only used naked-eye astronomy, and I think that this is true. But to achieve the required level of precision, they faced a few challenges. Let's back up a bit and see what is involved.

The goal is to measure the length of the year. For our purposes, we will define the year as the amount of time from the moment of one winter solstice to the moment of the next winter solstice. One approach is to focus on a single year. Here are the three steps of that approach:

1) Accurately detect the physical conditions that create the moment of the winter solstice.
2) Accurately record the time that this happens with a clock.
3) Do this for two consecutive winter solstices and subtract the recorded times.

This approach requires that the Maya use a clock that is very accurate over an entire year. Did they have such a clock? And how would they precisely detect the physical conditions when the axis of the earth is exactly pointing away from the sun, as much as possible, since this is the definition of the winter solstice?

But consider the following multi-year approach, which does not require a clock or the ability to precisely detect the conditions of the solstice. It will provide excellent accuracy for the length of the year. Here's how it works.

Many ancient cultures have used several ingenious methods for detecting the day of the winter solstice. Most of these methods focus on the length of the shadow produced by the midday sun. The day of the winter solstice produces the longest shadow. The method that I will discuss here is just a bit different in that it uses a beam of sunlight rather than a shadow. Let's take a look. If we construct a building with a round window in a wall that directly faces the sun at midday, it will create a beam of sunlight that will trace a path on the floor. This path is different for each day of the year. While this method does not give us the precise moment of the winter solstice, it will reveal the day that contains it. This type of building is called a pinhole solar observatory even though the window can be several feet or more in diameter - hardly what I would call a "pinhole," but that is a minor point. By the way, the bigger the building, the easier it is to measure the details of the path of the sunbeam.

Now comes the part that takes many years. We don't use a clock but instead, we count the days from the day of the winter solstice of our starting year to the day of the winter solstice many years later. For a period of 100 years, for example, we would count 36,524 days and this gives us a value of 365.24 days for the length of one year. Pretty good!

If the building is large enough, some of the subtle details about the paths that are traced on the floor can be put to good use. By paying careful attention to the path of the sunbeam for the days around the day of the solstice, we can get a rough idea as to what part of the day contained the moment of the solstice. For example, if the moment of the winter solstice was at high noon, then the path traced out for that day will stand out very well from the paths traced out the day before and the day after. The paths of those adjacent days would be very similar to each other but they would peak below the position of the day of the solstice. And if no single day has such a strong peak and instead two sequential days have similar paths, the solstice was near midnight between the two days and it would be hard to tell which day contained the moment of the winter solstice. It seems to me that with this attention to detail, it might be possible to get within 6 hours of the moment of the solstice, perhaps even much better.

So we have a 6-hour tolerance at the beginning of our 100-year long measuring period and we also have another 6-hour tolerance at the end of our measuring period. So we have a total tolerance of 12 hours for our 100 year period and this can be expressed as plus or minus 6 hours. Since it is spread out over 100 years, we need to divide by 100. If we convert 6 hours into minutes and divide by 100, we get a tolerance of plus or minus 3.6 minutes. Excellent!

But we have seen how the Maya needed a tolerance of about 43 seconds, which can be stated as plus or minus 22 seconds. So we still need a value approximately 10 times more precise. To improve our results, we can increase our observational period and / or increase our accuracy of detecting the moment of the winter solstice or both. What I found in this regard actually surprised me.

The ancient people of Mesoamerica had plenty of time on their hands. In fact, this is the key that unlocks the puzzle. In chapter 6 of John Major Jenkins's book, *The 2012 Story*, we learn of the work of archaeologist Marion Hatch. While John's information about Hatch's work is very brief and a bit sketchy, Hatch tells us that about 3,000 years ago, people in La Venta, which is a town just north of Izapa, learned of precession when they built a sacred building that pointed to the exact point on the horizon where a certain star rose from. Yet after about 70 years, the people noticed that the star now rose from a slightly different location and they rebuilt the building! The earth's very slow wobble had caused this change. And any change would inspire their astronomers to watch closely and measure carefully. This would include counting days.

As you know, this essay is focused on measuring the length of the year and not precession. But the important point is that we now know that people in Mesoamerica were count days going back 3,000 years. This means that they had over 1,000 years to observe the length of the year before they created the Long Count calendar.

One thousand years of observational data is the key!

Now we clearly see that the Maya were not trying to directly measure the length of one year to within a certain number of seconds per se, they were simply counting the number of days from one winter solstice to another winter solstice many, many years later. Knowing the exact number of days in one thousand years will allow them to calculate the exact number of days until the winter solstice of 2012. This approach is just precise enough to make the calendar! The error will be less than one day.

Well, that concludes essay. I hope that you found it thought provoking! If you find my comments intriguing, perhaps you will enjoy my book, ***Mystical 2012: Did the Maya Shamans Discover a Mystical View of Reality?*** You can buy it at Amazon.com or read my free essays at 2012essays.com. If you like my material, please spread the word! I would rather have many people enjoy my work for free than just a few who decide to purchase it.


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