The Unfolding Story of Scripture: Part 2

Lesson 5: Wednesday, November 9, 2005

Ralph D. Winter

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Your readings for this lesson give many detailed references to the theme of missions in the Bible. However, rather than to simply summarize those for you, let's begin today with an unusual way of studying the Bible. Many if not most Bible scholars do not use this approach. They may not be familiar with the fairly simple arithmetic which is necessary. What I refer to is called by a scary name, "exponential growth." It is important because it is the kind of growth process which is involved in exactly the same way in calculating interest on an investment, the growth of population of a country or the growth of town or a church congregation or denomination. Here we are mainly interested in the growth of the Jewish people. It is very handy to know how this works. Pastors in India especially need to know these things, where thousands of believers are held forever in debt due to interest rates they cannot easily calculate.

Let's take some examples.

Suppose either your bank account of a 100 dollars or your church of 100 members grows by two percent. How many dollars or members will be the result? You can easily add 2 to 100, since a growth of 2% means two people or two dollars per 100. But suppose the starting number is 200, then what will be the result of 2% more? Again, it is apparently 4 more making a total of 204. Suppose your starting number is 300 what is 2% more? To do that you finally have to get down to multiplying 300 by the decimal .02. That gives you 6, and added to 300 gives the new total of 306. One step further is to realize that if you multiply 300 by 1.02 you get 306 directly.

In case your congregation grows 2% one year and only 1% the next, you can handle that by first multiplying by 1.02 and then by 1.01, or

300 x 1.02 x 1.01, which is 309.06.

But suppose we don't contemplate a change of rate of growth from year to year. Suppose we are wanting to find out the result of an *average or steady* growth rate during a five year period.

In that case with a starting number of say $1,000 we get 1000 x 1.02 the first year, or $1,020.

The second year we get 1020 x 1.02 or $1,040.40.

The third year we get 1040.4 x 1.02 or $1,061.208, which is $1,061.21 if rounded off.

And so on. However, this process seems a bit tedious. It can be written for five years as:

1000 x 1.02 x 1.02 x 1.02 x 1.02 x 1.02

Don't take fright, this can also be written with a shorthand number as:

1000 x $(1.02)^5$, or $1,104.08

[Note the little "5" means you multiply the first number five times by what is in the parenthesis. This little number is called an "exponent" from which we get the scary name "exponential growth." It is also said "we are raising 1.02 to the 5th 'power.'" But it does not matter what this little shorthand number is called. We don't have to give it a name.]

Let's take a more useful example.

If you begin with 70 people instead of $1,000, and use a growth rate of 2% per year for 400 years:

70 x $(1.02)^{400}$, or 192,829.51

[In this case it is much easier to write a litle "400" than to write out 1.02 four hundred times!]1

This latter example might have been the case of the family of Abraham going down into Egyptian captivity. But note it results in nowhere near two *million* people.

But suppose they grew at 2.66%.

In that case we see that

70 people x $(1.0266)^{400}$ is 2,544,497 people (rounded off).

Of course, the immediate question is, "Is a growth rate of 2.66% (for 70 people for 400 years) a reasonable rate?" *The Pocket World in Figures* for 2006 (The *Economist*) lists 20 countries with a growth rate of 2.85% or higher. If the children of Abraham grew at 3.5% they would have become:

70 x $(1.035)^{400}$ = 66,257,944 that's 66 million not just 2.5 million!

Of course, if 70 "people" went down to Egypt, they may have only counted the adults. If an equal number of children were along, then they would not have had to grow 2.66%..

Note, however, the explosive increase in the results with just the additional .85% of growth rate from 2.66% to 3.5%! This is as significant for its effect on interest rates as it is for population growth rate.

In the case of the Egyptian sojourn the doubting scholars who question the number of people in the Exodus simply need to use a little arithmetic to see how readily it would have been possible.

A second illustration where the non-arithmetic intuition of scholars is flawed is in the arguments about the number of Jewish people in the Roman empire at the time of Christ. One of the major church historians of the past was Adolf Harnack. He thought that the Jewish proportion of the population of the Roman empire in Paul's day must have been ten percent. If the Roman Empire contained 100 million people (which itself is well accepted) then the Jewish population would have been 10 million.

Critics have wondered how there could have been that many Jews. Where would they come from? Some said it could not be. Others, like Rodney Stark have suggested that the Jews must have made a lot of converts to grow that large in number. In general the 10 million figure is not doubted. The question is how it happened.

But, again, by simply doing a little arithmetic it is possible to see how 10 million could easily have grown from say 586 BC, the fall of Jerusalem, to 14 AD, if only 26 thousand was the starting number and the growth during those 600 years was only 1%:

26,000 x $(1.01)^{600}$ = 10,181,168

If Jews grew at 2.5% they would have only needed to be four people 600 years earlier, since:

4 x $(1.025)^{600}$ = 10,873,747

None of these suggestions of growth rate were necessarily what actually happened, either 1% or 2.5%. However, these examples do show clearly that it would not have been unlikely for the Jews, who in general may have had more stable households, to have grown to ten million in Jesus' day.

Note, however, that it may be helpful to indicate just how these types of arithmetic can be done. All you need is a $5 hand calculator of the type that has an X^y key [In some cases an Y^x key]. In that case, taking one of our cases above, you do the following:

1. Punch in the starting number, say 70
2. Punch the times sign, X
3. Punch in the 2.66% in the form 1.0266
4. Punch the X^y key
5. Punch in, say, 400 years
6. Punch in the equals sign (=)
7. You get 2,544,497

In the same way if you want to know what $1,000 will become in ten years at a 4.7% growth rate, you

1. Punch in 1000
2. Punch in the times key (X)
3. Punch in 1.047
4. Punch the X^y key
5. Punch in 10
6. Punch in the equals sign (=)
7. You get $1,582.95

Now, suppose you want to know what the interest rate (or growth rate) would be if a number of 3,000 grows to 10,000 in 25 years?

1. Punch in 10,000
2. Punch in the divide key (/)
3. Punch in 3,000, then equals (=)
4. Punch the shift key the X^y key
5. Punch in 25
6. Punch the equals sign (=)
7. You get 1.049, which means 4.9%

This calculation could be written as $(10{,}000/3{,}000)^{(1/25)}$

[Note that in this case the little number is a fraction. In this case the "exponent" or "power" is the fraction, while just the 25, as a denominator, means you are taking the 25th "root," that is you are asking what number if multiplied by itself 25 times would equal the 10,000/3,000?]

While this latter way of doing things may seem more complex it is helpful if you want to know directly what it would take in growth rate for 70 people to grow to 2.5 million in 400 years:

1. Punch in 2,500,000
2. Punch in the divide key (/)
3. Punch in 70, then equals (=)
4. Punch the shift key then X^y key
5. Punch in 400
6. Punch the equals sign (=)
7. You get 1.02655, which means 2.655% average growth rate.

Or, if you want to know what kind of a growth rate (or interest rate) would be required to grow from 1,000 to 10,000 in 20 years, you

1. Punch in 10,000
2. Punch in the divide key (/)
3. Punch in 1,000, then equals (=)
4. Punch the shift key then X^y key
5. Punch in 20
6. Punch the equals sign (=)
7. You get 1.122, which means 12.2% average growth rate or interest rate.

One reason we cover this subject is

due to the fact that many people are bound up in confusion over things like this. Christians in India need a pastor who can help them calculate things like this so as to know what borrowing money at a certain interest rate will mean.

Incidentally, note that if you are working with an interest rate per month the same calculations will work. That is, $100 will grow to $200 if the interest rate is

5.95% per day for twelve days

5.95% per month for twelve months

5.95% per year for twelve years.

This is because the calculation is the same in each case:

$100 \times (1.0595)^{12} = 200$

or,

$(200/100)^{(1/12)} = 1.0595$ (read 5.95%)

One of the central meanings of these calculations is the fact that a slight change in growth *rate* makes for a big change in growth *result* over time.

A quite different growth factor we can see in the Bible would be the equally incredible. Let's think about the general question of what affects growth rate. Obviously when the hearts of the fathers are turned to the children fewer children die prematurely. I think that it is not illogical to suppose that the Jewish families had a higher growth rate in ancient times precisely due to factors of that kind.

The general observation is that if a population does not grow very much there must be a lot of war, disease, family breakdown occurring. It is easy to conceive of Satan doing his best to promote these contrary factors.

While Bible scholars do not often point it out, a very slow growth of population is indeed a measure of abortion and infanticide as well as the truly major factors of war and pestilence.

An example of this is the fact that southern England, after a relatively calm three centuries of literacy under occupation by Roman legions, in about 440 AD lost their protection and England immediately sagged back into chaos and bloodshed, with invading Anglo-Saxons, and all that. For more than 600 years until 1066 AD, studies estimate that the population did not increase in the slightest. This is not normal at all! Think of the abnormal loss of life during those 600 years!

Or, take the 27 million people estimated as world population in Abraham's day. After 2000 years, by the time of Christ world population is again estimated at 200 million. Is that a huge growth of an additional 173 million people? Yes. But is it a slow growth? Yes. Let's see:

$(200/27)^{(1/2000)} = 1.00100$, which we can read as .1%, (i.e. subtract 1 and then multiply by 100, or push the decimal point over to the left two places) that is not one percent but one tenth of one percent.

By comparison, the world population growth rate is 1.7%, or seventeen times as fast, and *The Pocket World in Figures* lists five countries in the world today that are growing faster than 4% which means 40 times as fast, and eleven are growing faster than 3%, or thirty times as fast.

However, even world population growth rate is only 1.7% due to the fact that many of the developing countriies are greatly suppressing their growth rate - 18 countries are at zero or negative rate of growth.

However, a dramatic way to measure the carnage and horror that has dogged the tracks of humanity for much of human history, is to ask what world population would have become, starting at 2000 BC with 27 million, if growth at 2000 BC had occurred at the current global rate of 1.7%.

The astonishing answer is that world population at even that reduced rate would have exploded to six billion from 27 million in only 321 years. And, if world population had grown at 3.5% it would have become six billion in only 123 years.

This should fairly broadcast to us the ugly presence of ongoing slaughter, disease and starvation for much of the human experience. At the same time it gives insight into the very real, physical dimensions of the advance of God's will in the expanding kingdom in more recent years. God is not simply out to save souls in eternity but to rescue His creation from war and pestilence. The degree to which that is accomplished is certainly related to the glorification of God, and that, in turn, to our sense of mission.

All the nations you have made will come and worship before you, O Lord; they will bring glory to your name. For you are great and do marvelous deeds; you alone are God (Psa. 86:9, 10).