

Predicting the future

Scientific Prediction of the Future

Science has been in the business of making predictions about the future for quite a long time. Ancient astronomers noted cyclic, repeated patterns in the sky and predicted that these patterns would continue into the future. With more observations and mathematical sophistication, astronomers could predict future eclipses of the Sun.

The physics of hydrodynamics and weather satellites enable modern-day meteorologists to predict the weather accurately several days ahead, resulting in advance warnings of destructive, severe weather.

However, chaos theory (dynamical systems are chaotically unstable) and the uncertainty principle in quantum mechanics, which says that we cannot simultaneously measure both the position and velocity of any particle with arbitrary accuracy, prevent us from making detailed, accurate, long-term predictions of the future. Therefore all predictions about the future must be made in terms of **probability of outcomes** of future observations.

The Copernican Principle

In Cosmology the Copernican principle, named after Nicolaus Copernicus, states that the Earth is not located at the center of the universe. Planet Earth orbits an ordinary star located at the edge of an ordinary galaxy. More recently, the principle has been generalized to the simple statement that humans are not privileged observers. In this sense, it is equivalent to the mediocrity or “nothing special” principle.

Observing something, say the human race, a company, a professional society, at a random time, there is a 50 percent chance you are observing it in the middle two quarters of its lifetime. In other words, assuming that you are observing a company at some random point in time, somewhere between its beginning and end, there is a 50 percent chance that you are observing it sometime during the middle two quarters of its existence. See figure 1A.

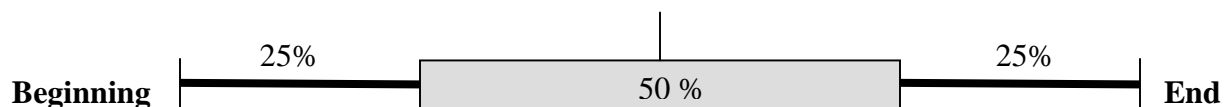


Fig 1A

If you made the observation at the beginning of the 50 percent interval (Now) then one quarter of the company's life cycle had passed and three quarters remained in the future. See figure 1B.

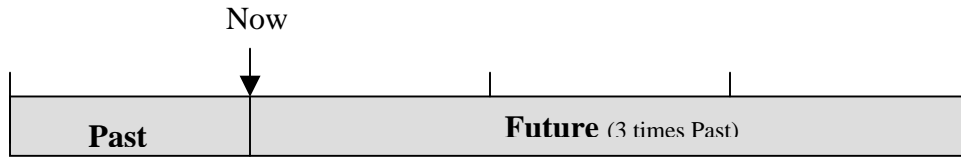


Fig 1B

If the observation was made at the end of the middle two quarters then three quarters of its existence had already passed and only one quarter or 25 percent remained. See figure 1C.



Fig 1C

So we can reasonably assume there is a 50 percent chance that the future longevity of the observed company is somewhere between **1/3** and **three times as long as its past longevity** (depicted in respectively 1C and 1B).

Needless to say that a fifty percent probability does not get us very far in predicting the future. Quality professionals like to make predictions that have a much higher chance of being correct. Most quality predictions are made with a 95 percent probability, which is high enough to minimize “luck-of-the-draw” outcomes and low enough to get meaningful prediction limits.

Applying the same reasoning and assuming a random time of observing, there is a 95 percent chance that that you are observing it during the middle 95 percent of its observable lifetime which could be the lifetime of a company, a society, a product line, etc. The chance that you are observing it in the first 2.5 percent or the last 2.5 percent of the lifetime interval is rather small (only five percent). See figure 2A.

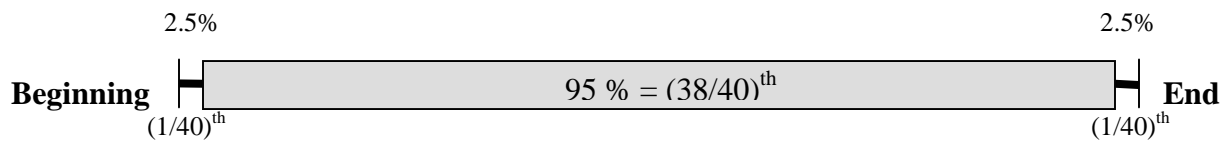
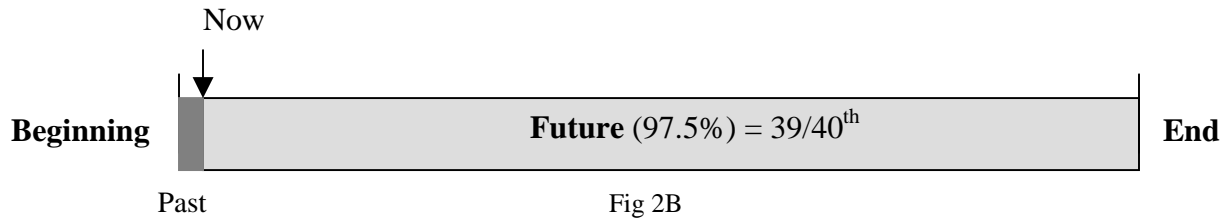
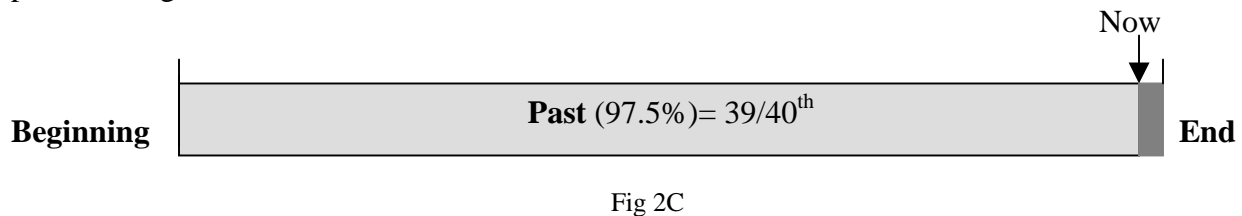


Fig 2A

If you observing it at the earliest point of the middle 95 percent you are just 2.5 percent from the beginning. In that case $1/40^{\text{th}}$ of the total interval is in the past and $39/40^{\text{th}}$ of the interval is in the future. The future is then 39 times as long as the past. (Figure 2B).



At the other extreme you are looking at the end of the middle 95 percent just 2.5 percent from the end. Only $1/40^{\text{th}}$ of the total interval remains in the future. The future is only $1/39^{\text{th}}$ as long the past. See figure 2C.



Again, assuming that we are making an observation sometime in the middle portion of its useful life we may say that there is a 95 percent chance that the future longevity is somewhere between **1/39** and **39 times as long as its past longevity** (depicted in respectively 2C and 2B).

Examples of the Corpercian principle

Modern human beings (Homo Sapiens)

Modern humans have been around for about 200,000 years. We may think that we live in a unique/special time but the likelihood of that is rather slim. The people who lived during the Renaissance in Europe thought they lived in a special time. We know better now.

If there is nothing special about our time of observation now, we have a 95 percent chance of living sometime in the middle 95 percent of human existence. Consequently we can set 95% confidence limits on the future longevity of the human species.

The future longevity of Homo Sapiens (modern humans) should be more than $1/39(200,000) = 5,100$ years but less than $(39)(200,000) = 7,800,000$ years.

Microsoft Corporation

Microsoft was founded in 1975. The company has been in business for 33 years. There is nothing special about the time of observing Microsoft now. Launching a new Windows Operating System (VISTA) does not make 2008 a “special” year to look at Microsoft. Companies launch new products all the time. Therefore we can set 95 percent confidence limits on the future existence of the company at: $1/39(33) = 33/39 = 0.85$ years and at $(39)(33) = 1287$ years. Hence, the future longevity of Microsoft should be more than 10 months but less than 1287 years. So you may want to hold on to your Microsoft shares a little longer...

The American Society for Quality

The American Society for Quality (ASQ) was established about sixty years ago. If there is nothing special about our time of observation now, we can set 95% confidence limits on the future of the ASQ at: $1/39(60) = 1.5$ years and $(39)(60) = 2340$ years. The professional society is expected to be around for at least a few more years and it even may still be there in the fourth millennium.

Some explanantory notes

- 1) The Copernican principle applies to the expected longevity of any species, organization, political system, etc. because none of these things are "special", not even Microsoft or the ASQ. They all have a beginning and an end. As long as the point in time that you choose to observe it is random, the principle applies. Very few people expect the ASQ to last 2340 years or that it would disappear in 18 months but it could happen. It's all a matter of probability. So, we can predict, with a 95 percent confidence level, that the longevity of the ASQ is at least 18 months but less than 2340 years.
- 2) The 2.5% is the probability that an observer would observe the life history (timeline) of a company, organization or species at a time that is very close to the beginning or end of its life. That would be a "fluke" point in time. For instance, if you would look at Microsoft one week after it was established or if you would observe the Titanic one day after the start of its maiden voyage the Copernican principle would not apply. Unknowingly you would have picked a "special" time.

The 2.5% does not reflect the probability that something will or will not happen. It merely reflects the probability of picking the “wrong” time and consequently making an incorrect prediction. In other words, using Microsoft as an example, if you made the observation today and Microsoft is still in business next year your prediction would have been correct. Again, the 95% reflects the probability that we are observing a company, a species, an organization, etc. at a time sometime in the 95% "middle" portion of its life.

A long and successful track record is usually a good safety indicator. The Copernican principle suggests that it is relatively safe to board (at a random time) a commercial jetliner that has completed a large number of flights. Its next flight is not likely to be its last. However, to be on the (very) conservative side, you may want to avoid flying on the brand new Airbus A380 Super Jumbo Jet until it has completed at least 39 trans-Atlantic flights...

- 3) Even if something that you observe has existed for a long time does not guarantee that it will exist much longer. It all depends on at which the point in time you made the observation. It could be a point very early in its life or it could be a point close to the end of its life. You really don't know. But there is a 95 percent chance that you are observing it somewhere in the "middle" of its lifeline.

The closer the "Now" time is to either end of its life line the more "special" it would be, which would make the Copernican principle invalid. To use, once more, the Microsoft example, it would be highly unlikely that "today" would be a "special" time to observe Microsoft. However, looking at the human species one month after the outbreak of an all-out global nuclear war would definitely be a "special" (Now) time.

So, given that the Now time is not a "special" time, the prediction you are making, with 95% probability, is that it will continue to exist a set minimum but less than a set maximum amount of time. However, the longer it has already existed, the higher these calculated minimum and maximum limit numbers will be.

References:

- Time Travel in Einstein's Universe by Richard Gott III
- Statistical Quality Control by Douglas Montgomery
- Quality Control Handbook by J. M. Juran