Expected human longevity

1. EXPERIMENTS

The computing was performed in a stochastic way: for a chosen N, a value of each parameter was randomly generated using the predefined probability density, and L was computed according to the modified Drake equation. The obtained probability distribution denotes the longevity of human civilization under chosen probability distribution for the given parameters and for the chosen N – the number of technologically advanced civilizations in our galaxy, i.e. the ones that transmit electromagnetic signals to space. From the obtained probability density, several derived graphs can be generated, e.g. the one in Figure 1.

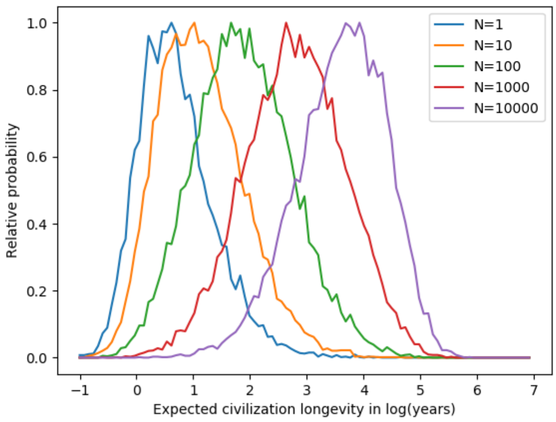

Figure 1: Graph for log(L), i.e. for expected human longevity based on the values of N – the number of civilizations in our galaxy.

N	median	stabilization	volume
1	4.65	13 600	2700
10	13.04	11 100	10 000
100	77.96	9 300	63 700
1000	681.68	5 800	545 600
10 000	5042.72	/	1 000 800

Table 1: Median and stabilization values for different N.

The same relations are also presented in side-view in Figure 2 and in 3D in Figure 3. Bigger N seemingly corresponds to better chances for longer human longevity, in a positive correlation with N. In addition, our longevity is obviously limited, but the exact relations are somehow difficult to comprehend due to the non-linear scale.

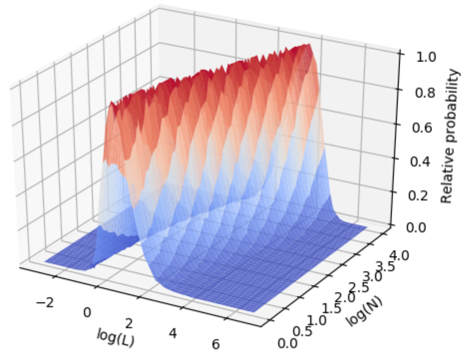

Figure 2: Longevity based on N, side view.

If instead of logarithmic scale, the graph of probability densities is presented in a linear scale (Figure 4), the impression is now quite different. The "true" relation between N and L is as follows:the majority of possibilities for smaller N are at the left part of the graph resulting in a bigger bump accompanied with a slower decline. The point of stabilization, i.e. when a decline is less than 1 percent in a corresponding 100 years is presented in Table 1 as "stabilization". One can also calculate median longevity by computing it for each graph, denoted as "median". The difference between "stabilization" and "median" is that median represents a point dividing all simulations into two equally frequent intervals, while stabilization indicates the end of steep, i.e. more than 1 percent decline in the probability densities. While median linearly grows with the number of civilizations, stabilization declines denotes where the peak in probability densities on the left is getting smaller than 1 percent. At N equal to 10 000, no decline is bigger than 1 percent. The right-most column "volume" denotes the percentage of the current integral of probability densities in a millennium decreases to less than 1 percent compared to the best 100 years (normalized). These

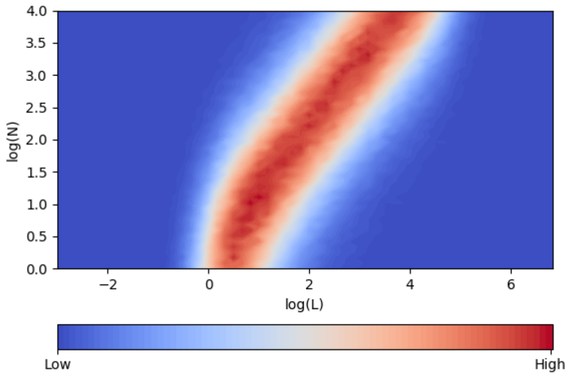

Figure 3: Longevity based on N, top view.

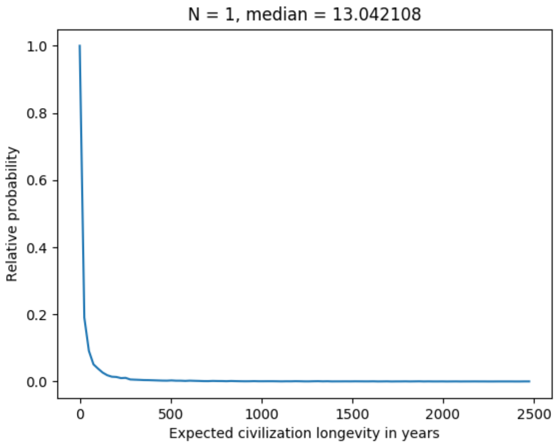

Figure 4: Graph for longevity, i.e. $\log(L)$ in linear scale for $N = 1$.

relations are highlighted in Table 2 where the average over an interval 0..1000, 1000..2000, 10 000..11 000 etc. is divided by an average over best (i.e. usually the first) 100 years. These numbers denote how much more probable are the first 100 years compared to the first 1000 etc.

The reason why we present graphs in logarithmic scale is that the linear scale does not enable the reader to comprehend anything outside the relevant scope. For example, Figure 4 would consist of two lines if the max years would be 25 000 instead of 2 500 – one vertical on the left and one horizontal on the x axis.

2. CONCLUSION

The aim of this research was to establish probability densities of longevity of human civilization. In this paper we presented results of just one model while we have tested hundreds of them. The model analyzed here shows that if there are more civilizations, we have higher probability of living longer. Regardless of N and after initial fluctuations very close to the left, the curve of longevity is monotonic, decreasing. At N equal to 1, i.e. if we are the only ones in our galaxy, we will probably live only for approximately 2 000 - 14 000 years. At N equal to 10, the expected high-probable longevity is from 11 600 to 22 000 years. At N equal to 10 000 there is no peak at the left and the probability density very slowly declines. In other words – there is not any explicit pattern and predictions are undecidable.

N	0-1000	1000-2000	10 000-11 000	100 000-101 000	1 000 000-1 001 000
1	0.186	0.024	0.002	0.000	0.000
10	0.289	0.073	0.010	0.001	0.000
100	0.600	0.276	0.058	0.006	0.000
1000	0.871	0.789	0.298	0.053	0.005
10 000	0.275	0.749	0.843	0.299	0.048

Table 2: Probability densities of 1000 years for different N at 5 specific longevities normalized to the highest value in 100 years.

Our maximum survival time seems to be about 10 000 - 20 000 and maybe up to 100 000 years. But most likely, the expected time is substantially shorter.

This study might be relevant because it indicates that we need to start acting wisely sooner rather than later to prevent grim scenarios. Namely, if the predicted time would be say millions of years, there would be no need to go to Mars and other planets soon, we should not worry too much about global warming or other problems. But if the predictions indicate that these dangers might hamper our progress relatively quickly, at least in terms of cosmic timing, we should actively analyze them and react appropriately.