# World Life Expectancy Visualization

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## 1 Overview

Human quality of life has improved astronomically over the last few centuries. Life expectancy was around 30 years for millennia. Since the industrial revolution in the mid $19^{th}$ century, life expectancy has grown steadily. Innovations such as antibiotics like penicillin, plumbing, and washing ones' hands have had a massive impact on life expectancy. For example, before the $20^{th}$ century, infant mortality was around 50%.

However, life expectancy has not changed equally for the entire planet. Different countries encounter different innovations and troubles, and as such have sometimes drastically different life expectancies. Our goal for this project was to visualize these differences in an effective way.

## 2 Background

For this project, we used materials that we either had prior experience with (Python, Blender), or learned to use through this class (Paraview, VTK).

## 3 Project Description

We began with a life expectancy dataset. This dataset consists of the majority of modern countries (with a couple of exclusions), and their corresponding life expectancy by year. Countries such as the DR Congo and Antarctica are excluded because of lack of data. The dataset ranges from 1800 to 2100, using projections for years not yet recorded.

Some questions were considered when designing this project: Can we highlight important events in human history through their impact on life expectancy? Will there be any abnormalities highlighted through the visualization?

# 4 Implementation

For this project, we decided to use the software we are most familiar with. The data processing was done with Python and the visualization itself was created in Paraview, then rendered in Blender.

We wanted to visualize the life expectancies in an intuitive and clear way. In particular, we wanted to somehow utilize the life expectancy data with a map of the world. This presented some issues, as the .csv format dataset we began with has no information regarding world geography. For this problem, we used another dataset: a geojson file that contains point information outlining each country on the planet.

With the two datasets on hand, we needed to correlate them in such a way that we can use visualization software without too much of a headache. For this, we wrote a pair of python scripts that parse the datasets into .raw files. These .raw files contain a geometric representation of each country and its corresponding life expectancy for a particular year. In total, this became a 3-dimensional dataset, with each file the globe's life expectancy by country, for a particular year.

Finally, to produce an effective visualization, we needed to interpolate the data. With just the .raw files, there can be significant jumps in life expectancy between one year and the next (e.g. 1939-¿1940). To get around this, we can interpolate the data: for each year, create $n$ timesteps representing small increments in life expectancy to the next year. With interpolation, the animation becomes much smoother. With additional tweaks to the color map and other important information, we felt the visualization was complete.

# 5 Results

In total, we have produced a few visualizations. Different perspectives on the global life expectancy are important, as small details can be lost with wide views. Further, we tried to make it as intuitive as possible to see the parameters in question, so the color map and elevation of each country are both designed to convey the life expectancy. We believe this has lead to a good visualization that properly conveys the information.

The visualizations are not perfect, however. There was some trouble getting the colormap to stay consistent. When applying the 'temporal interpolation' filter, the color of each country would dim considerably until the next timestep. This was circumvented by performing interpolation before processing in Paraview. Further, there are some quirks with the volume rendering that make it somewhat blurry.

With regard to the questions posed in the third section, we were able to note pivotal events in human history through the life expectancy. A large dip can be seen during both WW1 and WW2, as well as the steady increase since the industrial revolution. It is interesting to see the discrepancy of life expectancy between first- and third-world countries, as well as these discrepancies increasingly disappearing in subsequent decades.

# 6 Work Distribution

Alan Henderson was responsible for the data processing. He produced the scripts that process the data into .raw files, ready for use with Paraview. Gary Fehlauer and Carson Wilde worked together to process the data in Paraview to make a compelling visualization. Finally, Gary wrote the report and Carson made the presentation.