

# Global population from 1960 to 2016

## Process Book

### *Contents*

#### ■ Introduction

- Motivation
- Data
- Task
- User
- Related Work

#### ■ Process

- Data Processing
- Design Evolution

#### ■ Implement

- Overview
- Selection Bar
- World Map
- Year Chart
- Parallel Coordinates

#### ■ Conclusion

**Yanyan Zhang**

e-mail: [u1127804@utah.edu](mailto:u1127804@utah.edu)

UID: u1127804

**Lin Yan**

e-mail: [lin.yan@utah.edu](mailto:lin.yan@utah.edu)

UID: u1140293

The project repository is [here](#).

# 1 Introduction

## 1.1 Motivation:

World population has changed over years in many respects such as "Age dependency ratio (% of working-age population)", "Age dependency ratio, young", "Fertility rate, total (births per woman)", "Life expectancy at birth, female (years)" and "Female population 00-04". Users may need to study these changes to predict future population so that they can plan ahead to provide good education, health care and other services in the future. Different aspects of the world population data are closely correlated to different types of services. For example, studying "Fertility rate, total (births per woman)" and "Life expectancy at birth, female (years)" may tell users how much health services for childbearing will be needed in future years.

There were also interesting changes in values of some attributes throughout years. For example, in the US "Age dependency ratio, young" changed from ~51% in 1960 to <29% in 2016, and "Fertility rate, total (births per woman)" dropped from ~3.6 to ~1.8. In China "Life expectancy at birth, female (years)" increased from ~45 in 1960 to ~78 in 2016. We are interested in visualizing all these changes across countries and years. We also would like to find out explanations (e.g. from economical and political points of view) for these changes if possible. Studying the potential explanation that causes these trends could help users predict the global population in the future and make plans that could meet the current or future needs of people according to different distribution of population.

## 1.2 Data:

Downloaded from a [Kaggle link](#).

This database presents population and other demographic estimates and projections from 1960 to 2050. They are disaggregated by age-group and gender and cover approximately 200 economies. We can extract all the information we are interested in from this data set,

such as “Population Growth( annual %)”, “Population, Female(% of total)”, “Population Total”, “Work-age Population”, “Birth Rate”, “Death Rate”, “Fertility Rate”, and “Life Expectancy”. All of them were stored in one csv file, in the size of 44.2 MB.

### **1.3 Task:**

The primary questions we are trying to answer:

1. How do values of certain attributes of global population change over the years?
2. How do we compare changes of certain attributes over the years among selected countries?
3. How to visualize the population data of all or selected countries in a fixed year?
4. How to visualize the population data of a certain country in all or selected years between 1960 and 2016? Are there any correlations among attributes that can be observed from our visualization charts?

What we would like to learn and accomplish:

1. Give users a global view of population change. Provide users tools to track attributes they may be interested in from a global point of view.
2. If we can find similarities in the change trends of population among certain countries, users could try to figure out explanations that may lead to these similarities.
3. Users may be interested in certain attributes of certain countries that are correlated to the demand of certain services. Studying the changes in these attributes over the years will provide quantitative information that may help them determine their future plan.
4. If we could match economical or political changes of countries with their population changes in certain years, our visualization could help us explain how economical or political changes could affect global or specific regional population.

### **1.4 Users:**

The target audience could be the general public, the ones who are interested in global population change and specific information. It also could be city planners who would like to rearrange resource based on population in their plan regions. Researchers and educationist in related field may get inspirations from this visualization as well.

## **1.5 Related Work:**

All the members in our group come from China, one of the countries with the largest population in the world. Population is always a hot topic in our countries. We think developing simple demographic profiles to understand past and current trends of global population is a realistic and interesting topic. Moreover, during the visualization class, professor introduce many interesting views and method to visualize data, such as table, map, parallel coordinates and so on. By choosing this data set, we can implement all the visualization methods we are interested in.

## 2 Process

### 2.1 Data Processing

There are several problems we want to solve during data processing.

Firstly, there might be missing data. We tried to interpolate data to fill up small holes in data(during drawing world map) or drop a small amount of lines with too many missing attribute values(during data analysis).

Secondly, the data set is relatively large then the data we used in our previous homework. In order to improve the speed of visualization. Yanyan Zhang pre-process the data via python in her task.

Thirdly, we should decide what attributes we want to visualize. Although there are many attributes we are interested in, we can not visualize all of them due to the limit of time. Up to now, we select “Population Total”, “Birth Rate”, “Death Rate” and “Life expectancy”.

Finally, we convert the data to desired format according to different tasks by different member in our group.

### 2.2 Design Evolution

All attributes we are interested in are options in a selection bar. For different attributes, we show data in a world map with each country colored accordingly. A color bar is displayed beside the world map. There is also a year chart in which users can select a specific year, and a year slide bar with which users can see transition throughout years.

Users can select one country by clicking it on the map. A line chart of year vs. the selected attribute for the selected country will show up next to the world map. Clicking another country will add another line to the line chart, and so on. This line chart shows comparison among selected countries. If users would like to show comparison in another attribute among the same countries, they can keep the selections of countries and select

another attribute in the selection bar. By hovering over a line, a tooltip of more details will pop up. Lines of different countries have different colors. Users can remove the line charts they are not interested in any longer by simply clicking the Remove buttons beside those line charts.

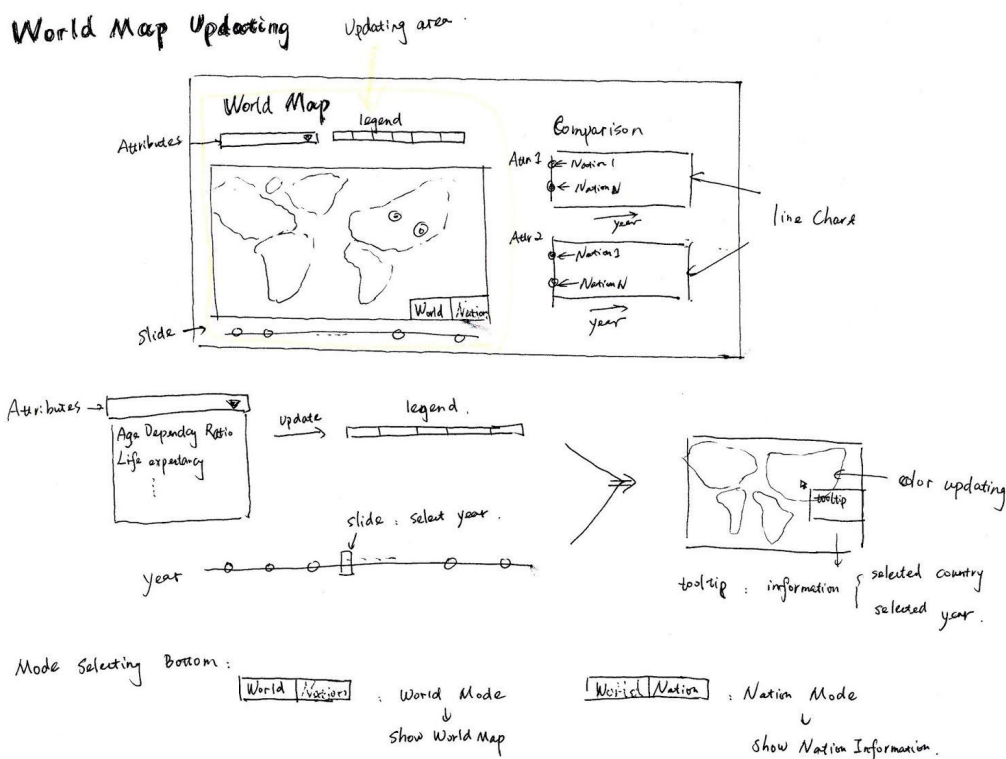
To show multiple attributes in one graph, we use parallel coordinates. For a selected year (or a selected country), we plot countries (or years) and attributes as parallel coordinates. By this chart, we can observe correlation between attributes. Each coordinate can be sorted and be moved to be reordered. Use brush to select part of a coordinate and to highlight paths that go through the selected part of the coordinate.

We can also use table to show data for a selected year. The columns of the table are countries and attributes. The table can be sorted by each column. Countries from each continental can collapse to one group.

## 3 Implementation

### 3.1 Overview

Up to now, we finished part of functions of selection bar, world map, year chart, and parallel coordinates. Following are the hand-written design and images of finished visualization.



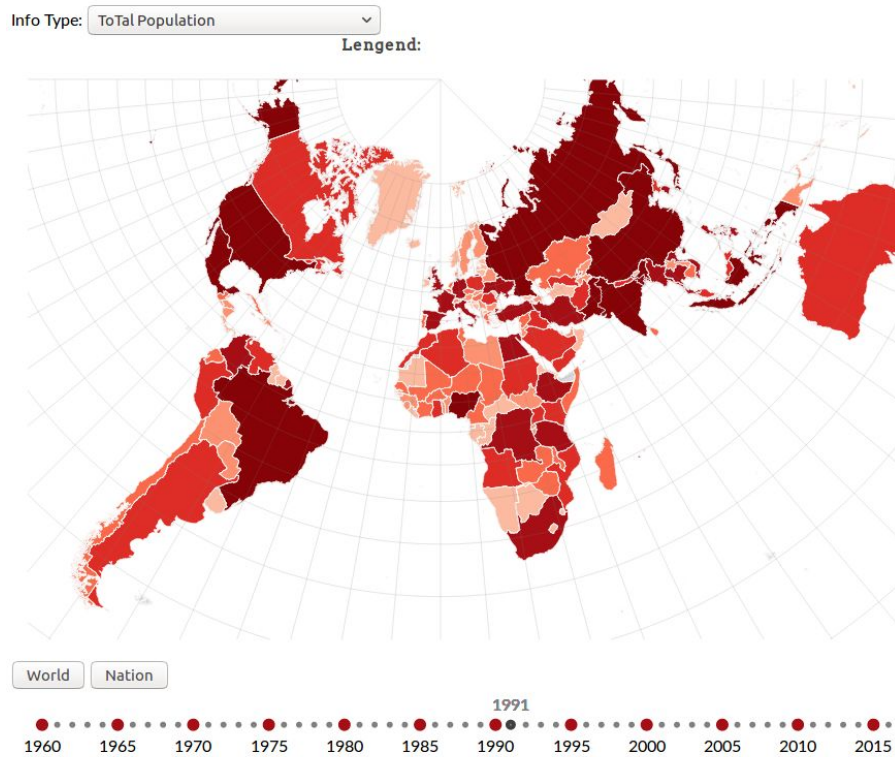
Hand-written Design

# Global population from 1960 to 2016

Name: Yanyan Zhang; E-Mail: u1127804@utah.edu; UID: u1127804  
Name: Lin Yan; E-Mail: lin.yan@utah.edu; UID: u1140293

## World Map

## Analysis Panel

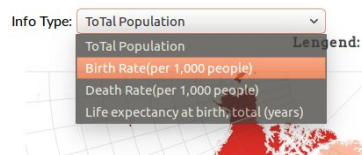


Overview of up-to-now Implementation

## 3.2 Selection bar

Selection bar can select one attribute from 4 interested attributes and visualize it in the world map.

### World Map

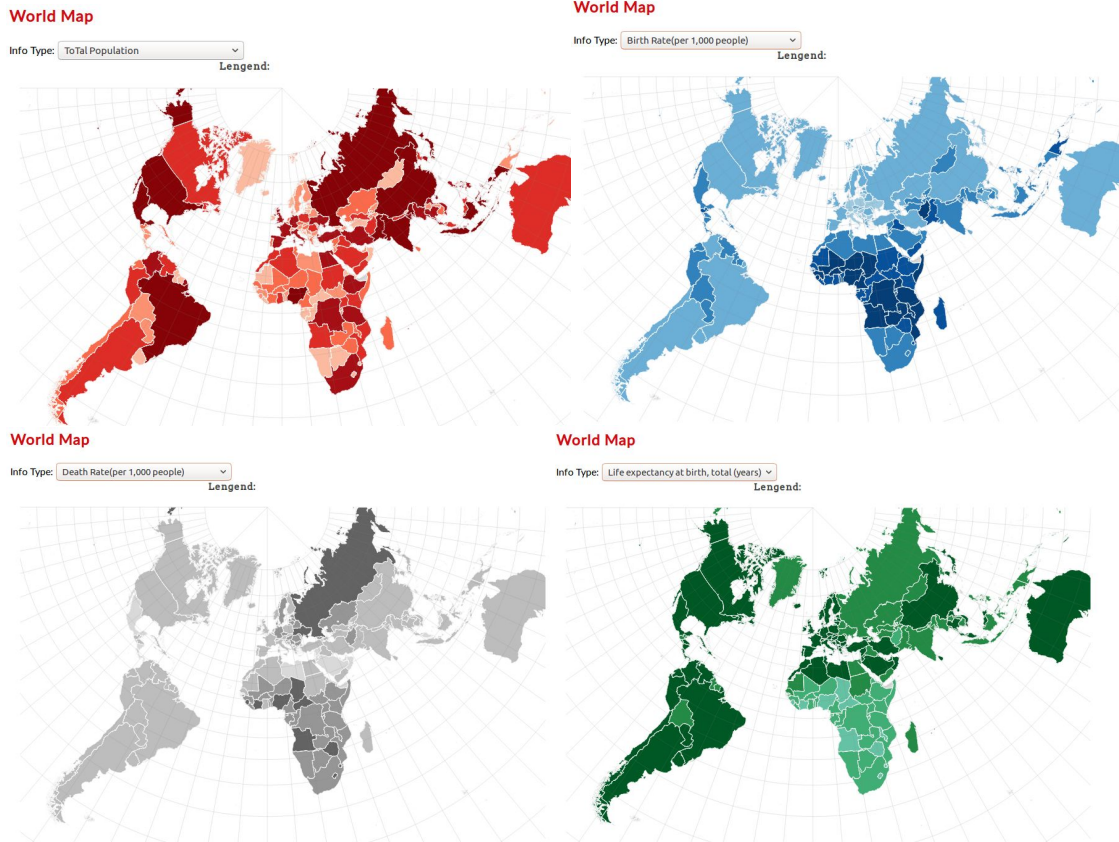


world map.



### 3.3 World Map

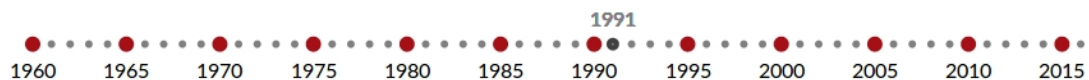
World map can update according to the year and attribute selected by users. It uses different color scale to represent different attributes.



World Map Updating Based on Different Attributes

### 3.4 Year Chart:

Year chart display every five years users can select. When user's mouse hover on the smaller circle, the year will display on the top of this circle, and will disappear when user removes mouse away.



### **3.5 Parallel Coordinates**



## 4 Conclusion

Up to now, we finished several tasks using this visualization:

1. (World map) Give users a global view of population change.
2. (Parallel coordinates) Users may be interested in certain attributes of certain countries that are correlated to the demand of certain services. Studying the changes in these attributes over the years will provide quantitative information that may help them determine their future plan.

What should we further improved:

1. We can show more information via world map. We will add tool-tip, zoom on it.
2. Year chart is hard to select. We could consider another method.
3. We could try non-tradition world map because geographical information is not important in our project.
4. Parallel coordinates ...