The Human Mortality Explorer

An Interactive Online Visualization of the Human Mortality Database

Jonas Schöley, September 25, 2015

Please visit

`https://jschoeley.shinyapps.io/hmdexp`

to experience the *Human Mortality Explorer*.

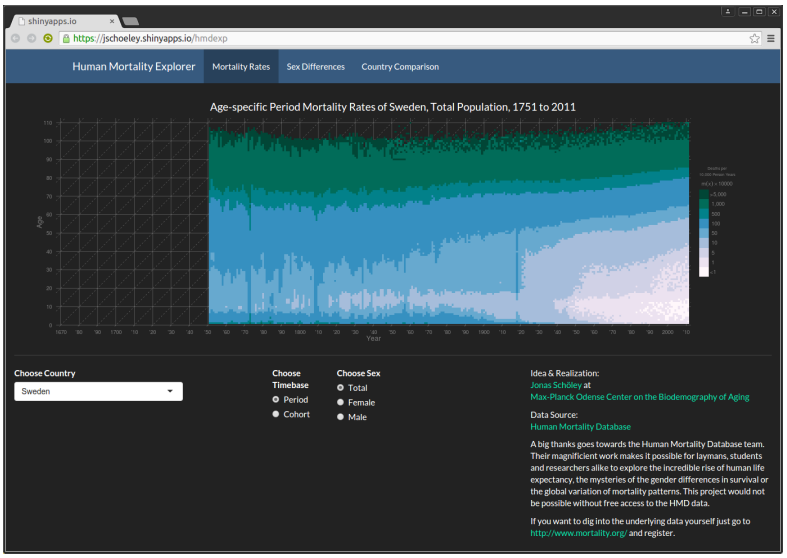

Figure 1: The Human Mortality Explorer: Mortality surface view.

Abstract. The *Human Mortality Explorer* is an interactive web-page visualising the death rates of the Human Mortality Database. The tools allows users from all around the world to easily explore human mortality dynamics across space and time. Users select data subsets on a graphical user interface and are immediately presented with results in the form of Lexis surface plots (Heatmaps over period and age). Users can toggle between a visualization of the pure mortality rates, sex differences in mortality and country differences. The Human Mortality Explorer is build using modern technologies that facilitate the construction of interactive web-pages without expert knowledge on web-technologies.

Background

Interactive visualizations are the medium of many success stories in recent years. "The Global Flow of People" (Sander, Abel, and Bauer 2014), "Gapminder World" (Rosling 2006) or "What's Really Warming the World?" (Roston and Migliozzi 2015) are a few examples of visualizations which were able to engage users to explore data and to generate publicity for the underlying study or the newspaper article. Less visible but equally important are domain specific visualization tools which help scientists with specific data analysis tasks such as genome analysis ("MizBee", Miriah Meyer, Munzner, and Pfister (2009)), cluster analysis ("Hierarchical Clustering Explorer", Seo and Shneiderman (2002)), browsing linguistic networks ("Constellation", Munzner, Guimbretière, and Robertson (1999)), poetry analysis ("RhymeDesign", McCurdy, Srikumar, and Mariah Meyer (2015)) or investigative journalism ("RevEx", Bertini (2015)), to name a few.

Today the barrier of entry for building such an application is lower than ever and researchers can build web-based tools themselves without relying on external expertise. The *Human Mortality Explorer*, a web application designed for easy exploration of the popular Human Mortality Database (Human Mortality Database Team 2015), serves to demonstrate this point. It has been developed over the course of a month by a single researcher without prior experience in web development.

Objective

The objective is to develop a tool that allows for the easy and quick exploration of data on human mortality by researchers, students and interested laymen. Researcher should be able to quickly check existing hypotheses against the data and generate new ones. Teachers are given a tool to demonstrate human mortality patterns while being able to spontaneously explore the HMD data together with their students, facilitating classroom interactions. The interested public should have easy access to the tool (in terms of availability and technical barrier) and be able to gain their own insight from the HMD data. A glossary of technical terms and interpretation guidelines allow non-demographers to use the tool.

Methods

The application is written in the `R` language for statistical computing (R Core Team 2014). The `shiny` library (Chang et al. 2015) is used to build a web-based user interface from within `R`. A special web server capable of interpreting `R + shiny` code hosts the application. The choice of tools illustrates an important point: Nowadays web-applications can be build by a single researcher, in a known programming environment, without

deep knowledge about `HTML`, `Java Script` or other web technologies. Development takes place in the open. The source code is publicly available at an online repository (`https://github.com/jschoeley/hmdexp/`).

Contribution

We contribute the *Human Mortality Explorer*. An interactive web page for the visual exploration of the Human Mortality database, visualizing death across time and space. The application is build around a heatmap representation of human mortality data on a Lexis surface (a period-age-grid). The user selects subsets of the data (country, sex, period or cohort rates) and is presented with the corresponding visualization. Currently there are three exploration views to choose from: pure mortality rates, sex differences of mortality rates and country differences of mortality rates.

The Human Mortality Explorer is in active development and not yet feature complete. Among other things, the final tool will feature:

1. The visualization of HMD life-table data ($d_x, q_x, l_x, L_x, T_x, e_x$),
2. the selection of a continuous colour scale, and
3. zooming into the graph,
4. a glossary and interpretation guidelines.

The project can be adopted for the Human Fertility Database (Human Fertility Database Team 2015) with little additional work, as both databases have similar data structures.

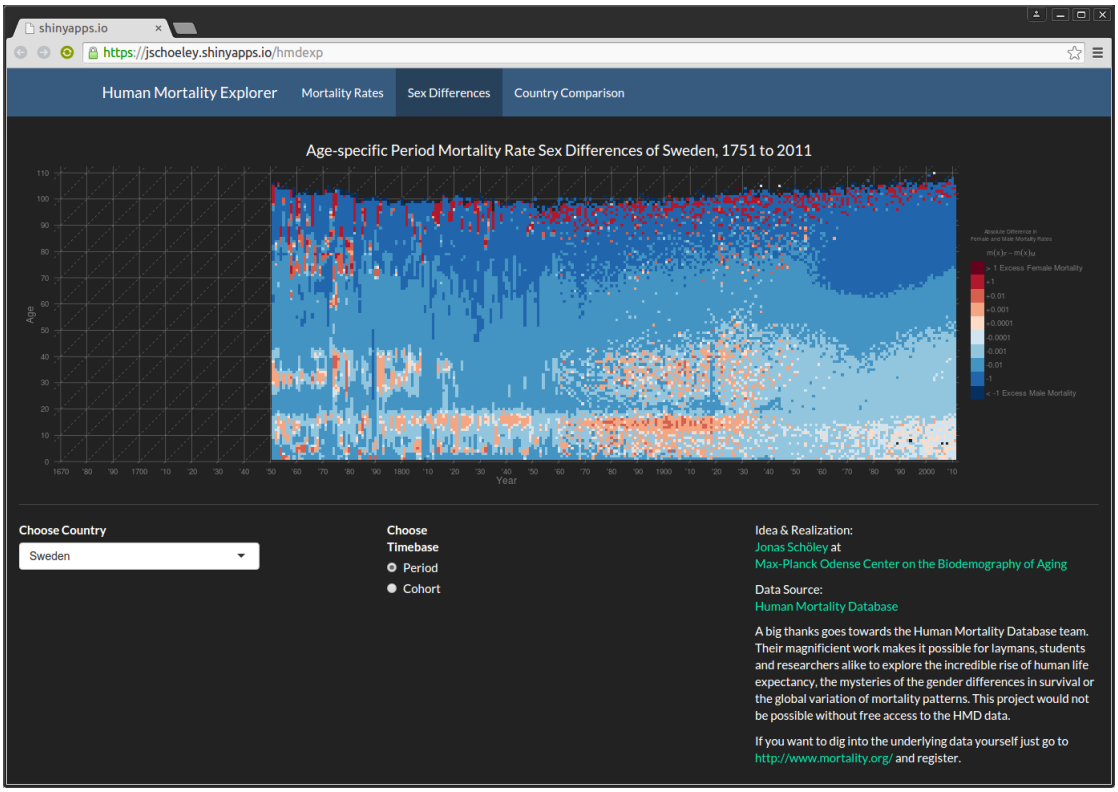

Figure 2: The Human Mortality Explorer: Sex differences view.

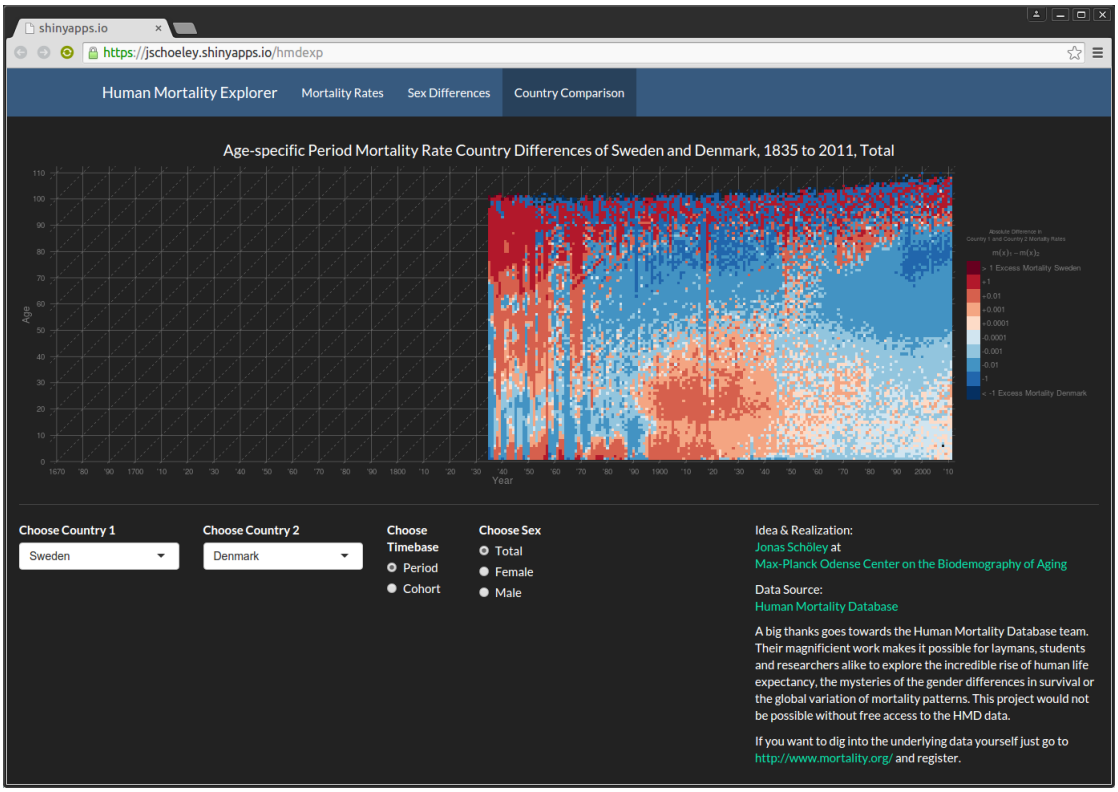

Figure 3: The Human Mortality Explorer: Country comparison view.

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