# Visualizing Refugee Movement Since 1959

**Ankita Singh**
ankita1@mit.edu

**Oliver Regele**
oregele@mit.edu

**Durgesh Das**
ddas@mit.edu

## ABSTRACT

In this data visualization project, we provide a narrative of refugee movement using scrolly-telling techniques. We begin our interactive visualization summary on the refugee movement trends over last 60 years followed by a more detailed analysis of three key events - the Rwanda refugee crisis, the Venezuela crisis, and the Syria conflict. Each analysis is followed by the crisis impact on the refugee movement trends. We conclude our narrative by providing a human aspect behind the statistics. To achieve this, we followed the personal stories of individuals who went through the crisis and where they are now. We are using data provided by the UN High Commission for Refugees data bank for our analysis.

### Author Keywords

Refugee Movement; Scrollytelling; Sankey Plot; D3.js; Syria Crisis; Rwanda Crisis; Venezuela Crisis

### Project Page

Please use the link below to access our deployed project page:

/https://github.mit.edu/pages/6894-sp20/FP-refugee-movement/

## INTRODUCTION

Narrative visualization has been a popular technique for data visualization in today's world where we have an explosion of information. The purpose of narrative visualization is to provide easy to digest, interactive, and engaging stories such that the reader can absorb the message with little effort. There is a range of interaction as seen in Figure 1. We attempt to find some space in the middle of the spectrum by balancing the author driven slide content in the crisis specific sections, with the reader driven ability to explore the data in the interactive maps and charts throughout the visualization.

Web-based data visualization tools like D3 have gained significant popularity in the last few years due to their ease of use, seamless integration with classic web-development tools, and excellent support through actively maintained open source libraries and examples.

In this paper, we have utilized several visualization techniques to provide an easy to digest information flow that strives to be both interactive and engaging. We have provided several customization options for users to actively seek and gather information they are interested in rather than overloading everything. In the sections below we will explain visualization techniques used in our project in the same sequence as it appears in our project website and will provide the reasoning for the choice of graphics, encodings, and interactions.


**Figure 1. The spectrum of interaction in narrative visualizations ranges from author-driven to reader-driven.**

## RELATED WORK

In this section, we will discuss prior work on refugee data sets, world map data visuals, and other attempts to visualize refugee movements over time.

The Washington Post has published a visual guide to the last 75 years of major refugee crises [1]. The data is presented mostly as bubbles, there are no world maps. It is hard to see past the numbers. Additionally, the report does not cover major events that caused people to be displaced.

The UNHCR has published extensively on this topic and we leveraged one data visualization in particular when conceptualizing our work. The popstats database [4] has a data visualization that shows bubbles of where people have become refugees. The visual does not encapsulate where those people went, or what happened to them after they became refugees. We found that having a world map for this type of data is meaningful, but without a start and end point, it is challenging to see past the numbers. It is hard to see bubbles of the number of refugees in a particular location without thinking about where they went or what happened to them.

The refugee project [2] is a comprehensive source for all information related to people displacement. The visually appealing dashboards show starting and ending destinations, but lack the deep dives into the major conflicts. It only provides country and year specific news clippings related to refugee movements. In this situation, we were hoping for a more author driven presentation, but perhaps it leans to far toward reader driven.

Stolper et. al discuss the importance of storytelling in visualization [3]. They describe the juxtaposition of textual narrative and data visualization and the four high level categories that



ACM ISBN N/A.

DOI: N/A

authors use to effectively communicate a story. These are communicating narrative and explaining data, linking separated story elements, enhancing structure and navigation, and providing controlled exploration. In our visualization, we attempt to leverage their recommendations mainly around navigation and controlled exploration.

## DATA SOURCE

The data set used for our project was retrieved from UNHCR population statistics database. The UNHCR is the refugee agency of UN and a global organization, which works towards providing safety and security to refugees, forcibly displaced communities, and stateless people. With such a data set, there are numerous challenges to collecting and maintaining information because reporting is not easily accessible and people may choose to remain anonymous. As a result, there are several gaps in the data set which we have tried to mitigate by informing the reader that data might not be available. The UNHCR population statistics database refers to these missing points are asterisks(*).

We believe an important baseline to discuss prior to diving into our project is the definitions of what it means to be a refugee, and the different types of displacement that people experience.

### Definitions

**Refugees** include individuals recognised under the 1951 Convention relating to the Status of Refugees; its 1967 Protocol; the 1969 OAU Convention Governing the Specific Aspects of Refugee Problems in Africa; those recognised in accordance with the UNHCR Statute; individuals granted complementary forms of protection; or those enjoying temporary protection. Since 2007, the refugee population also includes people in a refugee-like situation.

**Asylum-seekers** are individuals who have sought international protection and whose claims for refugee status have not yet been determined, irrespective of when they may have been lodged.

**Internally displaced persons (IDPs)** are people or groups of individuals who have been forced to leave their homes or places of habitual residence, in particular as a result of, or in order to avoid the effects of armed conflict, situations of generalised violence, violations of human rights, or natural or man-made disasters, and who have not crossed an international border. For the purposes of UNHCR's statistics, this population only includes conflict-generated IDPs to whom the Office extends protection and/or assistance. Since 2007, the IDP population also includes people in an IDP-like situation. For global IDP estimates, see www.internal-displacement.org.

**Returned refugees** are former refugees who have returned to their country of origin spontaneously or in an organised fashion but are yet to be fully integrated. Such return would normally only take place in conditions of safety and dignity.

**Returned IDPs** refer to those IDPs who were beneficiaries of UNHCR's protection and assistance activities and who returned to their areas of origin or habitual residence during the year.

**Stateless persons** are defined under international law as persons who are not considered as nationals by any State under the operation of its law. In other words, they do not possess the nationality of any State. UNHCR statistics refer to persons who fall under the agency's statelessness mandate because they are stateless according to this international definition, but data from some countries may also include persons with undetermined nationality.

**Others of concern** refers to individuals who do not necessarily fall directly into any of the groups above, but to whom UNHCR extends its protection and/or assistance services, based on humanitarian or other special grounds.

## VISUALIZATION DESCRIPTION AND METHODS

### Introduction

In this section we have used a simple summary text to introduce our project and provided a content overview. We added interactive features to the text containers to provide a quick navigation to the section of interest if the user doesn't want to scroll through everything. We have included a background image with lowered opacity to provide a central theme to our scrolly-telling. There are four dots on the right hand side of the screen to add additional page navigation options. This may seem redundant in this section but becomes useful in the later sections.

In this section, there are no data visualizations but we use a powerful background image to capture the reader's attention. All the links are scrolly-telling jumps to their respective sections.

### Summary

In this section, we demonstrated the movement of refugees around the World in the last 60 years by using an interactive World Map Chloropleth as seen in Figure 2. We have minimized the use of text in this section and instead allow the user to play with the interactive nature of the map, animated arcs, and data-rich tooltips to convey the story. We also included an animated line-chart as seen in Figure 3 to provide more insight on the different groups classified by UNHCR as people displaced due to unstable situation in their home country by year.

Both visuals are constructed in D3. The map allows the user to scroll by year through a feature in the ScrollMagic library. By observing the progress on scroll, the year is incremented or decremented. This triggers a change in the data that is pulled in to display the colors. The legend is the most challenging part of this design due to the wide range of movement. In this timeline we go from zero people moving to over 3M+ people leaving Syria annually from 2014-2016. We tried to encode this as best as possible with a D3 color scale. While there are intricacies that are missed by approaching the colors this way, we hoped the tooltips could fill the gap by informing the reader of the actual numbers.

The line chart is a global summary of the data shown in the map grouped by type of movement. Here, we select the five major types of people displacement - refugees, asylum seekers, internally displaced people, others of concern, and stateless

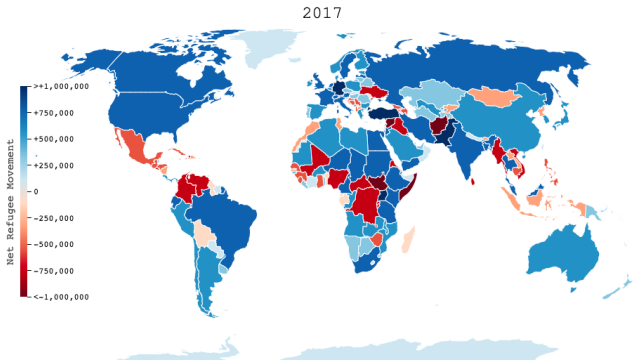


**Figure 2. An example of the Chloropleth Map providing insights on refugee movement around the World in 2017.**

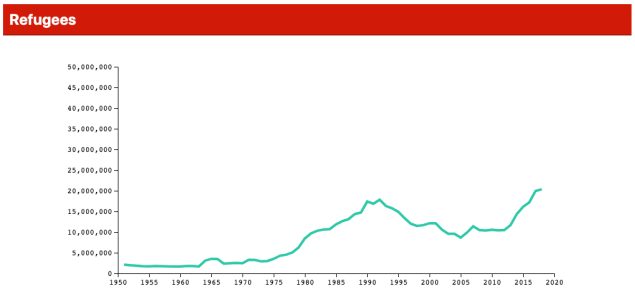


**Figure 3. An example of the line-chart providing details about different UNHCR people of concern groups.**

persons. The challenge we faced with the y-axis was making it dynamic. We weighed this technical difficulty with wanting to convey the absolute scale of each type of movement, without manipulating the axis to make it seems as though we were over-inflating one over the other.

### Key Events Sparking Refugee Movements

In this section, we focused our analysis to the three key events that sparked movements of refugees across the globe.

- Rwandan ethnic genocide: 1994
- Venezuelan political instability: 1997-present
- Syrian civil war: 2011-present

We selected these three events because the Rwandan conflict was due to ethnic tensions, the Venezuelan conflict was due to political ambition, and the Syrian conflict was due to civil uprising. We will walk through each of these events as featured on our project page.

Our first interactive display is a horizontal story board used to answer four fundamental questions.

1. What was the Geo-political situation of the country during the crisis?
2. What groups or key players were involved in the crisis?
3. What was the statistical outcome of the event?

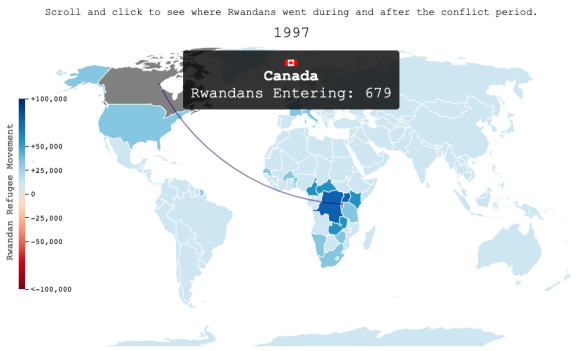


**Figure 4. An example of interactive map representing refugee movement from Rwanda.**

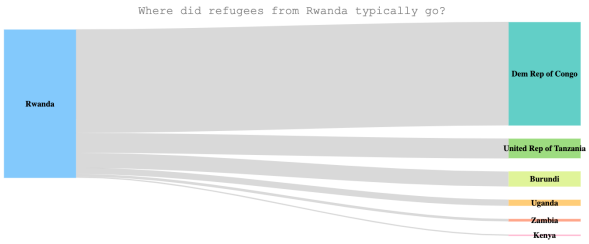


**Figure 5. An example of Sankey plot representing flow of refugees from Rwanda.**

4. What was the impact of this crisis on the suffering individuals?

In each of these slides, we utilized a combination of pictures(background images), data visualizations, and narrative text to convey the full story to the reader. The data visualization comprises a dynamic bar chart showing the number of refugees, asylum seekers, internally displaced people, stateless people, and others of concern over the period of the conflict by year. This visual is constructed in D3 on the third slide and accompanied by the outcomes of the event.

Following the slides, we have another interactive map display showing where the displaced people from the affected country during and after the crisis was over, as shown in Figure 4. Once again, we provided similar interactive features as the summary section for users to engage with the content. The data here is different - focusing on the conflict country as the origin, thus each one has a different legend. We face the same difficulty as previously described, and rely on the tooltip to fill the information gap.

Lastly, we included a Sankey plot, as shown in Figure 5 that showcased the flow of refugees from the affected country to various destinations. In this plot, we utilized aggregated sum of refugee flow over from the start till the end of the conflict to showcase a holistic view on where the most affected people traveled to. The key takeaway is that majority of people do not travel very far from their home country, which runs contrary to the narrative that western politicians tend to create about refugees. The Sankey plot is created using a third party library called AnyChart, due to challenges we faced with D3.

### The Human Experience

In order to humanize the refugee experience as well as tie what was presented in the data to a real human story, we included profiles of specific refugees that had gone through the crises that we detailed. This was accomplished by presenting a clear picture of the refugee and accompanied it with text that described the situation that they were fleeing as well as their experiences as a refugee. By giving the data a human element and by tying the data back to one specific person, we hope to encourage a sense of empathy with the refugees and the struggles they are facing. We also emphasized the human element in order to address the negative stereotyping and prejudices that are often present in regards to refugee movements, by fully presenting the dangers and struggles that a specific individual was facing.

We present this section in line with our scrolly-telling experience by locking the images as the informational text appears for the reader to absorb.

## RESULTS AND DISCUSSION

Per our visualizations, there are two major takeaways. First, the timelines provide an interesting dimension for the depth of the atrocities. The Rwandan conflict created over two million refugees in less than two years, whereas the Venezuelan conflict was slower to reach that level, but coincided with gradually declining quality of life.

Second, as is apparent in our Sankey diagrams and conflict specific world maps, most refugees did not venture very far from their homes. This is contrary to the xenophobic and populist messaging from multiple western nations. Most people displaced from Rwanda ended up in the Democratic Republic of Congo, from Venezuela ended up in Colombia, and from Syria ended up in Turkey. Venezuela could be seen as an anomaly in this analysis because there were years in the prolonged conflict in which the majority of refugees traveled to the USA. But over the whole range of what we have defined as the conflict, the majority of Venezuelan refugees stayed in South America.

## FUTURE WORK

We believe that the style of scrolly-telling visualization delivers a meaningful medium between fully author driven and fully reader driven. As such, we believe our work can serve as a framework to tell stories about any geographic data sets. Nonetheless, in keeping with the UNHCR, we would leverage other datasets about the challenges facing people once they become refugees, such as job placement, education opportunities, and other meaningful integration metrics. It would be prudent to include this information in addition to our analysis to build the full narrative about what happens to the people beyond the statistics we can see about refugee claimants.

## REFERENCES


[1] Lydia DePillis, Kulwant Saluja, and Denise Lu. 2015. A visual guide to 75 years of major refugee crises around the world. (2015). https://www.washingtonpost.com/graphics/world/historical-migrant-crisis/.

[2] The Refugee Project. 2019. Data – Refugee Movement. (2019). https://www.therefugeeproject.org/.

[3] Charles D. Stolper, Bongshin Lee, Nathalie Henry Riche, and John Stasko. 2016. Emerging and Recurring Data-Driven Storytelling Techniques: Analysis of a Curated Collection of Recent Stories. (2016). https://www.microsoft.com/en-us/research/wp-content/uploads/2016/04/MSR-TR-2016-14-Storytelling-Techniques.pdf.

[4] UNHCR. 2019. Data – Population Statistics (Time Series). (2019). http://popstats.unhcr.org/en/time_series/https://goo.gl/K8wMfQ/.