Visualizing The Human Toll of the Ukraine Invasion

Names of students who worked on the project

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Links to demos, documents, or whatever is needed to show the visualization

[Click here to visit the website](#)

Project goals

- Create a clear and compelling narrative that helps viewers understand the scale and impact of the displacement of former Ukrainian residents because of the 2022 Russia-Ukraine war
- Use data visualization techniques to highlight patterns and trends in migration flows because of the war
- Provide an objective and politically disinterested analysis of the effects of the war on the displacement of people formerly living in Ukraine
- Raise awareness about the crisis and encourage users to contribute to causes that work towards helping people affected by the war in Ukraine

Non-goals

- Demonstrate how financial resources have been mobilized and allocated by different actors involved in the conflict
- Assert an opinionated analysis of the actions of various actors in the war

By providing a comprehensive and accessible overview of these complex issues, we aim to raise awareness about the human costs of war and contribute to more informed policy discussions and decision-making through this project.

Target Audience

The interface containing the visualization is targeted towards the following user segments -

- Researchers and policymakers who may be seeking objective data sources and narratives on the 2022 Russia-Ukraine war
- General public who may be interested in understanding a more holistic picture of the migration patterns because of the war

Related Work

Anjali Bakliwal

a. https://www.reuters.com/graphics/HEALTH-CORONAVIRUS/DEATHS/xlbpgobgapq/index.html
   i. The use of time as means to show the gravity of the nature and bring more awareness about the seriousness of COVID19
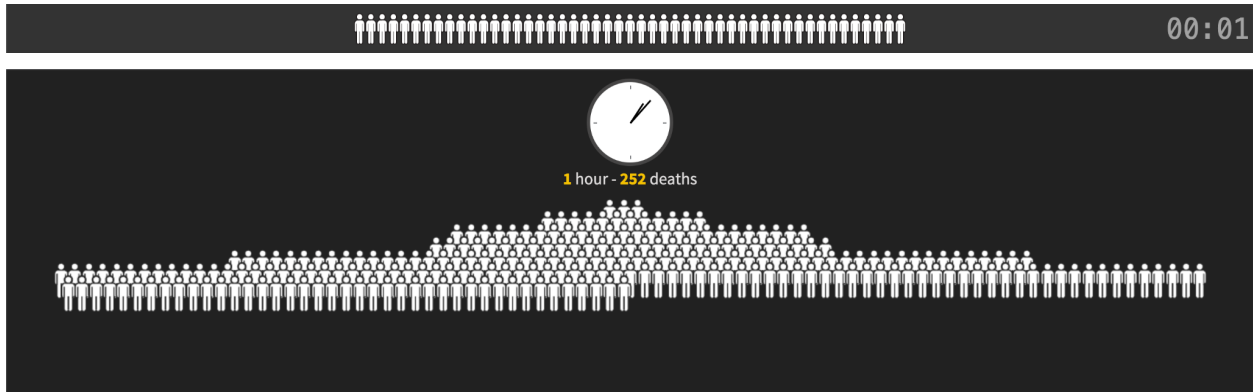
   ii. Simple design: Despite the complex nature of the data being presented, the website has a simple and clean design that makes it easy to navigate and understand. This served as an inspiration for data visualization because it shows that a simple and elegant design can be effective in presenting complex data.

b. https://xiangqi.rocks/soccer.html#data
   i. Storytelling approach: The website adopts a storytelling approach to present the soccer match data, using a narrative structure to introduce the teams, provide context, and highlight key moments in the match. This approach inspired our data visualization designs to present data in a more narrative and engaging way, rather than just presenting raw numbers and statistics.
   ii. The use of "time window" on the slider creates an engaging way to attract users, even users who do not understand soccer/football. The linked graph made it easier to visualize what was happening on the field and where the players were moving over time.
      1. This was one of our inspirations for a choropleth graph that would show how people were displaced over time using a time slider. (We were not able to achieve this in d3)
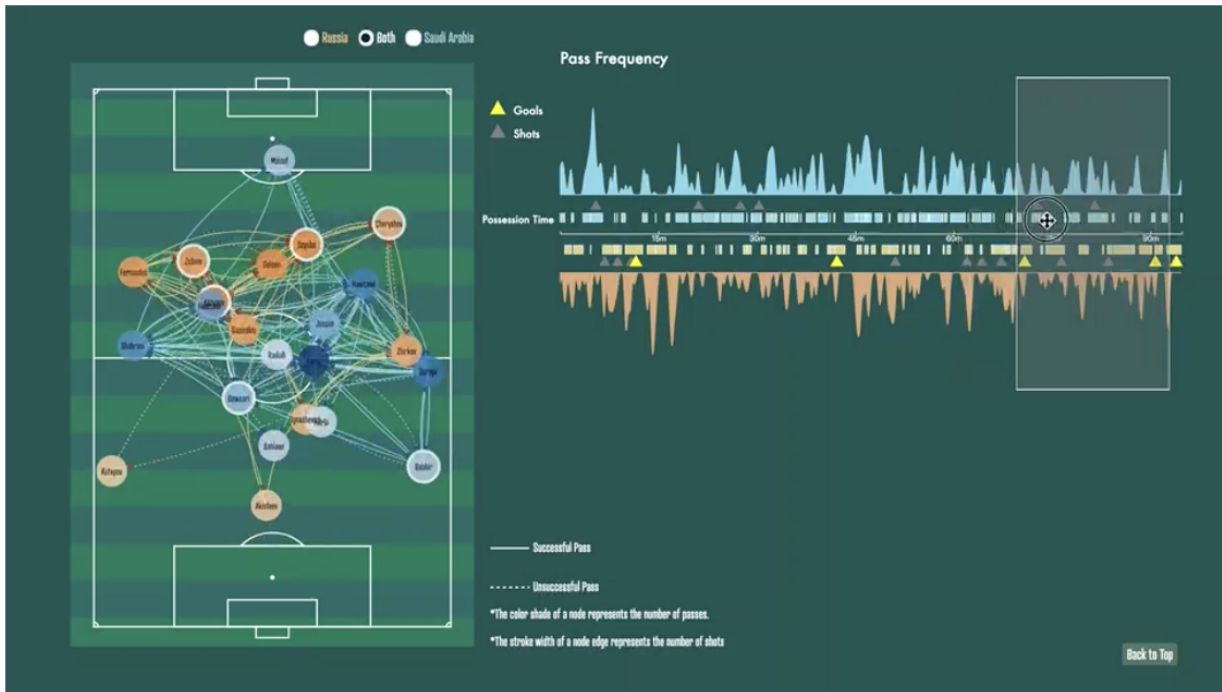
Moving a time window on the slider visualizes all player movement in the match

   c. https://projects.unearthed.greenpeace.org/big-oil-iraq/

      i. Use of real-life images and stories: The website uses real-life images and stories of people affected by oil spills in Iraq to convey the gravity of the situation. These images and stories help to make the data more relatable and engaging to users by highlighting the human impact of the oil industry. This use of real-life images and stories can inspire data visualization designers to incorporate similar elements to create more impactful and emotionally engaging visualizations.

         1. This website pushed us to add elements like real life videos and stories from people to add more authority and "realness" to our narratives - making it more true and helping in empathizing with the people who are living the crisis everyday.

Fatima shows a painting of her home surrounded by gas flares. Photo: BBC
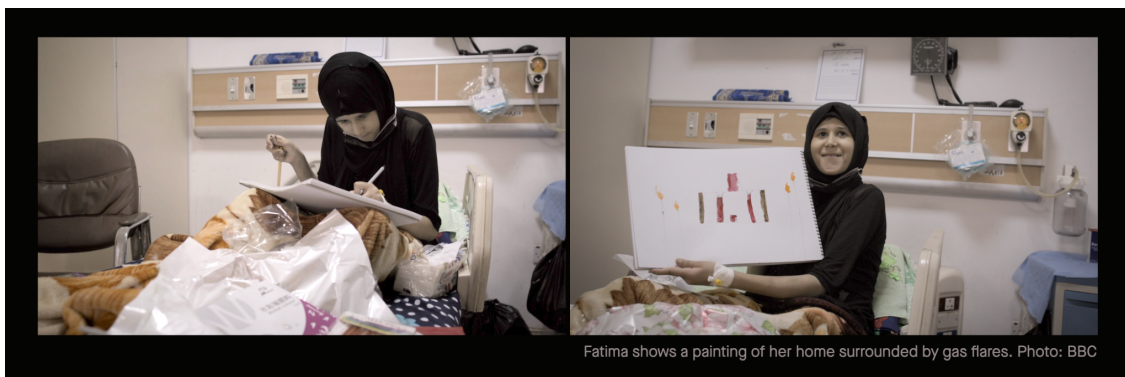
Ankita Suresh Shanbhag

a. <u>EU Responses to the Large-Scale Refugee Displacement from Ukraine</u>
   i. A thorough analysis by several political and sociological experts of the refugee crisis triggered by the war, the responses by various EU nations, and an evaluation of their migrant policy through an intersectional lens of race, culture, sex and other sociological dimensions
   ii. Insights into the overlap of EDA (exploratory data analysis), foreign policy and sociology
      ■ Example - difference in attitudes of citizens in various countries to migrants from Ukraine and migrants from Syria gives us insights into the impact of race, religion and culture on such attitudes
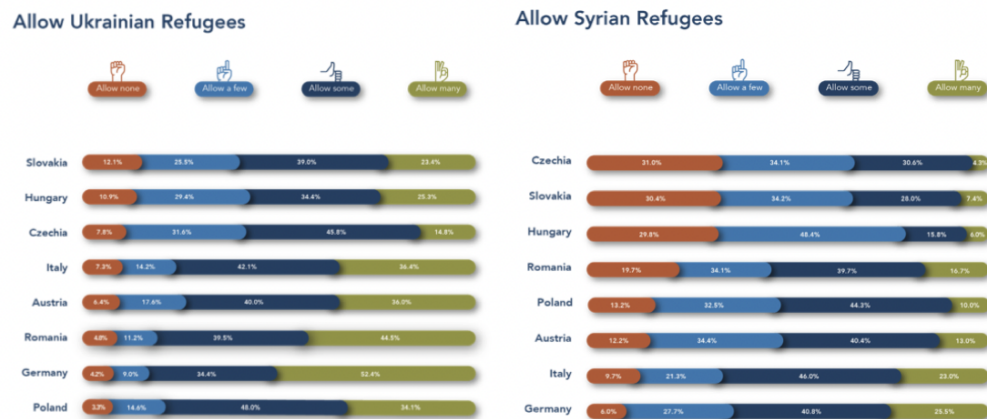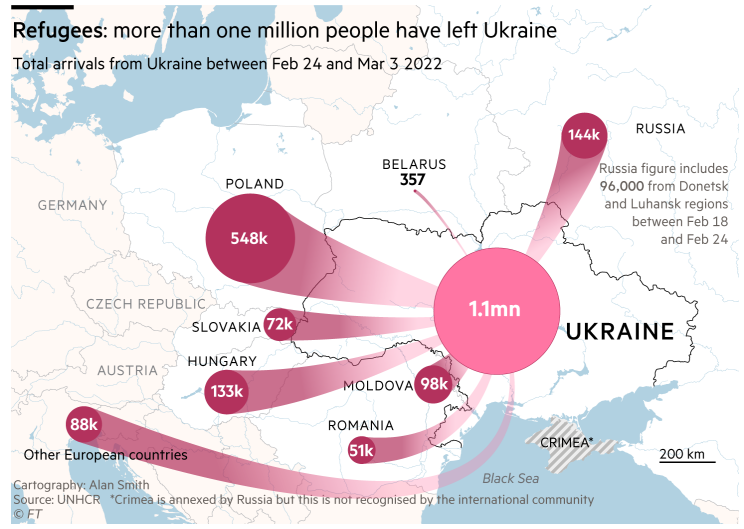

b. <u>War and Displacement: The Case of Ukraine</u>
   i. Academic research on the impact of human displacement triggered by the previous war in Ukraine (in Crimea and Donbas)
   ii. Scalable learnings from this migrant crisis were applied to our analysis of the current one
      ■ Example - the paper discusses the fluidity in 'the boundary between voluntary departure and displacement' [Sasse, 2020]. While we were originally planning on addressing both internal and external displacement, we limited our narrative to external displacement to somewhat address this fluidity concern.

c. <u>Reddit - r/dataisbeautiful</u>
   i. Several visualizations on the refugee crisis helped inform the direction of our project - one example is <u>[OC] Map showing more than one million Ukrainian have been forced to flee their country : r/dataisbeautiful</u>

Refugees: more than one million people have left Ukraine

Total arrivals from Ukraine between Feb 24 and Mar 3 2022

RUSSIA

Russia figure includes 96,000 from Donetsk and Luhansk regions between Feb 18 and Feb 24

144k

GERMANY

BELARUS
357

POLAND

548k

CZECH REPUBLIC

SLOVAKIA 72k

AUSTRIA

HUNGARY

133k

1.1mn

UKRAINE

MOLDOVA 98k

ROMANIA

88k

51k

Other European countries

CRIMEA*

200 km

Black Sea

Cartography: Alan Smith
Source: UNHCR *Crimea is annexed by Russia but this is not recognised by the international community
© *FT*

ii. Use of maps to visualize data is always a contentious topic - this prior art helped us take a more opinionated stance on when maps can help improve the visualization

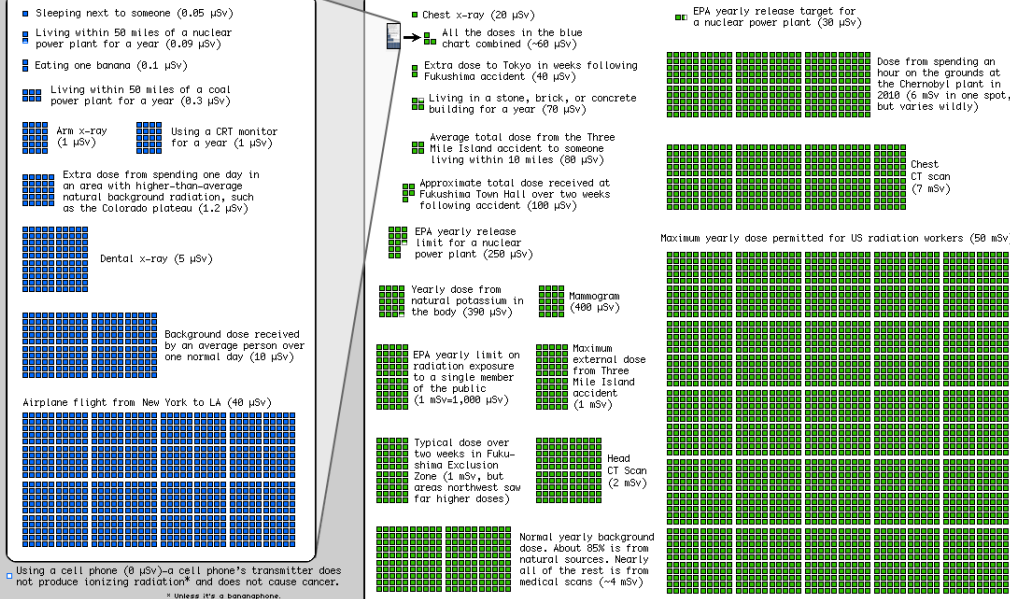## Drake White

a. CNN - Russia's War on Ukraine, one year on
   i. Information from major events in the timelines, organized chronologically
   ii. This was a big inspiration for our timeline view, and the general tone of our narrative infographic.
b. XKCD - radiation dose chart
   i. A proportionate chart showing dosages of radiation related to other forms of radiation exposure
   ii. This was a big inspiration for showing the relative amount of refugees from Ukraine, the biggest visualization of our website. Showing it related to the population of other countries helps to drive the point home

c. [How Western Weapons transformed the war in Ukraine](#)
    i. Vox makes great work - it's a series of visualization and information regarding the Ukraine War
    ii. Their visualizations and production quality served as an inspiration for our project, specifically a lot of their human-centric visualizations

Description

Overview Dashboard

The dashboard below has several small elements designed to grab the attention of a user as soon as they land on the website. Listed below are a few reasons that motivated us to create this dashboard -

- **Real-time data monitoring**: A dashboard allows users to monitor key performance indicators (KPIs) in real-time. This provides users with up-to-date information that helps them identify trends, make informed decisions, and quickly respond to issues as they arise. For instance in the dashboard below we use the live timer that tracks how long it has been since the Ukraine invasion commenced. Secondly, we added "Today's Headline" as a means to have it keep updating by pulling from the web with the latest news to keep people aware.
- **Increased efficiency**: Dashboards provide users with an overview of all relevant information in one place, reducing the need for multiple reports and analysis. This leads to increased efficiency, as users can quickly access and analyze data to make informed decisions.
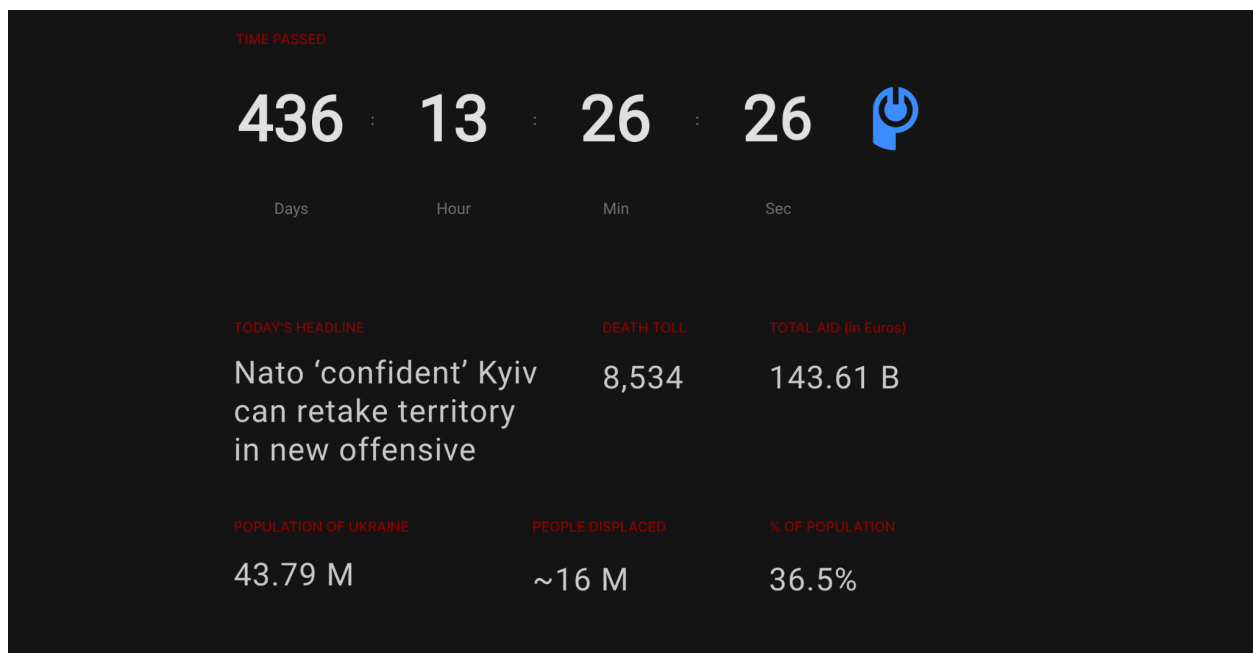
Context and History

This is an extension of the dashboard above. We wanted to create a seamless integration of the user to the amount of information they are exposed to later in the website. Not many people seem to understand the reasons behind why the invasion took place in the first place. Hence, it was important to tell the users the conflict is not a result of something happening recently but rather a long political unrest that only culminated after several decades of turmoil in the current refugee crisis.

With the help of a timeline, we highlight the main events that has happened in the history -
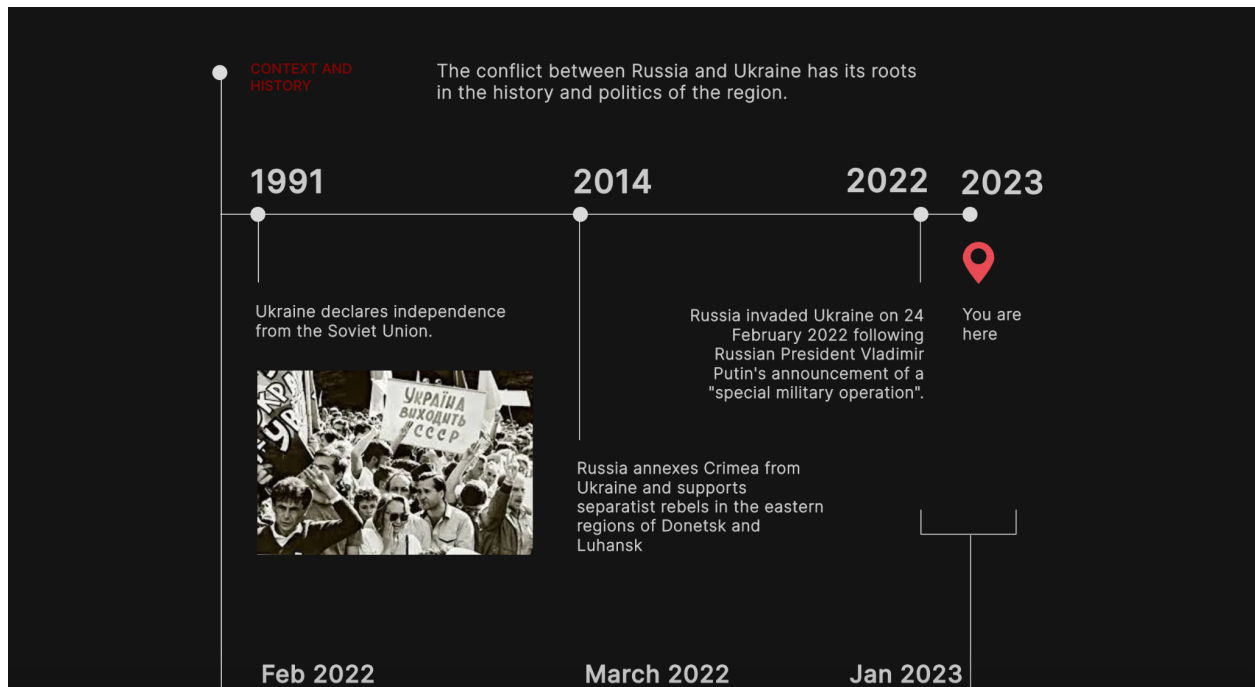
'Human Toll' Infographic

Our "Human Toll" infographic uses several Gestalt principles to create a powerful visual representation of the impact of displacement. By using human icons to represent every 1000 people, we applied the principle of similarity to group together similar elements. The rows and columns of icons, with slight gaps, create a pattern that uses continuation and closure, allowing viewers to perceive the overall pattern. Through the use of proximity and symmetry & order, we placed the icons close to each other to form blocks of 1 million people, creating a clear and easily understandable pattern. Moreover, we added a scale towards the left side of the infographic to compare the number of people displaced with other countries' populations, providing an additional layer of context and making it easier for viewers to understand the magnitude of the situation.

Overall, our infographic effectively communicates the human toll of displacement while utilizing visual principles to create a clear and impactful design.
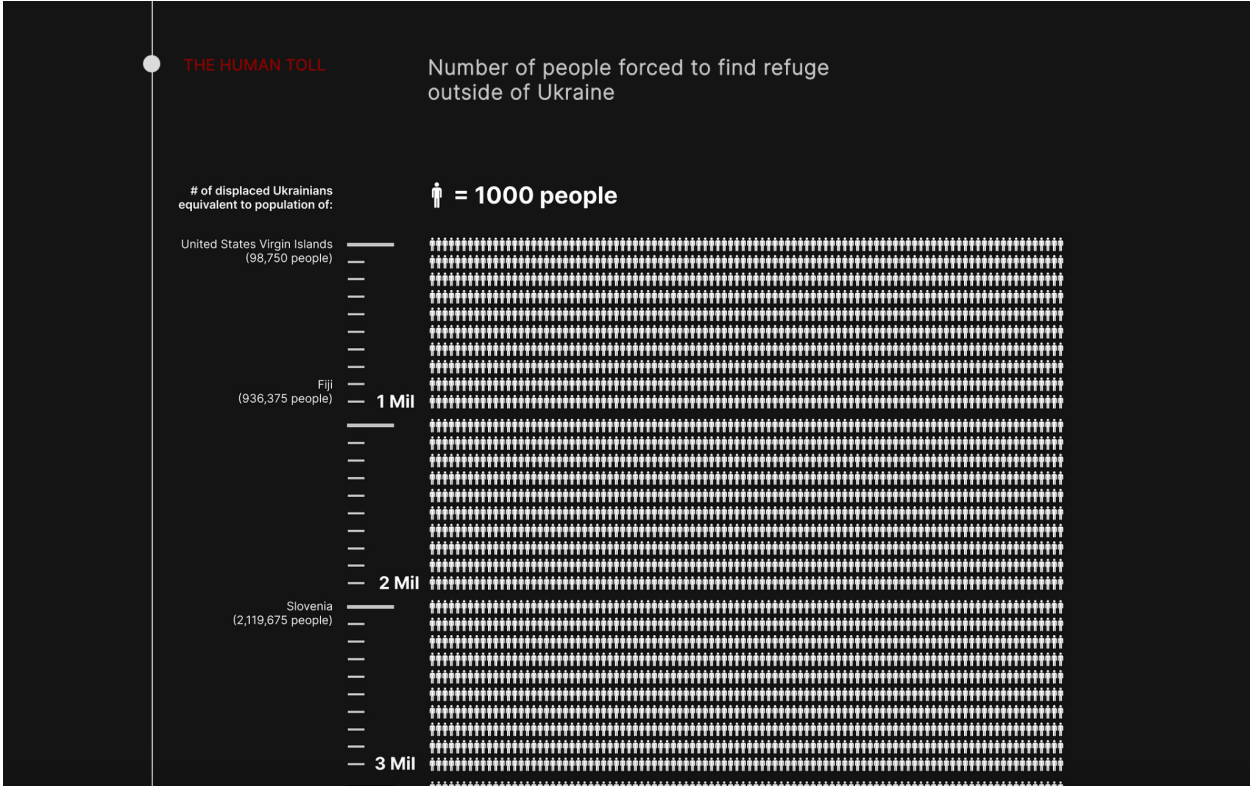
'Intensity of the Situation' Infographic

We applied the Gestalt principles of contrast and hierarchy in our infographic design, which made it easy to compare and understand different refugee crises. Using circles to represent each crisis, we created a visual pattern that groups together similar elements through the principles of similarity and proximity. We also used contrast to highlight Ukraine as the worst-hit crisis, creating a clear visual hierarchy that emphasizes the severity of the situation.

By employing these techniques, we simplified the comparison of refugee crises and highlighted important trends and patterns that may not be immediately apparent when looking at raw data.
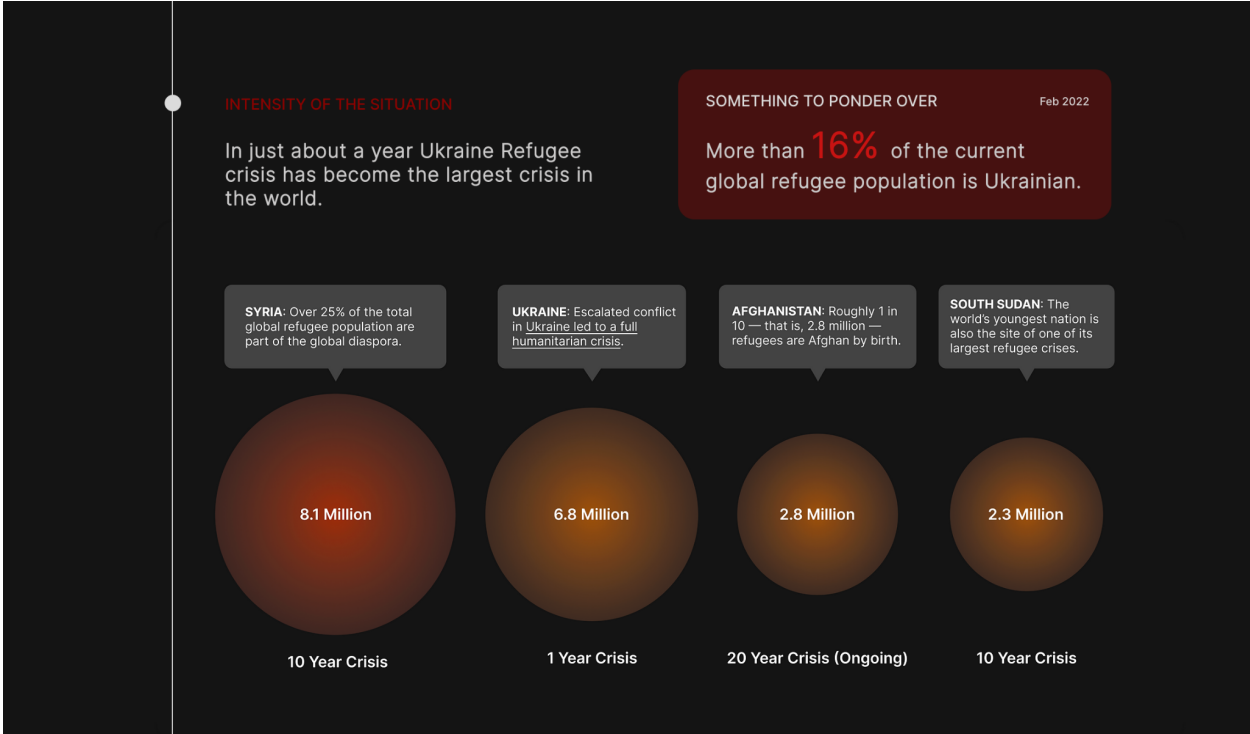
Migration So Far

This visualization aims to highlight the year of 2022-2023, during which the invasion took place and show how the population significantly dropped. Additionally, we have also presented data to show future population projection for Ukraine.

We use 2 graphs - one showing the Annual % change over time and the other about the population count. You can see the Annual % Change has been affected by almost -8.8%, which has been the highest for Ukraine in over 70 years.

We highlighted the year of 2022-2023 on both graphs with the help of the red color.
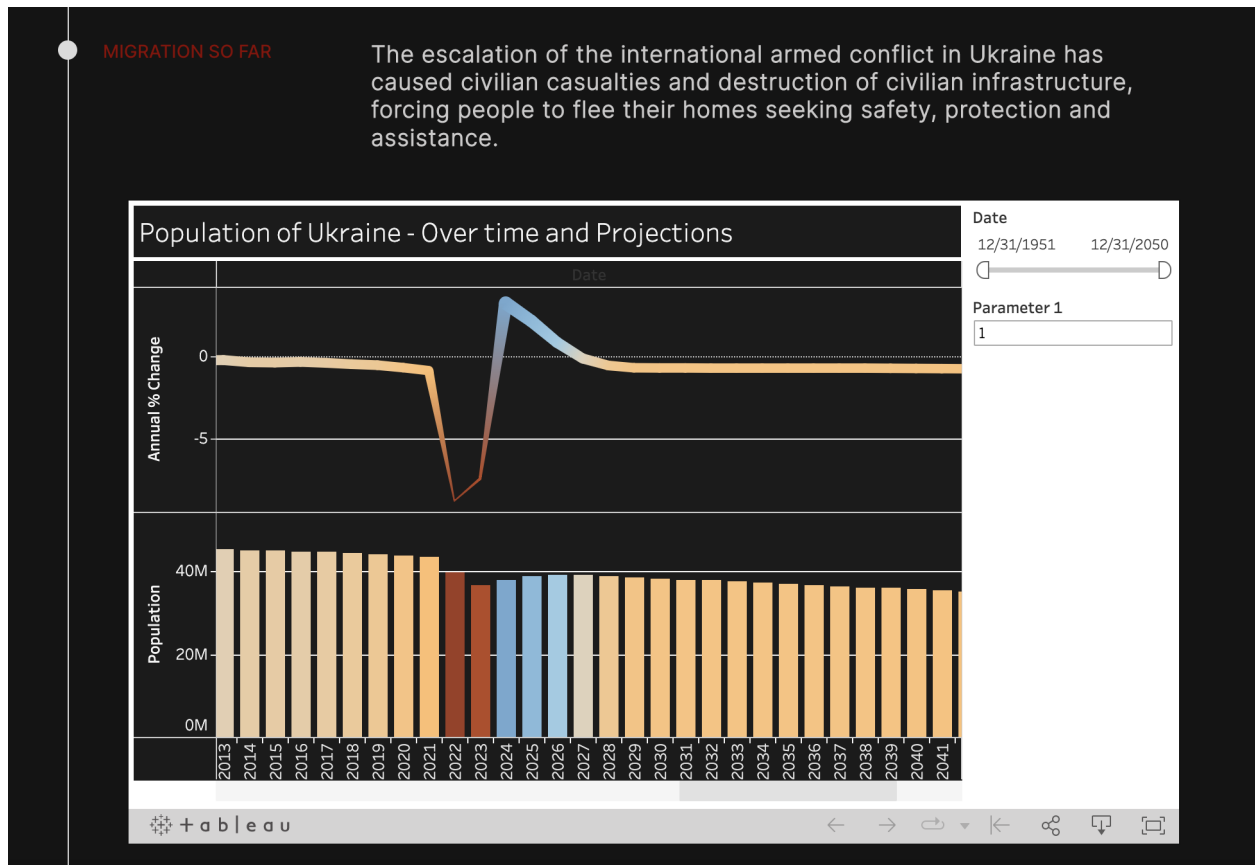
Scatter plot of Location vs Aid

This visualization shows the proportional amount of refugees received by a given country based on showing the distance of that country from Ukraine. It is intended to show insights based on countries that may have taken on the most migrants. The countries visualized are the top 10 countries who received refugees by the number of refugees.
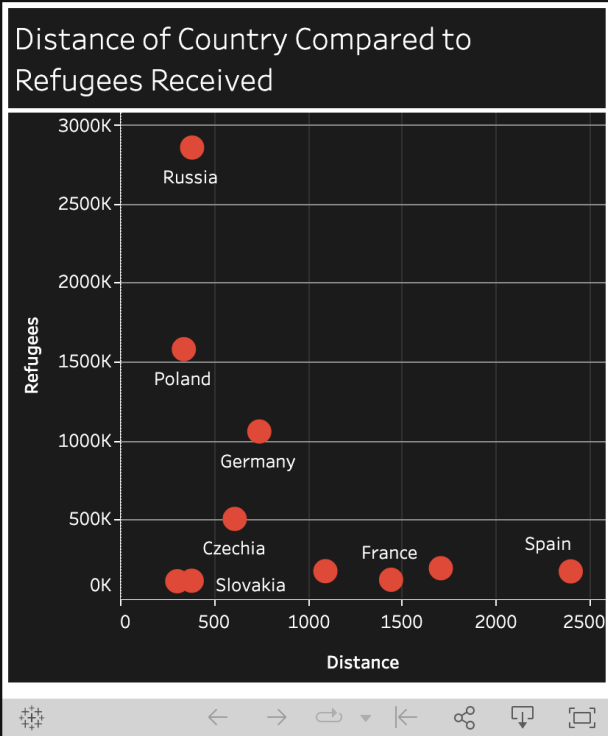
Dumbbell Graph - Aid Provided

The graphic depicts a ranking of the top ten countries that provided assistance to Ukraine and its displaced inhabitants, with the ranking determined by the proportion of each country's GDP contributed as donations. Poland is at the top in providing refugee support and Latvia is at top in providing monetary support (commitment).

Video of the Visualization

https://www.youtube.com/watch?v=pT_aVQWAfSA

Data Sources

All sourcing is provided on the website, wherever possible.

Our primary sources/datasets for visualization were pulled from the following places -

- Kiel Institute for the World Economy, Ukraine Support Tracker
- United Nations High Commissioner for Refugees, Ukraine Refugee Situation
- Statista - Russia Ukraine Conflict SUmmary - Statistics and Facts
- European Commission - Refugee flows from Ukraine

In addition, facts, other visualizations, and narrative content is pulled from a variety of sources -

- [AP News - 'The Mouth of a Bear': Ukrainian Refugees sent to Russia](#)
- [CNN - Russia's War on Ukraine, one year on](#)
- [UNHCR Hong Kong - Ukraine - Fastest Growing Refugee Crisis in Europe since WWII](#)
- [Concern USA - The 10 Largest Refugee Crises to Know in 2023](#)
- [Mercy Corps - The Facts: The crisis in Ukraine](#)
- [IOM UN Migration - Venezuelan Refugee and Migrant Crisis](#)

Tools Used

Information Retrieval

- Spreadsheet applications (Numbers, Google Sheets)
- Python (using Numpy and Pandas)

Exploratory Data Analysis

- Python (using Numpy, Pandas, Geopandas, Shapely)
- Tableau
- ArcGIS (eventually replicated the results in Tableau)
- D3 + Observable

Visualization

- Tableau
- D3 + Observable
- Figma

Design Prototyping

- Figma
- Google Docs

Presentation

- Presentation application (Google Slides)
- Figma
- Wix (for the website - used plugins like Powr.io)

Results

Usability Analysis

Quantitative

Some of the data points were collected for the purpose of quantitative analysis, including the total time that respondents spent perusing the website, as well as the number of questions posed by the respondents. These metrics were collected to gain insight into whether or not they varied in accordance with demographic factors. It is worth noting, however, that due to the limited quantity of data points (i.e., three), these metrics have not yet been employed in any form of detailed analysis. Additionally, while these quantitative metrics may have some directional insight, they will need further analysis to better interpret the results. For instance, the number of questions they posed may be an important indicator of the degree of ambiguity in the information we provided, but to better validate this working hypothesis, we will need to perform a more detailed analysis that was beyond the scope of this project.

Two respondents spent between 5 - 6 minutes to go through the visualization and one respondent took around 15 minutes. The first two were more aware of the situation in Ukraine and the third one had comparatively less familiarity with the crisis. We provided more context based on the questions asked by the third respondent to decrease the time spent by them on the website.

The respondents asked around 5-7 questions each. We attempted to understand gaps and blind spots in our analysis through the questions we received, and extrapolated these questions to additional context and information that other users might want. We then incorporated this additional information in our analysis and visualization to refine our understanding of our users' needs and pain points better, and improve the user experience.

Qualitative

1. Feedback around the "Did you know" facts was generally positive, and respondents felt as though these served as good anchors or attention holders
2. Some visualization needs more detail accompanying its content; for example, the timeline on circle area graph is not totally clear, or the population diagram needs better labeling
3. The infographic comes across as anticlimactic; adding something more resounding or final to the end can help the user leave with a feeling of awe
4. More explanation would be useful to explain displaced demographics; for example, the fact that the majority were women and children warrants more explanation
5. More explanation should be provided for the migration choropleth; theories on why people went to Poland, Russia, etc?

       a. General attitude, political relationship, refugee acceptance, etc?

6. There should be more disclaimers regarding this data; a lot of it is fluid and hard to corroborate as of yet
7. General aesthetic changes; more interactivity, clearer legends and labels, more visualizations

Contributions

Key/Legend

High Contribution   Medium Contribution

Phase	Anjali Bakliwal	Ankita Suresh Sha...	Drake White
Preparation	High	High	High
Visualization	High	High	High
Usability Tests	Medium	Medium	Medium
Website	High	Medium	Medium
Write Up	Medium	High	High

Anjali Bakliwal

- Website layout
    - Countdown timer
    - Timeline of major events
- Visualization - Human toll infographic
- Visualization - Intensity of the Situation
- Usability test interviews
- Final write-up

Ankita Suresh Shanbhag

- Research, dataset collection
- Visualization - population over time
- Visualization - dumbbell graph

- Usability test interviews
- Final write-up

Drake White

- Usability write-up
- Visualization - Distance v Refugees received scatterplot
- Tableau embed coding/formatting
- Final write-up
- Copy editing

Thumbnail

Software and Data

The full set of tools used can be found in a previous section - 📄 Final writeup . The software components of the toolset we used are as follows -

- Wix
- Tableau
- Observable
    - D3

(no hard coding of anything beyond front-end embeds, html, etc. along with D3 coding for some visualizations).

The sources of data are listed in a previous section in this document - 📄 Final writeup .