

- 1. A description of the data.** Report where you got the data. Describe the variables. If you had to reformat the data or filter it in any way, provide enough details that someone could repeat your results. If you combined multiple datasets, specify how you integrated them. Mention any additional data that you used, such as shape files for maps. Editing is important! You are not required to use every part of the dataset. Selectively choosing a subset can improve usability. Describe any criteria you used for data selection. (10 pts)

We got the data from UCS Satellite Database - Union of Concerned Scientists (http://www.ucsusa.org/nuclear_weapons_and_global_security/solutions/space-weapons/ucs-satellite-database.html#.VPY_4vnF-So). The data includes launches until 7/31/2014.

Once the data were obtained, we selected only the fields that interested us such as “country, user and purpose” and removed the others. By working with these variables we will be able to determine and visualize the countries that own/operate most satellites; the main 4 users of these satellites in orbit (civil, government, commercial and military); the satellite purpose, which can be for radio, research, navigation, communication, etc. The data needed to be cleaned and filtered. For instance, the property of each field was shortened and stripped of unwanted characters such as dashes. We then grouped together some properties in order to avoid redundancy and to facilitate visualization. For instance, we grouped Space Science Research and Earth Science into Scientific Research. We applied this procedure on country and users as well since the nature of the data comprised exclusively of text. In fact for the histogram and the horizontal stacked bar we had to convert the data into arrays of numbers before being able to work with it. After we generated the arrays, we were able to use them to create the graphical visualization. Once the data was cleaned and filtered we exported the excel file to a csv file and consequently converted it into a json file.

We also used a small data set generated from the database to select specific number of satellites launched by USA, Russia, China, Japan (the top 4 countries that had the most satellites) and the combination of other countries (excluded the 4).

- 2. A description of the mapping from data to visual elements.** Describe the scales you used, such as position, color, or shape. Mention any transformations you performed, such as log scales. (10 pts)

For the histogram: we created an array of numbers using iteration since our dataset was composed only by text. We defined the variables for width, height, x scale, y scale and others. We used ordinal scale for x and linear scale for y. We set up the margin and add it inside the attributes (width, height, etc.). The ordinal scale was also used to set up the color (pink for Civil, green for Commercial, blue for Government, and orange for Military). We appended rectangles to create the bars. We also used `rangeRound` and `rangeRoundBands` to round up values and provide better pixel resolution on screen. We also included the labels and a x-axis with 4 ticks.

For the stacked horizontal bar: we use layout.stack function to take the two-dimensional array and compute a baseline that can be propagated to different layers. We also reused ordinal scale for x, linear scale for y as well as rangeRound, rangeBand and rangeRoundBands. We added the rectangles for each data value and made sure to scale them appropriately. We then added the text and number for labeling the data. We also used paths to direct each rectangle from the bar to the label for the country that corresponded to it.

For the circle: we created an array of countries that takes in the name of the country of operator and number of satellites that were launched by that particular country. To increase readability/visualization, we appended the rectangles before the names of purposes and circles before the names of countries. We used rotation and transform to start at certain degree and map the variable around the circle. To signal the top 4 countries with the most satellites launches, we changed the color of the country to correspond to the color from the stacked horizontal bar. For the lines, we used getBoundingClientRect to get the coordinates for the lines.

3. The story. What does your visualization tell us? What was surprising about it? (5 pts)

The visualization tells us about the major users for launching the satellites (civil, commercial, government, military), the number of countries that launched satellites and the purposes. We can learn that the number of users for commercial is far more than for civil ($454 > 85$) but there is not a big difference between government and military ($360 > 336$) which is not quite surprising given the fact that government and military usually work closely together. However, a huge amount of commercial users is definitely not something we originally expected.

We originally expected to see the number of satellites launched by government/military to be the biggest given how media portrayed spying (as Surveillance in purpose) and conflicts between countries that drove to unexpected visits of 'flight objects' in inappropriate airspaces (For example: we saw a recent article about Britain deployed fighter jet to escort Russian Bombers near its airspace. You can read more [here](#).)

Also, the stacked bar shows that USA had more satellites launched than all of the other countries combining (excluded Russia, China, and Japan). It proves that USA has advanced very far because it had triple the number of satellites launches comparing to its runner-up Russia. China also did very well (not too far behind from Russia) when Japan only had half of the number of satellites compared to China.

Moreover, the most popular purpose of launching satellites for most countries are communications, followed by technology development. This part is very interesting. From the visualization, we can draw some assumptions such as the increasing need for connecting with

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people around the world and in space(alien (!)), or the technology war to see which country advances faster.