

Nuclear Explosion Tests

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Abstract

This research is about the nuclear explosion testings that happened between 1945 and 1998. In this research the tests of the USA and France will be discussed with regards to the questions given. The main dataset(nuclear_explosions) contains 14 variables that shows the related information about the explosions such as upper and lower yield. The second(n_occur) has 2 variables.

1 Introduction

The purpose of my work is to investigate the dataset about nuclear explosions. By editing the given dataset, I removed the rows that included “NA” values and also deleted the columns that were no use to me such as “magnitude_body” and “magnitude_surface”. The other variables are: date_long(Shows the complete date of the testing), year, country(Which country conducted the test), region(Where the test was conducted at), latitude, longitude, depth, yield_lower, yield_higher, purpose(Why the test was conducted for), name(Name of the detonated warhead) and type(How the nuclear test was conducted).

The question I decided on is “Were the USA’s nuclear tests more effective than the French nuclear tests on average?”. The question is related with the 4 articles I have found and they provided me with extra information I stated in the literature review section. Also from the dataset, I can gather the needed data by using some functional codes.

For the analysis, I will compare the occurances of US nuclear tests and the French nuclear tests with regards to the upper and lower yield to understand the effectiveness of the tests. I will be using a T-Test for this research in order do a better comparison.

The test is two-sided. The null hypothesis is “USA’s nuclear tests were more efficient than the French ones. The alternative hypothesis is”USA’s nuclear tests weren’t more efficient than the French ones.”

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1.1 Literature Review

Even though the literature I found is mostly made of data from the tests of nuclear weapons, the 4 articles and reports I found also include and give valuable information about the question.

The US is shown to have conducted almost all of its nuclear tests in Nevada Test Site or NTS as an abbreviation. Before the tests at NTS, USA conducted its tests at various places around the Pacific as given in quote: (Nils-Olov Bergkvist, 2000) “Nuclear weapon development continued in the USA and tests were conducted in 1946-62 at various atolls and islands in the Pacific Ocean. The first hydrogen bomb was tested in 1951, at Enewetak Atoll, then part of a UN Trust territory administered by the USA, now part of the Marshall Islands.” In the introduction section of the article from (Seantel Anaïs, 2016) it is stated how many tests were conducted and how big of a yield the tests had at the NTS is stated, which is also relevant to my first question with quote: “At the Nevada Test Site (NTS) northwest of Las Vegas, Nevada, 928 above- and below-ground nuclear tests occurred between 1951 and 1992. There were nearly 90 tests at the NTS in 1962 alone (NTS interviewee). Bombs of 61 and 74 kilotonnes were detonated at the NTS during the 1950s – by contrast, the bomb dropped on Hiroshima had a nuclear yield of approximately 15 kilotonnes.”

Information about the French nuclear tests are less shared to the public than the USA’s nuclear tests because of various reasons. These reasons include the failures of the tests, the health problems created by the test as stated in (Danielsson, 1984) with quote: “Most political, church and civic leaders in French Polynesia immediately voiced strong fears that any nuclear tests made in the Tuamotus might, as the American tests did in Micronesia, adversely affect the health of the 7 000 people living there.” and “By the beginning of July 1966, after three years of intense preparations, the Moruroa testing base was operational. The first bomb was placed on a barge anchored in the lagoon and detonated. The result was a catastrophe-all the water contained in the shallow reef basin was sucked up into the air and then rained down, covering all islets with heaps of irradiated fish and clams, whose slowly rotting flesh continued to stink for weeks.” However, from (Willis, 2006) it can be said that the testing of the French warheads were mostly conducted in the French Polynesia, especially in Moruroa and Tuamotus islands, but these were also not that effective and therefore, were not reported as after the failure of the first few tests, the types of which were “SURFACE” and “TOWER”, the French converted to different types of testing types.

2 Data

I found this data from “<https://github.com/rfordatascience/tidytuesday>”. The dataset was hard to find as I wanted to do a research on something that I was interested in. The main source of the dataset is SIPRI, Stockholm International Peace Research Institute, that conducts researches about anything from wars to illegal weapons trade.

The main dataset is named “nuclear_explosions1”. With cropping the rows that had “NA” values, I had 1382 entries in total. This was the only edit I did on the main dataset. Other

than this, I had to create a subset named “comparison1” in order to conduct a test relevant to my question. This subset has 2 columns: “country” and “upper_yield”. Since my question is about the effectiveness of the tests between the US and France, I deleted the rows that had the names other than USA and France. By doing this, I had 1236 entries in total inside “comparison1”.

The summary statistics shows the upper yield of the 2 countries seperately. Table 1 shows the statistics of France and table 2 shows the statistics of the US. Each table shows the mean, standard deviation(Given as “Std.Dev”), minimum value of the tests(Given as “Min”), median value of the tests(Given as “Median”) and finally, the maximum value of the tests(Given as “Max”).

Table 1: France Nuclear Test Statistics

	Mean	Std.Dev	Min	Median	Max
yield_upper	103.89	213.23	0.00	20.00	1000.00

Table 2: USA Nuclear Test Statistics

	Mean	Std.Dev	Min	Median	Max
yield_upper	226.34	1094.94	0.00	20.00	15000.00

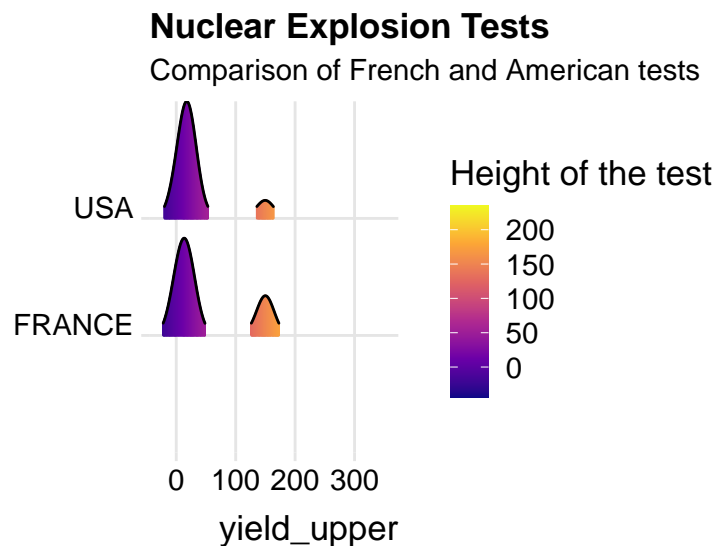
3 Methods and Data Analysis

I conducted a Two Sided T-Test to analyse the effectiveness of the nuclear tests of the US and France. It can be said that the populations are not normally distributed. Running an Ansari-Bradley test gives us that the variances are equal and this allows me to conduct a Two Sided T-Test rather than a Welch T-Test. From the T-Test, it can be seen that France has a mean of 103.8889 while the tests of the US has a mean of 226.3377.

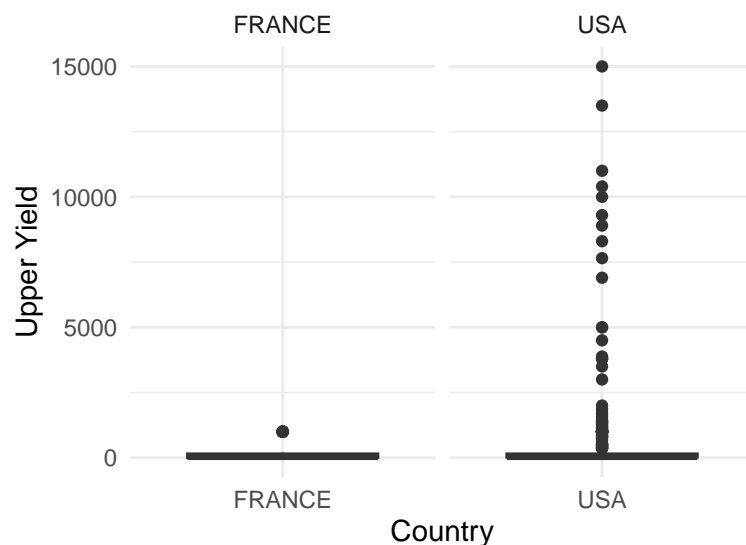
```
##
##  Ansari-Bradley test
##
## data:  yield_upper by country
## AB = 62861, p-value = 0.7139
## alternative hypothesis: true ratio of scales is not equal to 1

##
##  Two Sample t-test
##
## data:  yield_upper by country
```

```
## t = -1.6024, df = 1234, p-value = 0.1093
## alternative hypothesis: true difference in means between group FRANCE and group USA is not equal to 0
## 95 percent confidence interval:
## -272.37008  27.47237
## sample estimates:
## mean in group FRANCE      mean in group USA
##          103.8889          226.3377
```



This graph shows the nuclear test ratios of the US and France that has a upper yield lower than 200. It can be seen that the difference of these tests are not significant as they look close. With this, it can't be said that the tests of these countries with the filtered yield is more significant than one another. However, the graph below shows the real difference.



This graph show the scattered tests of both countries. The black filled rectangles at the bottom of each countries shows us that many of the tests conducted by these countries were

below the upper yield of 500. However, the dots on the graph shows that some of these tests were above the upper yield of 500 but different from the graph above, we can see that the US had many more tests that were above the yield of 200 and even reaching the point of 15000. Meanwhile France had only a few tests that reached barely 1000 upper yield.

4 Conclusion

Summarize the results of your analysis in this section. Discuss to what extent your results responded to the research question you identified at the beginning and how this work could be improved in the future.

5 References

- Danielsson, B. (1984). Under a cloud of secrecy: The french nuclear tests in the southeastern pacific. *Ambio*, 13. https://www.jstor.org/stable/4313070?saml_data=eyJzYW1sVG9rZW4iOiJjYTc2ZTcyYS1iZjM5LTQ3YmItOWUxZS1hZjhjMDFhODhiNzgiLCJpbnNO
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- Nils-Olov Bergkvist, R. F. (2000). Nuclear explosions 1945 -1998. *SIPRI*.
- Seantel Anaïs, K. W. (2016). Secrecy, publicity, and the bomb: Nuclear publics and objects of the nevada test site, 1951–1992. *Cultural Studies*, 30:6, 949–968.
- Willis, E. (2006). French nuclear tests in polynesia. *Medicine, Conflict and Survival*, 22:02, 159–165.