Drugs and Incarceration:
Did Drugs Win the U.S. War on Drugs?

http://groups.ischool.berkeley.edu/Drugs-Incarceration/
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Information Visualization 2016

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Project Goals

Much has been written about the “War on Drugs,” the United States’ manner of dealing with drug use and abuse via the criminal justice system. However, most resources we found were reports and statistics that don’t allow readers to interact with the data and don’t engage the viewer. Many reports also showed only one side of the argument to further their argument, which we found to be misleading at times.

We wanted to allow viewers to explore the data themselves to see trends and make conclusions as to what is happening and to what extent, and whether it has changed over time. Specifically, we invited viewers to explore:

- Drug use mapped against public policy decisions made with the goal to affect drug use
- Types of illicit drugs, and their prevalence of use over time
- Drug arrest trends among different population groups
- General trends in sentencing severity for drug convictions
- Correlation (if present) between drug arrests and drug use trends
- A few implications arising from the War on Drugs
- Worldwide incarceration rates for all crimes
- Data and background information on a different model for minimizing drug use

We also incorporated qualitative elements and editorial design features that call out quotes from articles about the War on Drugs. These helped introduce each section and provide some context to our graphs.

Related Work

Most work relating to the War on Drugs has been highly critical of the US's criminalization approach, and either very granular or very broad. One exception is the Sentencing Project (referenced below), which has a fairly comprehensive static overview of the US criminal justice system. Additionally, the data referenced in almost all work solely consisted of 'summary statistics' and did not allow readers/users to explore the data on their own. While a large number of our pieces of related work come from the news and popular media, Duke, Bennett, and Wallace provide academic and legal grounding for the relationship between the War on Drugs, mass incarceration, and the benefits of a public health model for addressing drug abuse.

Duke, Steven B., "**Mass Imprisonment, Crime Rates, and the Drug War: A Penological and Humanitarian Disgrace**" (2010). Faculty Scholarship Series. Paper 826. http://digitalcommons.law.yale.edu/fss_papers/826

- In his article, Duke, a professor at Yale Law School, takes a holistic look at the trends driving mass incarceration in the United States. After providing an overview of key statistics and how they relate to criminal activity, he concludes 'the most likely explanation [for mass incarceration], ironically, is the "War on Drugs"' (3). While Duke gets into details as to how the War on Drugs is likely to cause, rather than prevent, crime, his overarching conclusion that the War on Drugs has directly lead to mass incarceration provides academic and legal grounding for our project.

Bennett, Mark W., "**A Slow Motion Lynching? The War on Drugs, Mass Incarceration, Doing Kimbrough Justice, and a Response to Two Third Circuit Judges**" (March 1, 2015). Rutgers Law Review, Vol. 873, 2014. http://ssrn.com/abstract=2571954

- In his piece, Bennett, 'a federal district court judge who has sentenced more than 4000 defendants reflects on federal sentencing and its role in mass incarceration' with a focus on crack cocaine cases (873). The article speaks to the role mandatory sentencing guidelines had in 'incarcerating almost exclusively black men for unprecedented lengthy terms of incarceration' (876). While Bennett is focused on historical discrimination in sentencing, and judges' recently acquired capacity to use discretion in sentencing based on 'policy disagreements,' he draws a clear connection between the War on Drugs and mass incarceration. Quoting Professor Dorothy E. Roberts, he concurs: "The War on Drugs became its own prisoner-generating machine, producing incarceration rates that 'defy gravity and continue to grow even as crime rates are dropping'" (880).

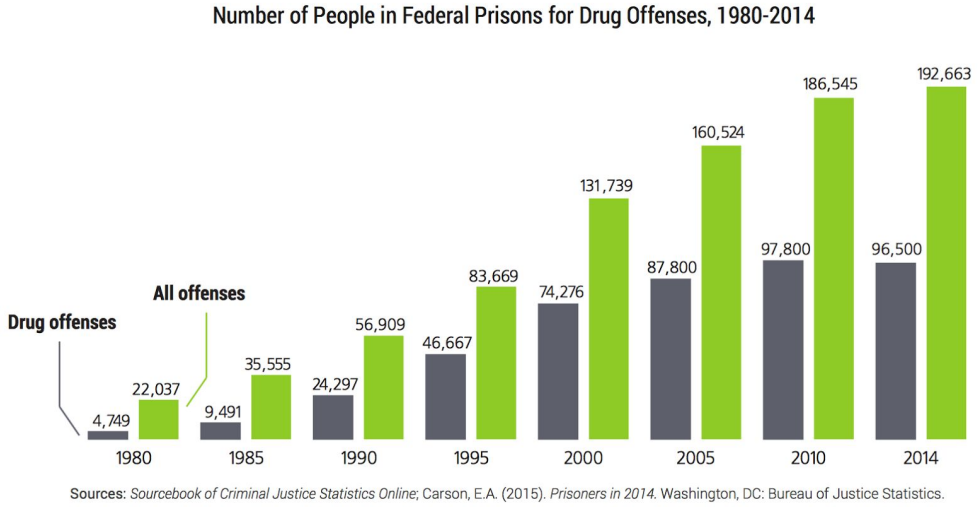
Wallace, Barbara C., "**Controversies in Knowledge Translation for Community-Based Drug Treatment: The Need to the End Policies of the War on Drugs and Mass Incarceration of Drug Offenders to Achieve Health Equity**" (2012). J Urban Health. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3531354/

- While Wallace largely focused on better structuring drug treatment research to facilitate real world use of the findings, she is adamant that 'end[ing] the policies of the

war on drugs and mass incarceration of drug offenders' is the most pressing priority in advancing drug treatment (894). She quotes Heasley 'the selection of a policy position is a highly political process, not a scientific one,' and argues for evidence-based drug treatment rather than political policy (901). She concludes, 'a public health policy approach needs to prevail that is consistent with the goals of health equity, ethical practice, and effective [knowledge translation], permitting community-based drug treatment to serve as an alternative to the policies of the war on drugs and mass incarceration of drug offenders' (902).

Sentencing Project: Trends in US Corrections

- http://sentencingproject.org/wp-content/uploads/2016/01/Trends-in-US-Corrections.pdf
- This fact sheet, created by the sentencing project, gave us significant inspiration for this project. We learned useful general facts about incarceration rates in the US, while also learning about drug abuse and sentencing. This fact sheet was one of many that also exposed how misleading statistics can be when talking about the War on Drugs. Though the statistics are all factual, they have been cherry picked to promote a specific cause. For example, when looking at the percentage of drug offenders in prison, they only show those incarcerated in federal prison (50%, as opposed to federal and both at 25% when combined). We used this representation of facts as motivation to focus more on exploring data and coming up with your own conclusions.



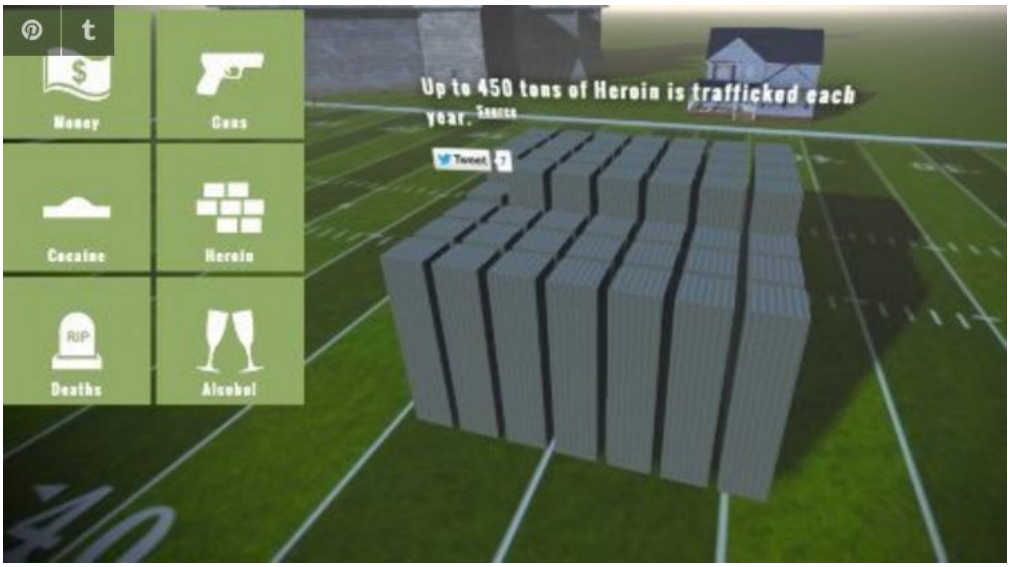
NPR: "Timeline: America's War on Drugs"

- http://www.npr.org/templates/story/story.php?storyId=9252490
- This was one of several sources used to learn the history of the War on Drugs. We used NPR because they hold themselves to a higher journalistic standard and attempt to show facts in a nonpartisan way. They also provided a very thorough timeline of events, both in and outside of the US. Many of the events in our timeline came from this source. We kept their lack of visualization in mind as we considered alternate ways to display our

own timeline after realizing our first attempt wouldn't work. One takeaway we had was how unstimulating this otherwise highly interesting article was, because it was just text.

GOOD: "A Stunning Visualization of the War on Drugs"

- https://www.good.is/articles/a-stunning-visualization-of-the-war-on-drugs
- This visualization attempts to bring the drug war into perspective by showing multiple visualizations that display charts conveying a sense of physicality. Unfortunately, by using 3D bar charts it fails to fully show the extent of the drug war problem. The choice of a football field for physical context, while potentially factually accurate, is not something that most people have a good handle on. They're used to seeing it on a TV screen, but that is an unrealistic judgement of size and proportion. These choices make it rather unsuccessful as a visualization, although the content that the rest of the article covers is quite useful in laying out some implications of the drug war, especially regarding cocaine.



White House Fact Sheet, 2016

- https://www.whitehouse.gov/the-press-office/2016/02/02/president-obama-proposes-11-billion-new-funding-address-prescription
- We went back and forth on whether our case study should be on the US or Portugal. The US has been experimenting with drug courts for the last 20 years, with mixed results. Some claim they are working very well (those who do generally have an agenda geared toward keeping drug courts alive), while others say the data is biased and based on poorly conducted research.
- While conducting research on drug courts in the US, we came across this fact sheet about the White House requesting new funding to combat the heroin issue with treatment-focused methods. We ultimately opted to focus on Portugal, as the story was

stronger, but we hope people walked away from our visualization recognizing the positive impacts the Obama administration has had on the War on Drugs.

VICE: "Mass Incarceration in America"

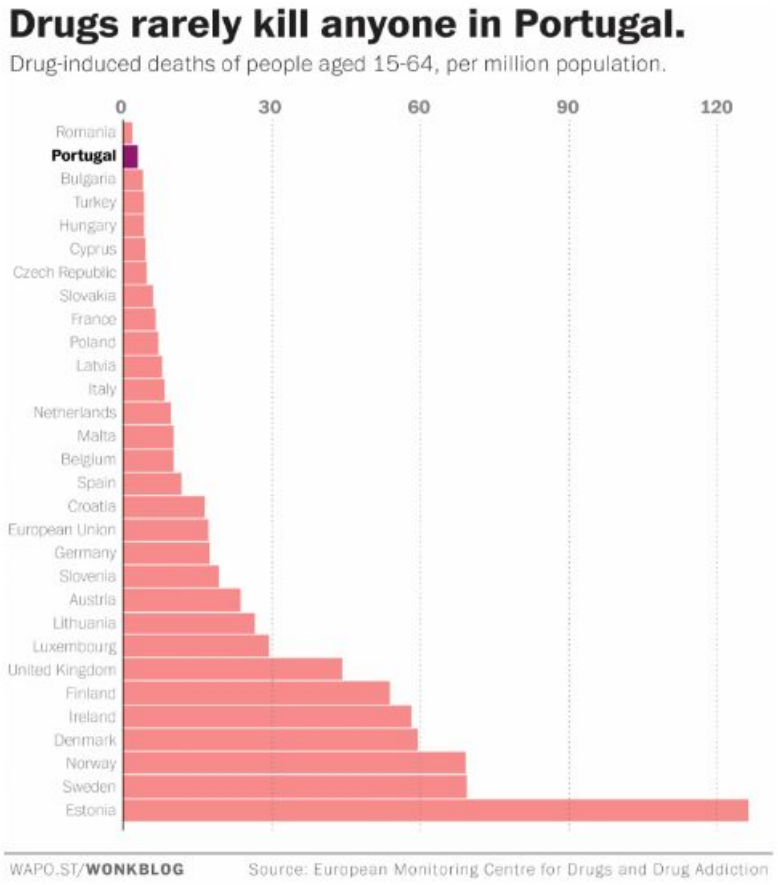
- https://www.vice.com/read/mass-incarceration-in-america
- While researching US incarceration rates, we found a Vice article that visualized incarceration data across the world in visually interesting ways. Though we ultimately decided not to replicate elements of that design, we wanted to incorporate the learnings. We found the underlying data in the Prison Policy Initiative and used it to create our box-and-whisker plot.

The Economist: "Treating, Not Punishing"

- http://www.economist.com/node/14309861
- This article is from 2009, so a few years before our other two, and before the Transform data came out in 2014. While this article doesn't contain any visualizations other than a illustration, it provides ample background on the meaning and process of the Portuguese system of decriminalization. It highlights common misperceptions about what "decriminalization" means, and outlines what happens when someone using drugs is apprehended by the police. Perhaps most importantly, it provides context around the public worries at the time of decriminalization, and how the Portuguese were worried that drug tourists would take over their country.

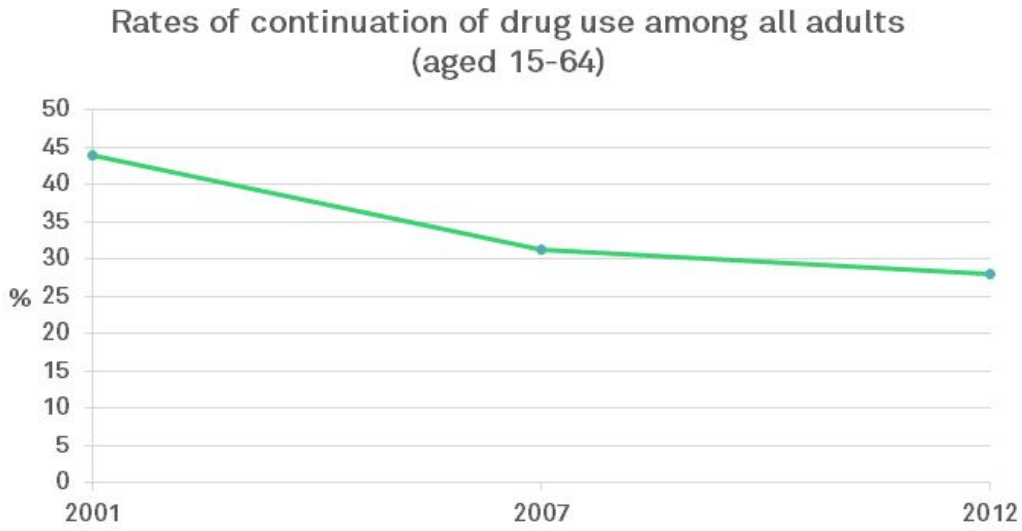
Washington Post: "Why Hardly Anyone Dies from a Drug Overdose in Portugal"

- https://www.washingtonpost.com/news/wonk/wp/2015/06/05/why-hardly-anyone-dies-from-a-drug-overdose-in-portugal/
- Getting a feel for the way that public conceptions of the drug war are shifting was important to us, so we sought out recent news articles from reputable sources. This article was one of them, which reports on the Transform Drug Policy Foundation report that we based our Portugal case study on. It was interesting to see the different statistics that these journalists pulled from the report and others. This article reported mainly on the rate of overdose and drug-related deaths. This was an interesting statistic (and highly supportive of Portugal's public health model), but ultimately one which we felt did not coincide with the rest of what our visualization allowed users to explore.



Mic.com: "14 Years After Portugal Decriminalized All Drugs Here's What's Happening"

- http://mic.com/articles/110344/14-years-after-portugal-decriminalized-all-drugs-here-s-what-s-happening#.YETQUAxwE
- This is a great case study on the effects of decriminalizing drugs and refocusing resources on public health efforts. This article is interesting because it attempts to provide background context for the issue for uninitiated audiences, which served as a great example for us in how to build out our own case study. Unfortunately, they directly reproduce the bland charts from the Transform Drug Policy Foundation report, which we found to be lacking in visual interest and also a bit confusing. But all in all, we felt this article did a very nice job of covering different facets of the issue, while bowing to the fact that decriminalization is complex and cannot be separated from other societal changes made in Portugal.



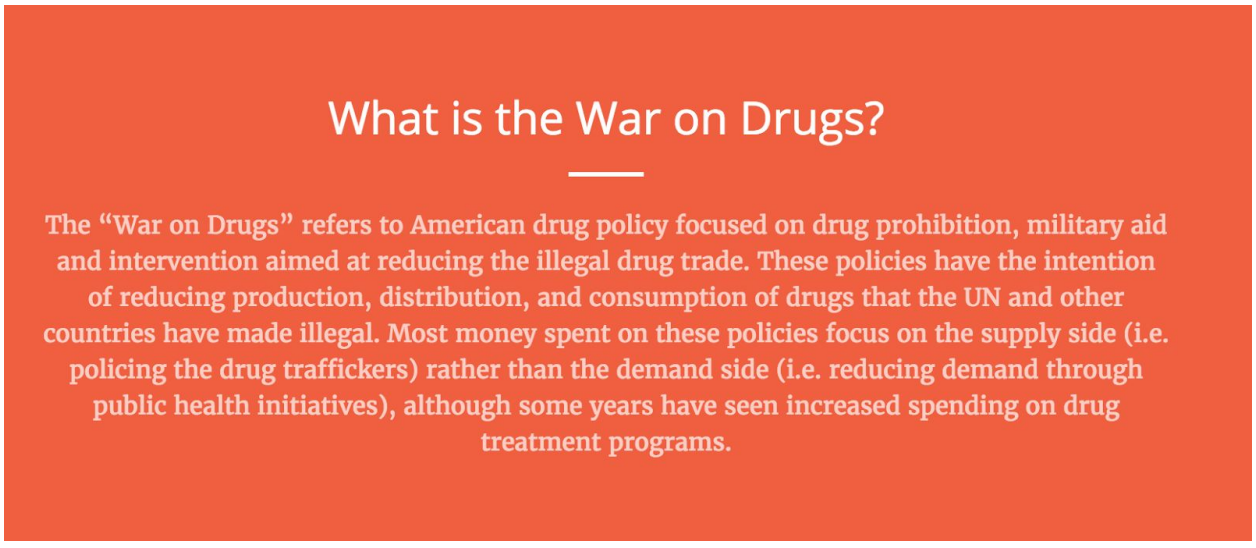
Our Visualization

http://groups.ischool.berkeley.edu/Drugs-Incarceration/

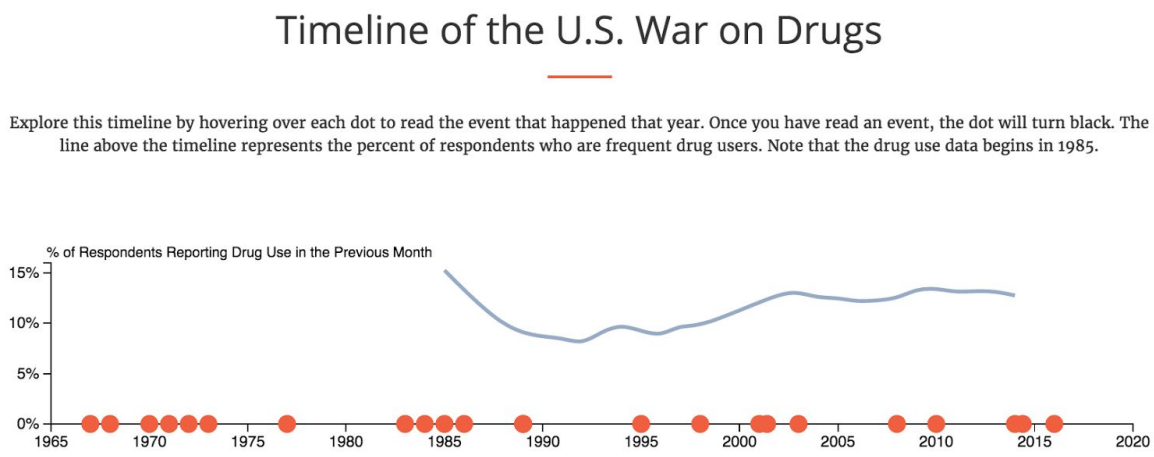
Our overall aim for this visualization was to tell a story, while allowing the reader to come to their own conclusions by exploring data. We came into this project with our own beliefs, some of which were confirmed, while others were not. We learned a lot as a result, and hope to have a similar effect on our readers.

Background

We started the visualization by creating a background section. The purpose of this section is to inform the user of what the War on Drugs is in the event they are unfamiliar.

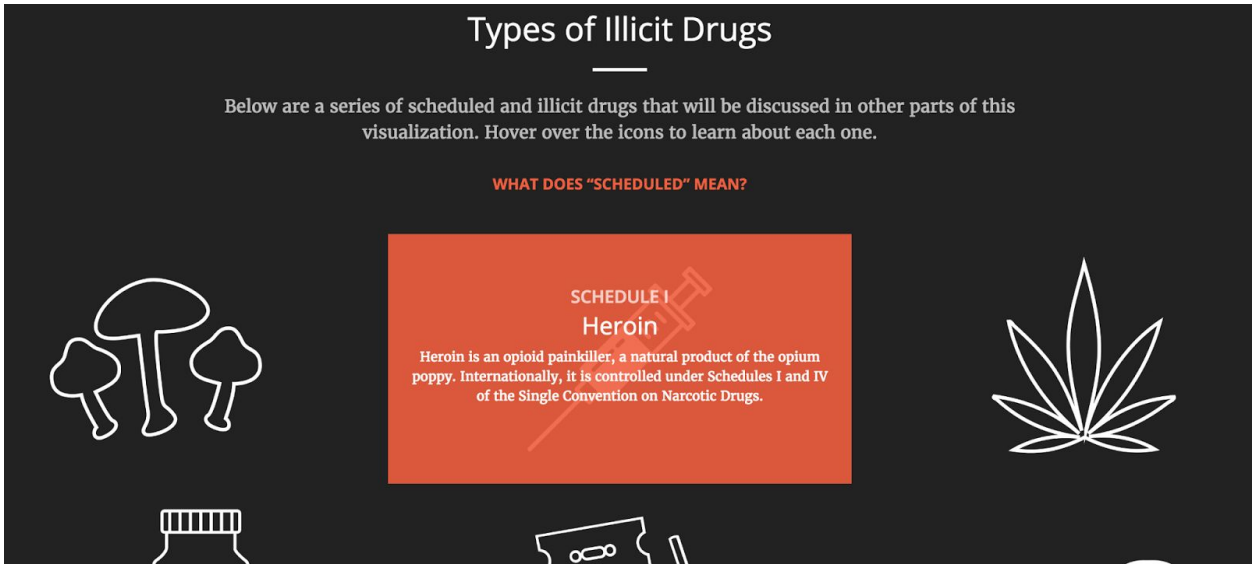


We also added a timeline to show relevant events that took place over the last 40 years. This provides context surrounding the War on Drugs, and helps to potentially explain drug use trends, which have been laid on top of the timeline, treating it as the x-axis.

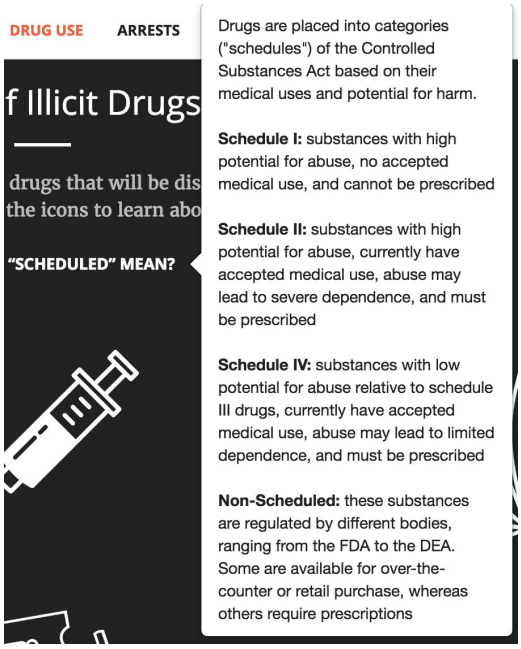


Drug Types and Drug Use Over Time

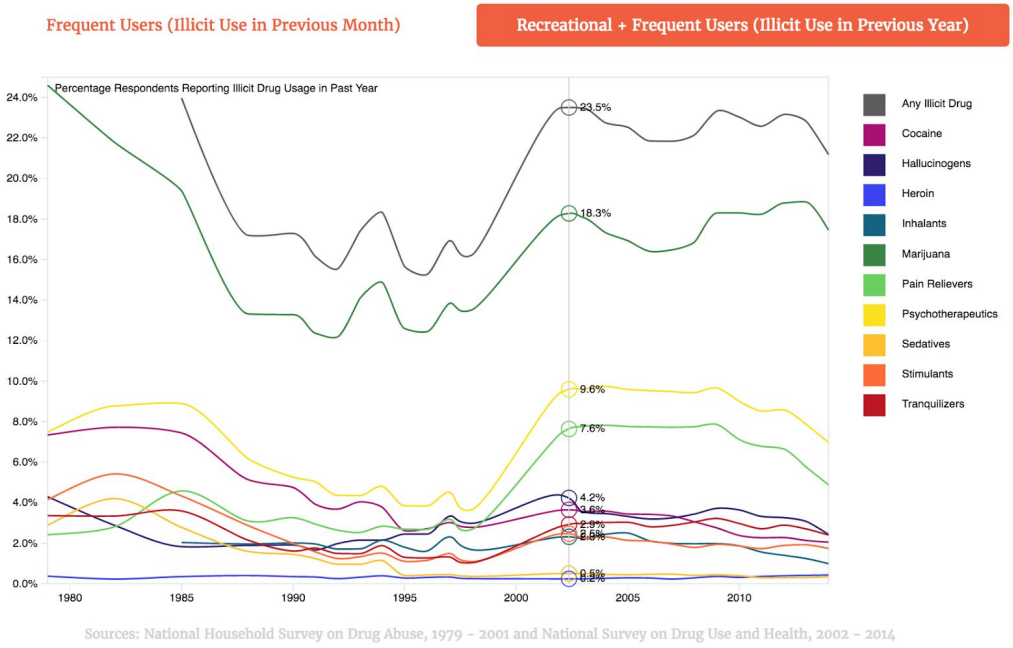
The goal of this section was to explain to users which drugs are considered illicit and under attack in the War on Drugs. We started by listing the top 9 categories of drugs with representative iconography, along with explanations of what they are, whether they're scheduled or not, and examples of drugs from that category when applicable when hovered over.



We also added a tooltip popover to explain what ‘scheduled’ means:



We then covered drug usage trends over time. This line chart is helpful in two ways: it allows readers to determine overall drug usage trends over time, as well as hone in on how specific drugs become more or less popular over time.



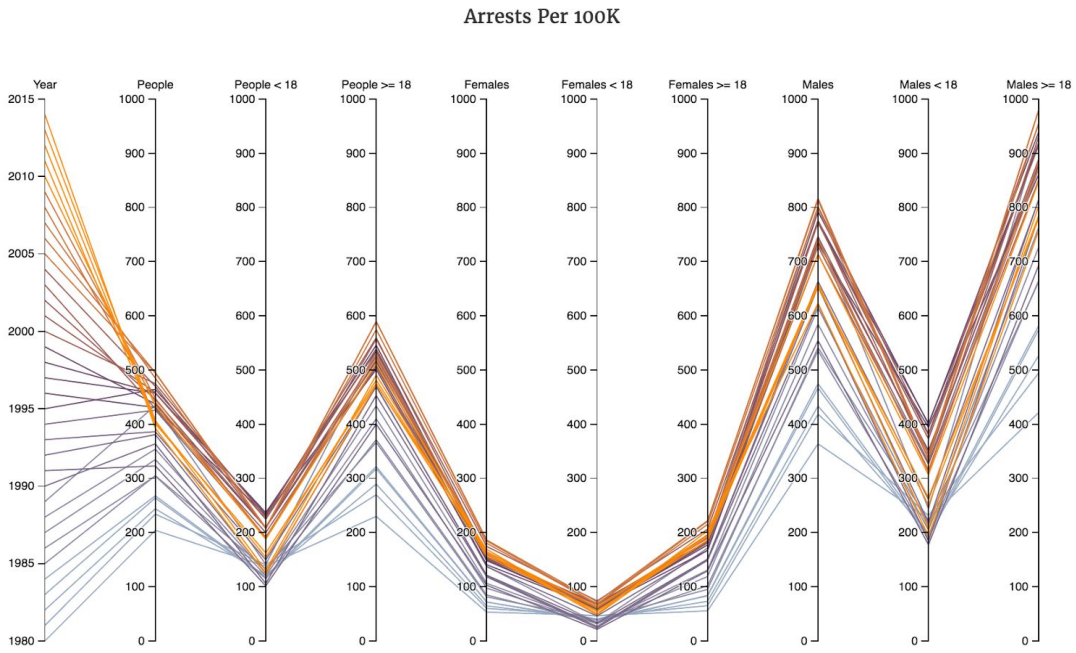
Sources: National Household Survey on Drug Abuse, 1979 - 2001 and National Survey on Drug Use and Health, 2002 - 2014

Drug Arrests

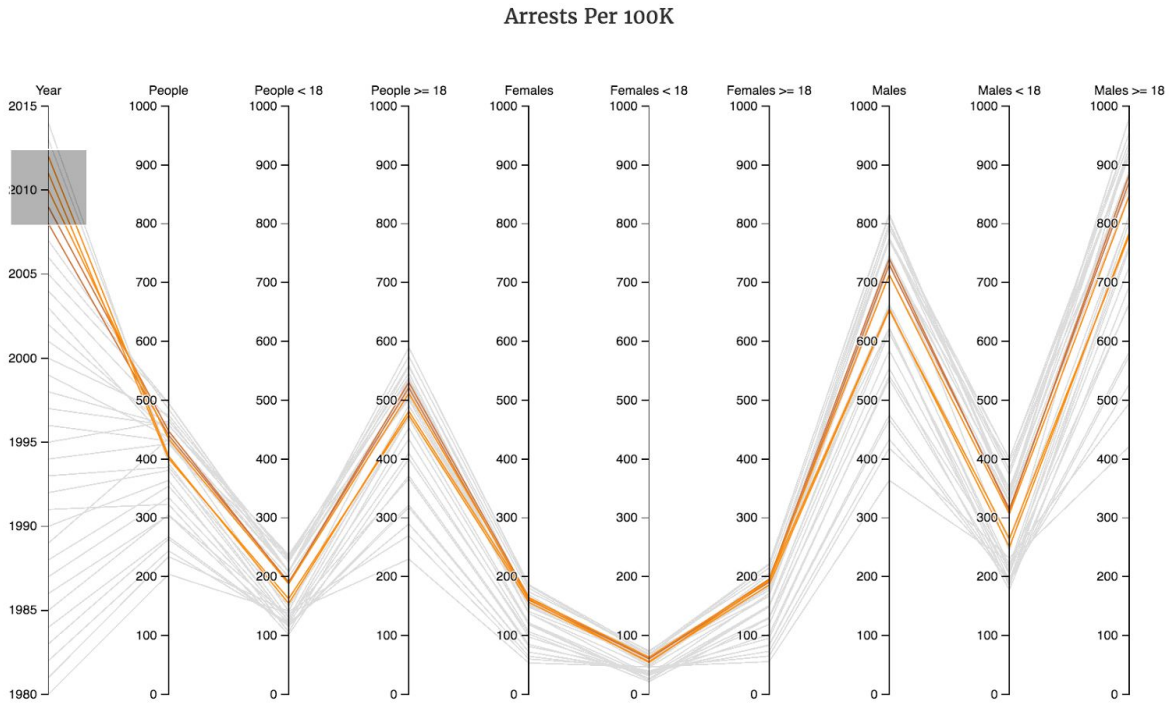
We introduced this section with the infamous quote from Nixon, where he declared drugs as “Public Enemy #1”. This was meant to provide a greater editorial feeling to the overall visualization. It also adds to the narrative flow; after showing drug usage is a problem, this quote acts as a way to then do something about it, thereby introducing our next section: arrests.

> “Public enemy number one in the United States is drug abuse. In order to fight and defeat this enemy, it is necessary to wage a new, all-out offensive.”
>
> President Richard M. Nixon, 1971

We chose a parallel coordinates to visualize drug arrest rates (per 100k people) for different demographic groups. Though parallel coordinates is normally used to show correlations between different variables, the goal here was to indicate overarching trends across these groups. Based on feedback received from usability tests, we found that readers took away those trends successfully. Our average reader will also most likely not be familiar with parallel coordinates, so the fact that its use is nontraditional should not detract from their experience.



We also chose to color lines by 5-year increments, so that readers can automatically see trends without having to necessarily interact with the visualization (lighter = more recent). If they do, then they can clearly see each year as being distinct from other years.

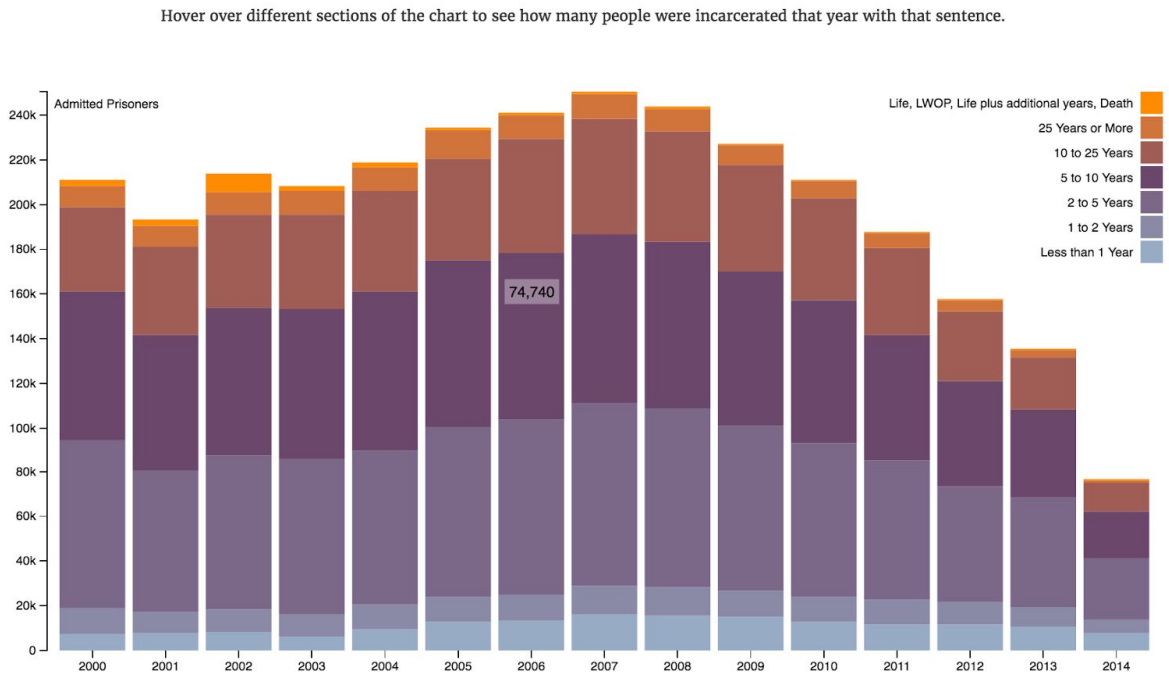


Drug Sentences

We again introduced the next section in keeping with the rest of the visualization and used a quote. This was meant to make the reader question how heavily drug offenders are sentenced.

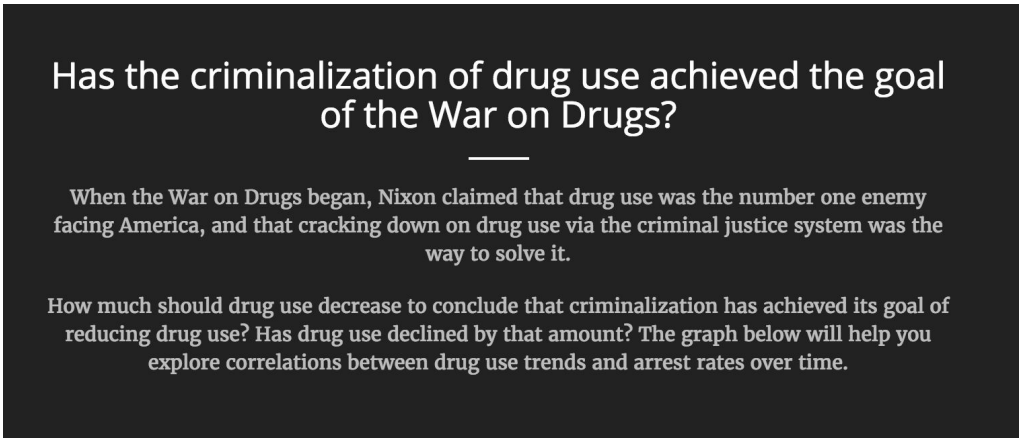
> "The turn to pressing murder-like charges against drug dealers is a reminder that crises and panics prompt many in law enforcement to turn to punishment as their default solution."
>
> Daniel Denvir, Salon.com, 2015

This leads naturally into our next section on drug sentences over time. Originally, we had a stacked bar chart showing the harshest drug sentences per state. Feedback indicated this did not feel in line with the rest of the narrative (exploring the Drug War over time), so we changed it to be all sentences over time. The purpose of this stacked bar chart is to show how the number of drug sentences across the US have changed over time, both in terms of trends and using hover overs for specific numbers. It primarily shows that drug sentences have gone down significantly since Obama entered office in 2008.

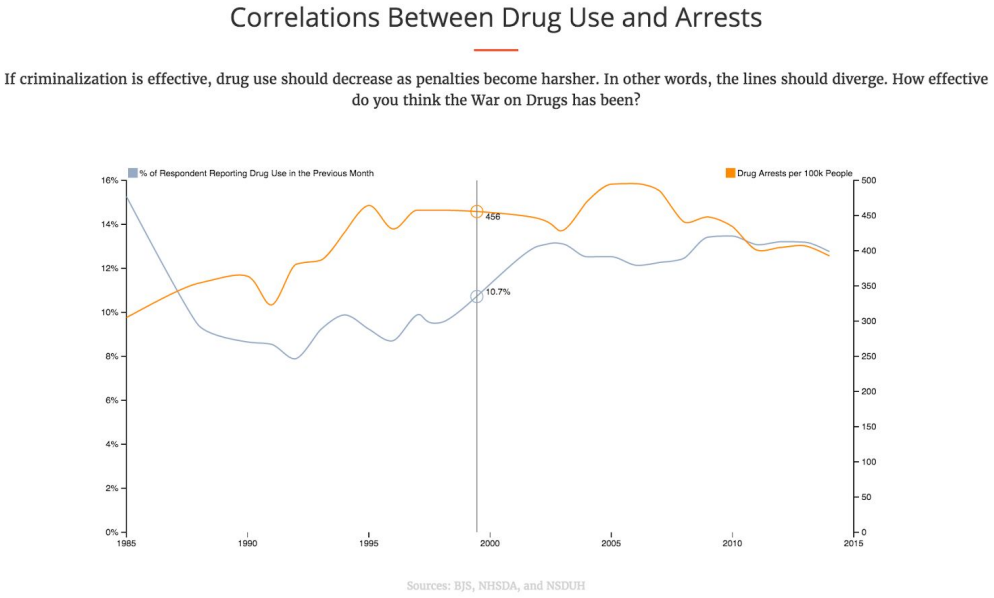


Correlations Between Arrests and Drug Use

One of the charts that most research participants expected to see in a visualization on the War on Drugs was a correlation chart between drug use and drug arrests. The goal of the War on Drugs was to stem drug use with incarceration, which we reminded the reader about in our section intro.



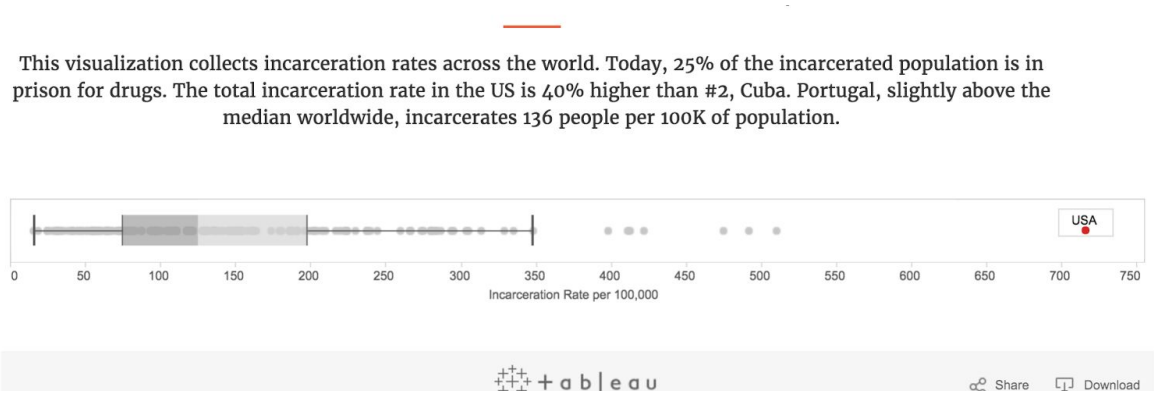
Given this goal, we should expect to see a negative correlation in the chart. We originally tried a scatterplot here to show the correlation (or lack thereof, depending on your interpretation), but after further research, we decided to simplify things and use a multi-line chart created in d3. Users who saw this version of the chart were able to quickly and easily come to their own conclusions, whereas those who saw the scatterplot had a difficult time understanding the point of it.



Implications of the War on Drugs

The War on Drugs is incredibly complex. Multiple factors are involved, and given our scope for this project, we were forced to ignore most of them (for example, much of the war was fought outside of the US, race and socioeconomic status are enormous factors, etc…). We wanted to use this section as a way to remind people of that, and give a glimpse into some of the more offensive outcomes of the War on Drugs.

We went on to show international implications of the War on Drugs by comparing our incarceration rates to other countries. Because the US is essentially an outlier, the box-and-whisker visualization ended up being quite powerful, as we heard from our research participants. We also wanted to show where Portugal is to relate this section to the next. Unfortunately, Portugal is buried near the median, and we were unable to make it stand out. As a band-aid, we wrote in Portugal's incarceration rate in the text above the plot.



Case Study: Portugal

We introduced our final section with a quote from Noam Chomsky. This quote comes from an interview Molly did with him in 2012, adding a personal touch to the visualization. This project was personal to all of us in different ways, so we tried to embed the visualization with small personal touches like this.

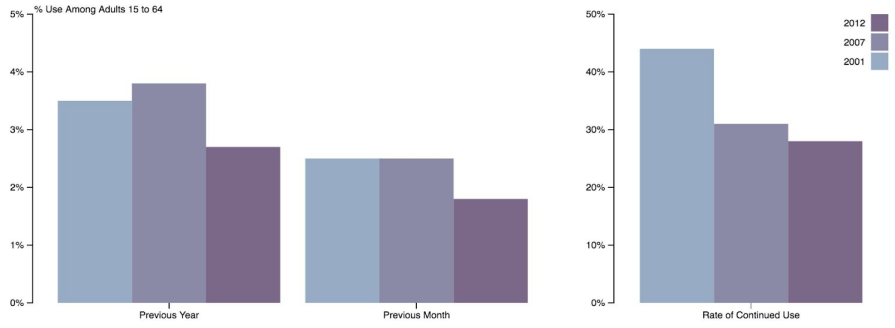
> "There are methods that could be used that would be very likely to succeed, but they're not being tried."
>
> Noam Chomsky, 2012

It also served to introduce the concept of treatment over incarceration as a means of dealing with drug abuse. That concept was further explored in our case study on Portugal, who decriminalized drug use over 10 years ago. Because the 1% statistic felt small to some research participants, we bolded the word "addicted" to emphasize this wasn't just a drug abuse problem, it was a drug addiction problem.

Portugal Case Study: A Potential Solution?

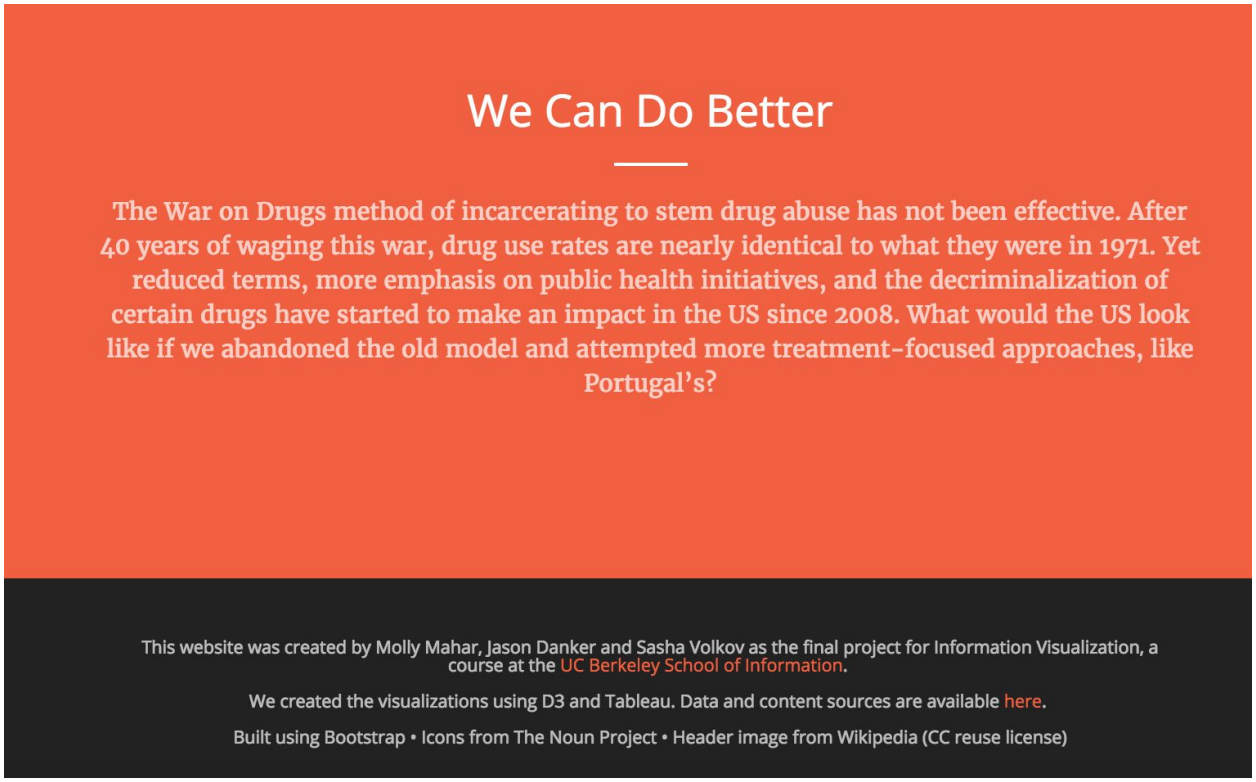
After a near-50 year dictatorship, Portugal experienced a difficult period with drug abuse. The country became a natural gateway for drug trafficking given its newly opened borders and location. Throughout the 1980s and 1990s, Portugal practiced similar drug criminalization policies to the United States. But by 1999, 100,000 people (1% of the population) were **addicted** to heroin. In 2001, the country decided to decriminalize drug use, institute a public health model (shifting drug control from the Justice Department to the Ministry of Health), and expand the welfare system. While drug use continues to be illegal, and drug trafficking is still prosecuted as a criminal offense, drug usage violations are exclusively administrative violations, and have therefore been removed from the criminal law realm.

We then made a simple bar chart to visualize how effective Portugal was with decriminalization and focusing on public health.



Conclusion

We ended the visualization with our own conclusions, which is that we can do better. While we wanted readers to come up with their own conclusions during the read-through, we did want to offer our opinion once theirs had been formed.



Data Used to Accomplish the Goals

We focused our efforts on governmental data because, although the data may be biased towards governmental interests, it is likely to less biased than the data reported by interest groups.

Drug Use Data:

- United States Department of Health and Human Services. National Institutes of Health. National Institute on Drug Abuse. National Household Survey on Drug Abuse, 1979 - 2001. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor]. http://www.icpsr.umich.edu/icpsrweb/ICPSR/series/64/studies 2015-11-23
- United States Department of Health and Human Services. Substance Abuse and Mental Health Services Administration. Center for Behavioral Health Statistics and Quality. National Survey on Drug Use and Health, 2002 - 2014. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor]. http://www.icpsr.umich.edu/icpsrweb/ICPSR/series/64/studies

Arrest Data:

- United States Department of Justice. Federal Bureau of Investigation. Uniform Crime Reporting Program Data: Arrests by Age, Sex, and Race, Summarized Yearly, 2009 - 2014. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor]. http://www.icpsr.umich.edu/icpsrweb/ICPSR/series/57/studies
- United States Department of Justice. Federal Bureau of Investigation. Uniform Crime Reporting Program Data [United States]: Arrests by Age, Sex, and Race, Summarized Yearly, 1980 - 2008. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor]. http://www.icpsr.umich.edu/icpsrweb/ICPSR/series/57/studies

Incarceration Data:

- United States Department of Justice. Office of Justice Programs. Bureau of Justice Statistics. National Corrections Reporting Program, 1991-2014: Selected Variables. ICPSR36404-v1. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2016-04-13. http://doi.org/10.3886/ICPSR36404.v1

We also used key statistics and quotes from various other sources to help us tell the story:

- Recidivism:
  - http://www.bjs.gov/content/pub/pdf/rprts05p0510.pdf
- Budget:
  - http://www.drugwarfacts.org/cms/Economics#sthash.jtO51vzD.dpbs
- Race:
  - http://bjs.gov/content/pub/pdf/Llgsfp.pdf
- Gender:

        - http://www.sentencingproject.org/wp-content/uploads/2016/02/Incarcerated-Women-and-Girls.pdf
    - Portugal:
        - https://www.drugpolicy.org/sites/default/files/DPA_Fact_Sheet_Portugal_Decriminalization_Feb2015.pdf
        - http://mic.com/articles/110344/14-years-after-portugal-decriminalized-all-drugs-here-s-what-s-happening#.YETQUAxwE
        - http://www.drugwarfacts.org/cms/Economics#sthash.jtO51vzD.dpbs
        - http://www.tdpf.org.uk/blog/success-portugal%E2%80%99s-decriminalisation-policy-%E2%80%93-seven-charts
        - https://en.wikipedia.org/wiki/Drug_policy_of_Portugal
        - http://www.economist.com/node/14309861
    - Drug budget/ Money saved by legalizing drugs:
        - http://www.drugwarfacts.org/cms/Economics#sthash.jtO51vzD.dpbs

Some notes about data quality:

- Overall, and given our focus on governmental data, the data was all of high, and standardized, quality.
- While we did not encounter any issues with data quality per say, we did encounter issues with data consistency over time. Given the length of the War on Drugs, it has been over 40 years since Nixon's initial declaration, the capabilities for recording, and storing, data has changed substantially. Due to this, there were often metrics captured by more current datasets that were not reflected in old ones. To address this issue, we focused on the metrics that were consistent over time which allowed us to minimize gaps in the data.
- In one instance, our access to historical data was limited by the approval process necessary to gain access. While we were easily able to access incarceration data from the U.S. Department of Justice from 1991-2014, the data prior to 1991 was not accessible to us within the turnaround timeframe for the project as, amongst over things, we would have needed to secure IRB approval.
    - "NCRP data are restricted from general dissemination. Users interested in obtaining these data must complete a Restricted Data Use Agreement, specify the reasons for the request, and obtain IRB approval or notice of exemption for their research. You can apply online for access to the data from the study homepage under the "Access Notes" section." - National Archive of Criminal Justice Data
- While we are confident that the data from the governmental sources are as accurate and unbiased as possible, the key statistics and quotes pulled from other sources, although not biased in terms of distorting the facts themselves, were presented so as to reflect a specific agenda. While these other sources presented the facts in isolation, which could

lead them to be misleading, we incorporated them in our report while providing the surrounding context which allows the reader/user to independently assess their validity.

Tools Used to Accomplish the Goals

Tableau was used for exploratory data analysis, prototyping charts, and two final charts.
Python was used to process the datasets, merge files, and aggregate metrics as appropriate.
D3 was used substantially in the final site.
Bootstrap was used to create the site.

Steps Required to Accomplish Goals

- Read papers and articles about the War on Drugs and its implications
- Find the data
- Process, merge and clean the data
- Conduct exploratory analysis on the data
- Figure out the story linking the data
- Thoroughly research the War on Drugs and case study
- Prototype the site and charts
- Conduct 2 usability interviews on the first prototype iteration
- Revise the first prototype based on feedback from the first 2 interviews
- Conduct 2 usability interviews on the second prototype iteration
- Revise the second prototype based on feedback from the second 2 interviews
- Conduct 1 final interview on the site prior to the showcase
- Edit the final prototype with outstanding issues in response to the final interview
- Convert, to the greatest extent possible, all remaining charts to d3
- Demonstrations during the showcase
    - Informal usability tests during the showcase
- Conduct a heuristic evaluation for further work
- Final edits to the site based on showcase feedback and heuristic evaluation
- Finish (not really) !

Research Results

As mentioned above, we conducted 3 rounds of informal interviews and usability tests, one round of informal usability tests at the showcase, and one heuristic evaluation.

The informal interviews asked the participants whether they were aware of the War on Drugs, how they were aware of it, and to define it. It then asked them to sketch a 1-page visualization with the following goals: to explain the War on Drugs, explore whether it achieved its stated goal of reducing drug use, and consider alternate methods to stem drug use.

We then switched to the usability test, and let the participants explore our visualization, keeping those goals in mind. We let them initially review the visualization with no questions or instruction, but rather to treat it as a 'Talk Aloud', where the participant would mention anything they liked, disliked, found confusing, etc...We then asked follow-up questions about points they had made earlier, or about the flow, design, content and anything else that came up.

The informal usability tests allows users to simply explore the visualization, and provide feedback on things they liked or disliked, found confusing, etc. Finally, one heuristic evaluation was conducted, using Nielsen's heuristic principles. The findings from both rounds of testing have been applied to our 'further work' section.

ROUND 1: Informal Interview and Usability Test

The first round of informal interviews and usability testing was on a live prototype. Many of the charts were still in Tableau, and the copy was in draft form. The main goal of this round was to understand whether our narrative flow was logical, whether we were missing key charts, and whether our initial visualizations were usable. This round was conducted with 2 information visualization experts, 1 male and 1 female. We understandably received the most results in this round, with the following highlights:

- **Flow:** Our narrative flow for one respondent felt 'backwards'. In response to this feedback, we created an A and B version of the site, with the B version flipping the middle sections of the visualization.
- **Timeline:** Our original timeline had trouble with visual hierarchy, making it difficult to know what to read first. The visualization was also fun and interactive, but difficult and clunky. We made some edits to it for the next round, but none were extensive.
- **Types of drugs:** Our drug overview was originally two rows of static copy and iconography. We were told this felt overwhelming, which lead to our redesign of hover-over tiles. It also led to us ordering the drugs by their schedule, to instill a hierarchy.
- **Drug use:** Our drug use chart originally included alcohol and cigarettes, as well as another user type that was decidedly difficult to understand and irrelevant. We removed it for the next round of testing.
- **Drug arrests:** Our drug arrest chart was already a parallel coordinates in d3. It originally had states as well as years, and made the chart very busy and difficult to understand. The parallel coordinates chart is also difficult to use for many who are unfamiliar with it, which became clear during one interview. We removed the state data at this stage.
- **Sentencing:** Our drug sentencing chart used to be a chart on harsh sentencing by state. It showed 2 harsh sentence types: 25+ year and life, life without parole, life plus additional years and death sentences, all by state. After showing this visualization, though the information was powerful, the data was not normalized by population, which caused pause. One respondent also felt the state-level data was not in line with our national-level narrative. Finally, we were told by one respondent that it would be valuable to have more context. For example, what percentage these sentences were relative to other sentences. We ultimately created a new stacked bar chart in d3 that showed all national drug sentences by year.
- **Correlations:** We originally had a correlations visualization between drug arrests and drug use that was a scatterplot with frequent and frequent + recreational users in the same pane. This visualization was very difficult for our participants to understand, shown by the length of time and memory used to discern our point - that as drug arrests go up, drug use does not necessarily go down. Though the visualization was compelling and interesting to look at and engage with, it was unclear, so we rethought it and decided to use a clean, multi-line chart instead.

- **Implications:** Our section on the implications of the War on Drugs was far rougher than other sections during the first round, and had rough copy with placeholder icons. Understandably, this section was considered to be somewhat ho-hum. We revisited this section by replacing the placeholder icons with larger, encircled statistics and fixed the copy.
- **Incarceration rates:** One of the less updated charts is the boxplot found in the incarceration rates around the world section. Though a simple chart made in Tableau, our point came across very clearly, given the stark difference between the US and country with the next highest incarceration rate (Cuba). We did, however, change the colors to make the US stand out even more, making it red while the others grey. We also tried to make Portugal stand out, but because of its location near the median, even a color change wouldn't help it stand out. As such, we altered the copy to explain its position and incarceration rate to both contrast the US and prepare the reader for the case study.
- **Portugal:** Our case study started as a block of text. Though the text was fine and a reasonable length, our participants were displeased at the lack of visualizations. We added a screenshot of a visualization we found in our research as a placeholder for the next round.

ROUND 2: Informal Interview and Usability Test

We took the next day and a half to make significant edits to our visualization before our next round of usability tests. This time, we showed the A and B versions of the visualizations to two classmates, one male and one female. The first respondent saw the A version first, while the second respondent saw the B version first. Highlights from this round:

- **Flow:** After showing both respondents the two versions, we decided our original version made the most sense, as the B version was deemed backwards by one respondent, while in some ways better and other ways confusing by the other respondent.
- **Timeline:** We continued to receive mixed reviews on our timeline. One respondent loved the interactivity of it, while the other became bored and frustrated at having to scroll over each flag to read the text. He also commented on how only certain titles caught his eye, and that the rendering of the full text below the timeline was distracting and again, clunky. Finally, both requested additional context — a metric of some sort to show the effects of these events. For our next round of testing, we decided to change our timeline visualization to something far simpler - a line with colored dots and hover-over text representing events.
- **Types of drugs:** Our tiles went over far better than the former version. Useful feedback here was that it would be useful to have a definition of 'scheduled'. We weren't sure how prevalent this lack of knowledge was among our users, so we decided to hold off on edits.
- **Drug use:** Removing alcohol and cigarettes, along with the confusing user group was far more helpful. There was, however, still confusion about the names of the other user groups, which at the time were "past month" (frequent users) and "past year (frequent and recreational users)". These names came from the data, and interviewees had to guess at the significance of those names. We changed them in time for the next round.
- **Drug arrests:** We removed the state data and reordered the axes in line with our first round of feedback. This made the parallel coordinates far more readable, and showed overarching trends, though one participant would have preferred different colors or a gradient to signal different years. We changed the color scheme in the next round.
- **Sentencing:** Our stacked bar chart was very clear. One respondent wished there was more information added to it to provide further context. Though we did not make additional changes to this chart, it made us think about how we could make better use of our timeline.
- **Correlations:** The multi-line chart went over well. Interestingly enough, one participant took away our point, while the other thought it was making the opposite point. This was more a factor of the data than the chart, so we decided to leave it as is for the next round.
- **Implications:** Though statistics had replaced the placeholder icons, they were considered to be somewhat flat and visually uninteresting. We decided to use colored icons instead for the next round. Two statistics were also replaced with more compelling ones.
- **Incarceration rates:** This chart received positive feedback, so we didn't make any edits.

- **Portugal:** The placeholder visualization was disappointing. We ultimately didn't have time to create a proper chart in time for the next round. We also received feedback that the case study wasn't very compelling, and didn't provide enough context or information to feel like it was successful. We made some copy changes in time for the next round.

ROUND 3: Informal Interview and Usability Test

The third round of usability testing was conducted with one female. We consider her to be a subject-matter expert, given her work with the ACLU on the drug war, though she is not an info viz expert. She is also older than our other participants, which gave us an added perspective in how she approached exploring the visualization, and how certain heuristics were more or less valuable.

- **Timeline:** We had changed our timeline visualization to a line with colored dots and hover-over text representing events. She quite enjoyed this representation, though she wished there had been more context (ex: a metric representing public sentiment toward drugs over time). Because we had received similar feedback from other participants, we added a simple line chart representing drug use. This chart uses the timeline as its x-axis to indicate a the desired association.
- **Types of drugs:** The participant thoroughly enjoyed the tiles. However, when asked whether she was familiar with 'scheduled' versus 'unscheduled' drugs, she was a bit hazy in her memory. We added a line of text "What does 'scheduled' mean?" above the tiles that allows the user to hover over it and read about the different schedules represented in the tiles. This proved to be a nice way to save on room, while still informing users adequately. We also added examples of each drug, as she expected to see one in particular (Meth), but wasn't sure which category it belonged to.
- **Drug use:** Changing the names were deemed quite helpful.
- **Drug arrests:** This participating was new to parallel coordinates, and required further instruction on how to use it, which was added for the next round. We also added a label.
- **Sentencing:** She didn't realize you can hover over the sections of the stacked bar chart to find out how many prisoners were given each sentence. We added instructions.
- **Correlations:** No feedback on this chart.
- **Implications:** She enjoyed these statistics, and offered one more as a suggestion (number of children growing up without parents because they are incarcerated). Though we found a useful statistic, we decided to leave it out to ensure readability of the other stats.
- **Incarceration rates:** The participant was disappointed that we used this chart to show how the US compared in overall incarceration rates, as opposed to drug incarceration rates. Because we didn't have international data for drug arrests, we opted to include a contextual statistic: Today, 25% of the incarcerated population is in prison for drugs.
- **Portugal:** Our participant enjoyed the extra information added to the case study, stating it was just enough information to start thinking about alternate methods. For the next round, we added a couple of additional stats to strengthen the case, and replaced the screenshot visualization with several d3 bar charts to indicate how many adults use drugs and the proportion of the Portuguese population who have ever used a drug and continue to do so.
- **Other:** Finally, we added a conclusion and separate sources page. The conclusion was meant to indicate our perspective on what the data showed us. Though our goal of this visualization is to let people explore it on their own, play with the data, and come up with

their own conclusions, we also wanted to explain our perspective. Whether the user agrees with us or not is based on their interpretation.

ROUND 4: Informal Usability Tests During Showcase

During the InfoViz Showcase, we took the opportunity to receive feedback from users exploring the visualization. Given the busy environment, most users read through it much faster than our other participants. However, the feedback we received was very useful. Much has been addressed already (see below). The rest has been added to our 'future work' section.

Findings

- **Timeline:**
  - One person asked for explanatory text on how to use the timeline, which we added.
  - There was some confusion around why the orange dots turned black (after that event has been read). We added explanatory text above the timeline.
  - The drug use line needs a note that the data started later, which we added.
  - Thin lines seem to not quite match with the thicker look of the rest of the site - make it thicker. We played around with all of the thinner lines, and ultimately only changed the thickness of the line graph in the timeline, as increasing the thickness of other lines made the charts feel too busy.
- **Drug Use:**
  - One person didn't understand what "Any illicit drug" means. We added copy to explain above the chart.
- **Drug Arrests:**
  - In parallel coordinates say "click elsewhere on the same axis", text we added to the instructions above.
  - It was unclear that years are reflected by color; we added a key at the top to clarify.
- **Implications:**
  - By highlighting an icon when hovering over it, the icon feels clickable when it's not. We removed that functionality.
- **Incarceration rates:**
  - US is too far. Need something to point to it and make it stand out more. We added "USA" above it and encircled both in a box.
- **Portugal:**
  - One person asked that we highlight key takeaways for each paragraph in the Portugal case study, which we did.
  - Another recommended we add titles to charts to better explain the decline in drug use, which we did. We also explained what 'continued use' means, as that was confusing to some.
- **Other:**
  - A few people indicated that we need to state that we're focusing on the US because much of the war is fought outside of it. We added in "US" or "American" throughout the visualization to clarify that.

ROUND 5: Heuristic Evaluation

Our final round of research was the heuristic evaluation. This was conducted by only one person (Sasha) as a means to review the visualization through the lens of Nielsen's 10 heuristic principles. Full results can be found here, or the findings can be reviewed below.

FINDINGS

- Button says "scroll down" - if it's meant to be instructional, it shouldn't be a clickable button.
- Text in places like the War on Drugs background doesn't have enough contrast. Could be hard to read on some displays.
- Labels on most charts are written in small text and could be hard to read.
- Icons in the illicit drugs section are a bit too large and don't fit on one screen. Involves scrolling that takes the reader away from the title and instructions.
- Some of the charts, like the drug usage one, are too large and don't fit on one screen, so I have to scroll away from the title and contextual text.
- Parallel coordinates is difficult to use, even with the instructions.
- Expected to be able to filter out individual sentences in drug sentence stacked bar chart, based on how prior charts worked (drug use).
- Using raw numbers as opposed to percentages in the sentencing stacked bar chart means you have to try harder to remember things and how they compare to each other.
- Reader has to remember the timeline of events to create context for metrics in other charts.
- Box-and-whisker plot is too busy because the points bleed into each other toward the median. Hard to distinguish countries.

Student Work Breakdown (divided by task)

Task	Molly	Jason	Sasha
Data and statistics research	30%	40%	30%
Content research	45%	10%	55%
Exploratory questions to ask	50%	30%	20%
Data clean-up/processing	3%	90%	7%
EDA	15%	70%	15%
Creating charts in Tableau	15%	60%	25%
Creating charts in d3	35%	65%	0%
Website design	100%	0%	0%
Content creation	45%	0%	55%
User research design, execution and analysis	0%	0%	100%
User research sessions + notes	25%	30%	45%
Prototype and chart updating in response to feedback	50%	50%	0%
Copy updates in response to feedback	25%	0%	75%
Write-up	35%	15%	50%

Future Work

As mentioned in the 'research' section, we received some rich feedback during the informal usability sessions at the showcase, as well as from the heuristic evaluation. Though we will not be able to address these points before turning our assignment in, we will list them here, and hope to address them over the summer. An original goal of this project was to have our visualization published by The Sentencing Project – this continues to be our goal, and hopefully making these final changes will allow us to do that.

Timeline:

- One person was confused by the line in the timeline. They didn't notice the label. Everyone else noticed it and understood its significance, so this may not be worth pursuing.

Drug Use:

- One person would have liked to know the other user group (frequent and recreational + frequent) was a tab. They didn't realize they could toggle between the two.

Drug Arrests:

- Make the click and drag bar in the parallel coordinates wider for easier use.
- Parallel coordinates is difficult to use for first-timers, even with the instructions.

Drug Sentences:

- Expected to be able to filter out individual sentences in drug sentence stacked bar chart, based on how prior charts worked (drug use).
- Using raw numbers as opposed to percentages in the sentencing stacked bar chart means you have to try harder to remember things and how they compare to each other.

Portugal:

- Gaps would be helpful between the bars. They are currently a little too fat. Makes it seem like the bars represent more than 1 year.

Graphs:

- Make the d3 charts responsive.
- The Use of Illicit Drugs graph has what seems to be a bug in it, wherein missing data points continue to be graphed at the most recent data value when the mouse hovers over the graph (you can see this in "Any Illicit Drug" for the 1982 value, which is missing). We would like to find a solution to this, but haven't yet been able.
- Box-and-whisker plot is too busy because the points bleed into each other toward the median. Hard to distinguish countries.
- Reader has to remember the timeline of events to create context for metrics in other charts.

Design:

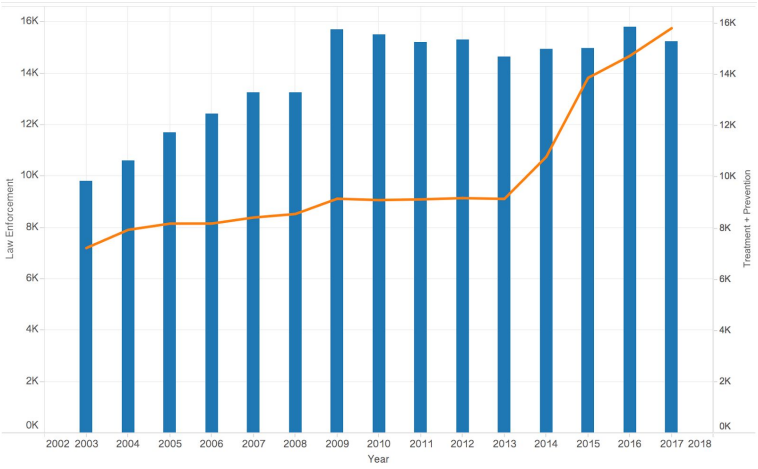
- There are orphans in the text when the size of the screen changes. Our website is responsive, so we aren’t sure how to address that when the display size changes.
- Button says "scroll down" - if it's meant to be instructional, it shouldn't be a clickable button.
- Labels on most charts are written in small text and could be hard to read.
- Text in places like the War on Drugs background doesn't have enough contrast. Could be hard to read on some displays.
- Icons in the illicit drugs section are a bit too large and don’t fit on one screen. Involves scrolling that takes the reader away from the title and instructions.

Finally, there was one chart on budget we'd still like to have added. It was a late addition based on some participants talking about budget in their initial expectation of what the visualization should include. We were unable to agree on a place for it, and opted to focus on improving our existing visualization. Below is the accompanying text along with a screenshot of a draft of the chart:

War on Drugs Budget (2003 - 2017*)

The War on Drugs budget is split into two parts: preventative and treatment, and law enforcement (domestic, International, and Interdiction).

The line represents treatment and prevention budget; the bars represent law enforcement budget. Hover over the line and bars to see how much was spent or will be spent.
*Proposed budget for FY 2017



APPENDIX

Photo from project showcase

Interview + Usability Questions (User Research Protocol)

- Introduction to study:
  - Thank you for being willing to participate in this study! Do you mind if I record you?
  - An overview of why we're doing this: we are looking at the War on Drugs and trying to a. understand whether it achieved Nixon's original goal of reducing drug abuse, and b. investigate whether alternate methods (ie, public health) should be considered.
- Warm-up questions:
  - Have you ever participated in an interview like this before?
  - Ok great, I'm going to ask you a few initial questions and then show you a few visualizations. Those visualizations are prototypes, so there may be some things that don't work exactly right, or some content that's missing. We're mainly looking to understand what you think about what is currently there.
  - There are no wrong answers, I'm just interested in your opinion. Sound ok?
- Expectations:
  - Are you familiar with the War on Drugs? What do you know about it?
  - I'm going to read a short blurb that explains how we're defining it:
  - "The **War on Drugs**" is an American term commonly applied to a campaign of prohibition of drugs, with the stated aim of reducing drug abuse. This initiative includes a set of drug policies that are intended to discourage the production, distribution, and consumption of drugs that the participating governments and the UN have made illegal. The term was popularized by the media shortly after a press conference given on June 18, 1971, by President Richard Nixon—the day after the publication of a special message he gave to Congress on Drug Abuse Prevention and Control—during which he declared drug abuse "public enemy number one".
  - Imagine you are looking at a 1-page visualization that accomplished the following:
    - Explained the War on Drugs concept
    - Questioned whether the War on Drugs accomplished its goal (reducing drug abuse)
    - Proposed a focus on public health as an alternate method of addressing drug abuse
    - What would you expect to see in this visualization? If it would help, feel free to draw a loose sketch.
- Walk-Through
  - Now, I'd like to show you a version that seeks to address those three points mentioned earlier. I didn't design this, so feel free to be blunt and honest, it won't hurt my feelings.
  - (let them walk through without interruption first and take feedback, then ask about specific points - areas where they stopped, looked confused, asked questions, etc...)
  - Is there any information you think is missing? That you expected to see?
  - Is there any information you think is unnecessary?
  - Is there anything that doesn't make sense?
  - Is it valuable to look at alcohol and cigarettes in the drug use chart?
  - What do you think of the flow of this information? What changes, if any, would you make to the order? What do you think of this alternate?
  - Consider the original points this visualization sought to address. Do you think this visualization addresses all of them? Would you add anything to address them better?
- Concluding thoughts:
  - Do you have any last thoughts about the visualizations you just saw, or anything else about the War on Drugs you would have expected to see?
  - Thank you so much for your time!

Interview Artifacts – Interview Notes

- Participant 1 interview notes
- Participant 2 interview notes
- Participant 3 interview notes
- Participant 4 interview notes
- Participant 5 interview notes

Interview Artifacts – Audio Files

- Participant 1's interview (audio)
- Participant 2's interview (audio)
- Participant 3's interview (audio)
- Participant 4's interview (audio)
- Participant 5's interview (audio)

Heuristic Evaluation Results

- Findings + Ratings

Interview Artifacts – Sketches

(sketches of what they expect from a visualization on the War on Drugs)