INFO 247: Course Project Report

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9 May 2018

Grass is Greener

1 Project Goals

We originally had three goals for this project:

- Education around existing outdoor activities, health benefits of participating in those activities, and accessibility of those activities.
- Fill out a questionnaire to assess motivation towards engaging in outdoor activities.
- Generate an action plan for people to take their new-found excitement and information about hikes in the area to help plan an actual outdoor activity.

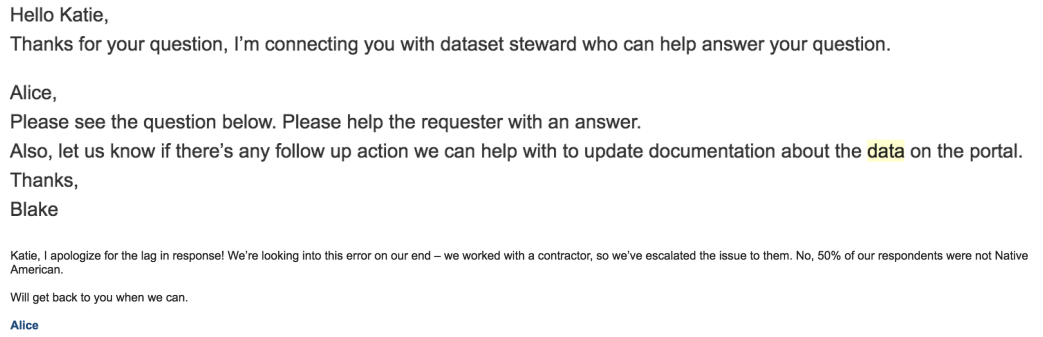
Throughout completion of this project, we focused primarily on the first two goals. We implicitly address the last goal by educating about the locations of parks in San Francisco, but leave it up to the user to generate their own action plan.

2 Related work

A great deal of research has been done on the mental and physical health benefits of outdoors activities. We found evidence that engaging in outdoor activities improves sense of self-efficacy, mindfulness, and subjective well-being [9], as well as improved short-term memory [5]. Time spent outdoors is also associated with signs of lower inflammation (associated with various disorders and health issues) [8], even improved vision [13]. We gathered all of these into a section about the Individual Benefits of going outdoors.

An extensive report from the Trust for Public Land [3] includes information about individual health care costs, as well as benefits to the environment. It is presented in simple tables. We extracted the data and display the health care costs information in an infographic format in the section about Community Benefits. We also found extensive surveys on park maintenance [4], but didn't use the data since most parks were rated the same.

The Outdoor Industry Association hosts an extensive range of datasets about people who participate in outdoor activities, including current [2] and historic [1] data on: income distribution, gender, race, and age. This data was used to convey information about who uses the outdoors, both to motivate increased participation, as well as to communicate trends. Additional


Hello Katie,
Thanks for your question, I'm connecting you with dataset steward who can help answer your question.

Alice,
Please see the question below. Please help the requester with an answer.
Also, let us know if there's any follow up action we can help with to update documentation about the data on the portal.
Thanks,
Blake

Katie, I apologize for the lag in response! We're looking into this error on our end – we worked with a contractor, so we've escalated the issue to them. No, 50% of our respondents were not Native American.

Will get back to you when we can.

Alice

Figure 1: Email correspondence to discuss potential coding error of survey data.

demographics were found in a dataset released by the National Park Service and used to create another infographic [6]. The data turned out to have a bug, however: the coding indicated that over 78% of SF residents identified as Native American. We reached out to the SF office, who indicated that the data had been collected by a third party and almost certainly had been coded incorrectly. Figure 1 shows email correspondence we've begun with the San Francisco government to address and clarify our concerns.

The National Parks provide usage datasets for various parks throughout California, including Point Reyes National Seashore and Golden Gate Recreation Area [11]. Specifically, monthly usage data for each park, and yearly visitation rates from 1919-2017. We also found a rich dataset about park usage between 1996-2017 [10]. After some data cleaning (described in the "Data" section), this informed our persuasion section. Additionally, the San Francisco Parks and Recreation Department published a dataset including locations and types of parks found in San Francisco [12], which we used in our map visualization.

Jackson [7] studied the impact of appreciative (e.g hiking), consumptive (e.g. hunting), and mechanized (e.g. trail biking) activities on participants' attitudes towards the environment. We re-used some of the questions from this study to assess attitudes towards the environment in our evaluation to assess if our visualization affected attitude towards the environment.

3 Description of Visualization

Our overall vision was to scale our visualization from small to large. At a high level, our visualization story progressed from Individual Benefits to Community Benefits.

3.1 Banner

As is in fashion in websites today, we wanted to begin with a banner with an engaging and inspiring picture. There is text explaining that the user will have to scroll to navigate through our site. For people skimming or reading quickly who may miss this text, there is also a button which demonstrates a downward scroll to the first section. In our user studies, we were surprised to see nearly 100% of people clicked the button to proceed, which has the added benefit of animating the scroll and teaching people the scrolling style of the website.

3.2 Individual Benefits

We decided to begin with a focus on the impacts on and in the individual's body. Our interactive infographic begins with cellular structures being changed within the body of a single person through either urban or outdoors experiences. We then "zoom out" conceptually to effects on the mind and emotions, and finally to larger body structures such as the eyes.

We also wanted to start with something interactive, and to "hook" people in right away with positive information about the effect of being outdoors. Since much of this information is dense, this also encourages people to slow down as they navigate the site. We wanted each of the visualizations to communicate the meaning of the information, and also recreate some of the experience. For example, we hoped the mental health visualization of gently flowing "lava lamp" style movements would be calming and relaxing, similar to how participants self-reported feeling in the studies.

We chose to start the person closer to the city to represent the fact that users of the site are likely to be in or near a city when they access our site. The two images of the city and the forest are actually buttons, so the pulsing colors behind them both help to group the images to the information related to the city and forest respectively as well as indicating that they are sites for interaction. When each button is pressed, colored dots representing chemicals inside the body populate the figure in the center, and move the figure closer to that image. The buttons, colored dots, and information in the text are all linked through color highlighting to conceptually tie them together.

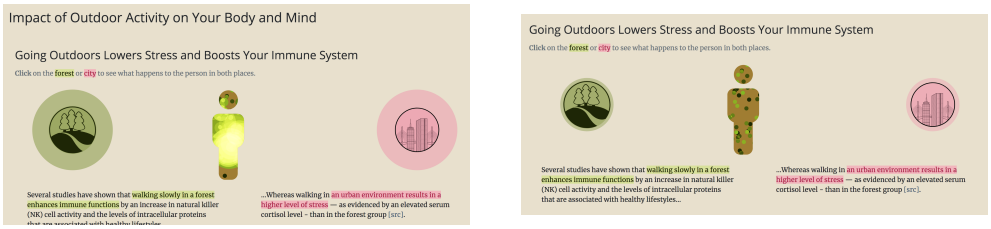


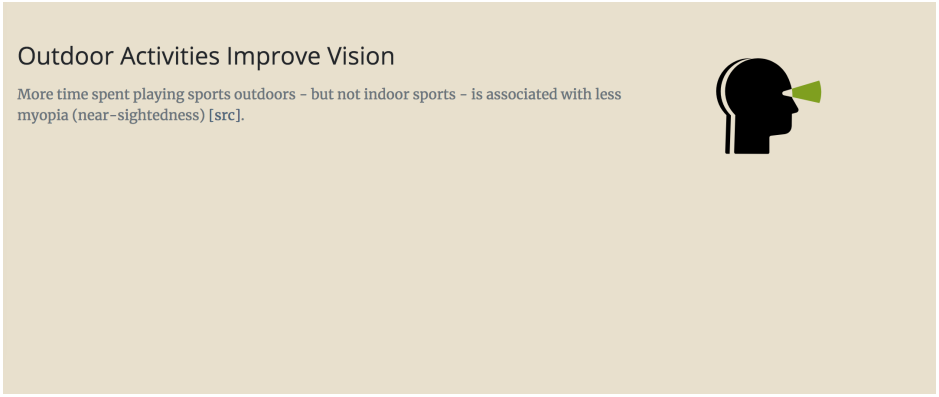
Figure 2: Left: The dynamic interaction as the forest image is being pressed, or if someone moves the mouse over the figure. Right: The figure is populated with healthy green dots after the dynamic visualization has settled. Note also the change in the city and forest image, showing the pulsing.

In the next subsection, we created a dynamic visualization to recreate and hopefully induce the feeling of relaxation and mindfulness in visitors to

our site. We chose a green color scheme at first, but found through user testing that it evoked feelings of "ooze" or toxicity, so we updated it to a calm rainbow color scheme that still fit with our site design.

Figure 3: The dynamic mindfulness visualization changing over time.

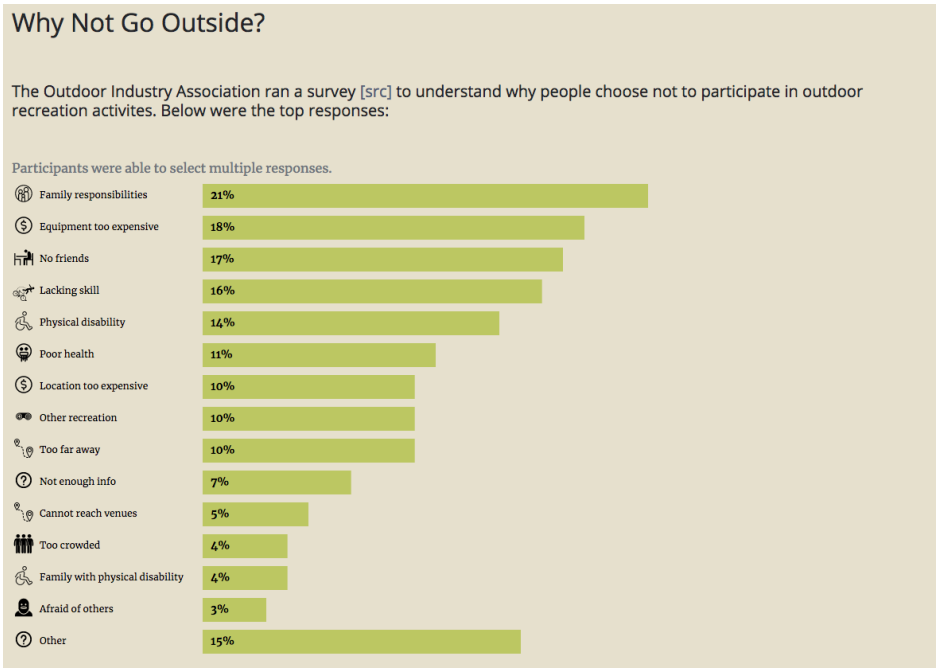
Finally, we added an icon to represent improved vision. As with all our previous designs, this was color coded to match the core concepts of our infographic.



3.3 Why Not Go Outside?

Though we just extolled the virtues of going outside, we recognized that in any case where there's a call to action there will be excuses and reasons not to participate. Like any good high school persuasive essay, we wanted to acknowledge those reasons and refute them. The next section attempts to address those reasons right away, using a survey [2] that probed common reasons people give for not wanting to go outdoors, a survey [10] which measured SF park sentiment and usage, and a database [12] of parks in SF. In this section, we begin to zoom out from the individual to a specific city.

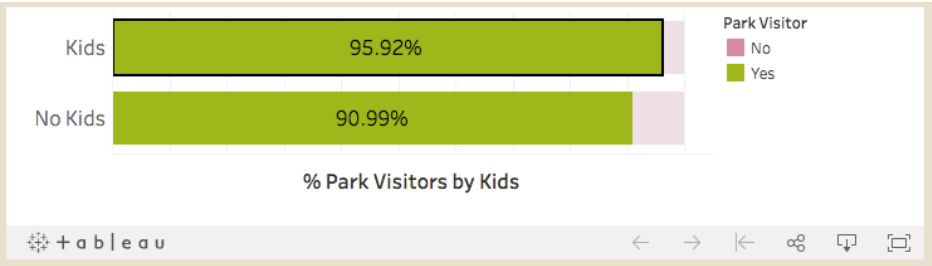
First, we present the most common reasons that people selected to not participate in outdoor recreational activities.



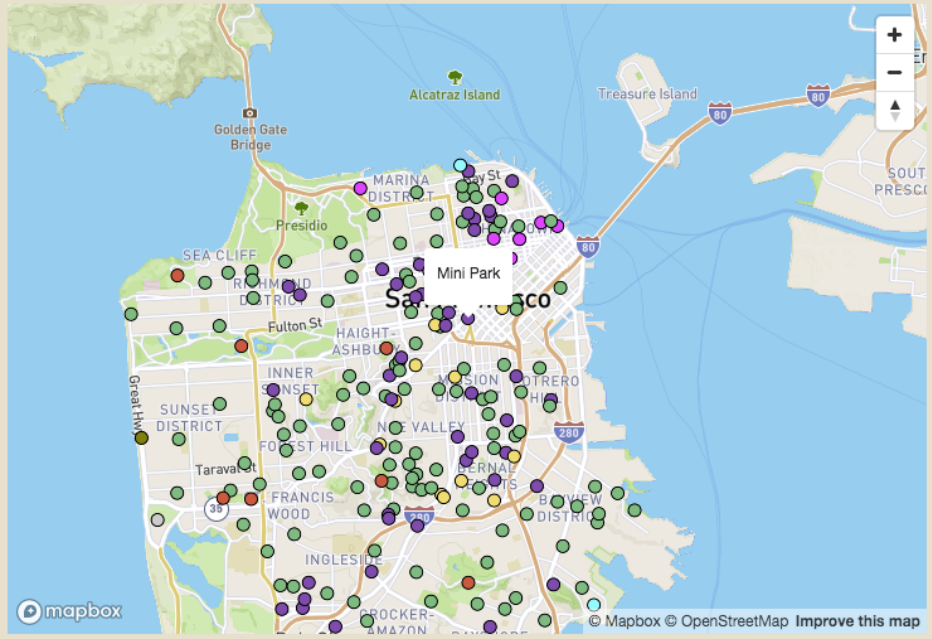
As the user navigates down, the graph zooms out to the left. We then use our data sources to refute most of the reasons, 1 to 2 at a time. To maintain the context, we wanted to explicitly highlight and remind the viewer of the point being refuted. As the user scrolls down, points that have been successfully refuted are grayed out, also giving the user a sense of the dwindling valid arguments.

We also maintain the proportions of each response to the survey to aid the user in remembering the popularity of each reason. One challenge for this section was how to really highlight the relevant points without disrupting the accuracy of the graph. We chose to not change the size of the bars at all, but rather highlight them by adding the text description and magnifying the relevant icon, shifting subsequent entries down using the context and focus technique.

We used two types of visualizations in the refutations. For most, we used a simple stacked bar chart showing a proportion of park visitors to park non-visitors based on survey results [10] and broken down by relevant demographic information. We utilize a stacked bar chart because we are only comparing two populations, so each bar segment is grounded to an edge of the bar allowing for comparison. To make it very easy to understand, we highlight the relevant metric, park visitors. To demonstrate the proximity of parks, we displayed an interactive, annotated maps of parks in SF. For this visualization, we utilize Mapbox GL [1] and following the tutorial [2] from our class's guest speaker Chris Hendricks. We map the locations of San Francisco parks from the SF Parks and Recreation dataset [12] on a San Francisco map. The point colors represent the type of park, which is further displayed in the tooltip.



[1] https://www.mapbox.com/mapbox-gl-js/api/
[2] https://bl.ocks.org/clhenrick/57a76d0f25877840568ab26515eb03ac



3.4 Community Benefits

Our last informative section portrays information about parks' impact on the environment. The last visualization in the "Why Not Go Outside" section is a map of parks in San Francisco, so we believed this was a nice transition to the city- and community-wide benefits that parks provide. For this section, we combine an animated graphic scrollytelling story on the right with a narrative infographic and textual information on the left, as seen in Figure 4.

We begin by asking the user to reader to consider their local community without parks and setting the stage to explore how parks provide many benefits to the community. The starting narrative images transform as the user scrolls through the different park benefits to reveal a thriving community, as seen in Figure 5. With the addition of each piece of information about how parks improve a community, the corresponding negative image fades out and is replaced with an image representing that positive benefit.

We utilize isotypes to quantify how many particles are absorbed from the atmosphere by trees and vegetation found in San Francisco parks, as seen in Figure 6. For stormwater retention and community cohesion, we rely on the animated story and text to convey the community benefits of parks.

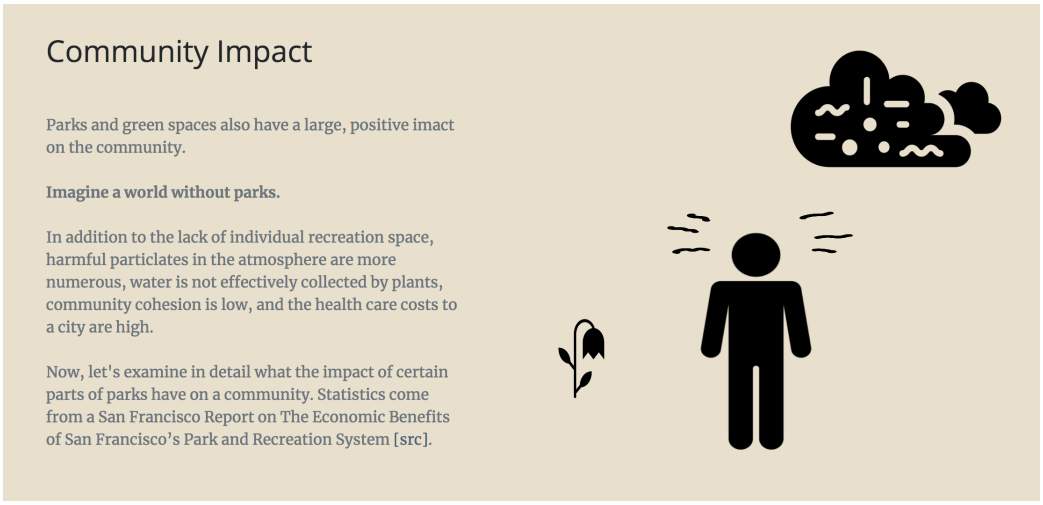


Figure 4: Introduction to Community Benefits section of website. The left of this section includes text and narrative infographic, while the right is a progressive story told via animation and images.

Figure 5: End of the community cohesion section. All the negative images initially seen in the story have now been replaced with positive images tied to park benefits.

For health care cost, we employ an Illustrator-designed graphic styled as a decision tree. We invite users to quantify how much additional financial burden they put on the San Francisco government by being active or not, as seen in Figure 7. Additional screenshots of this section can be seen in the Appendix.

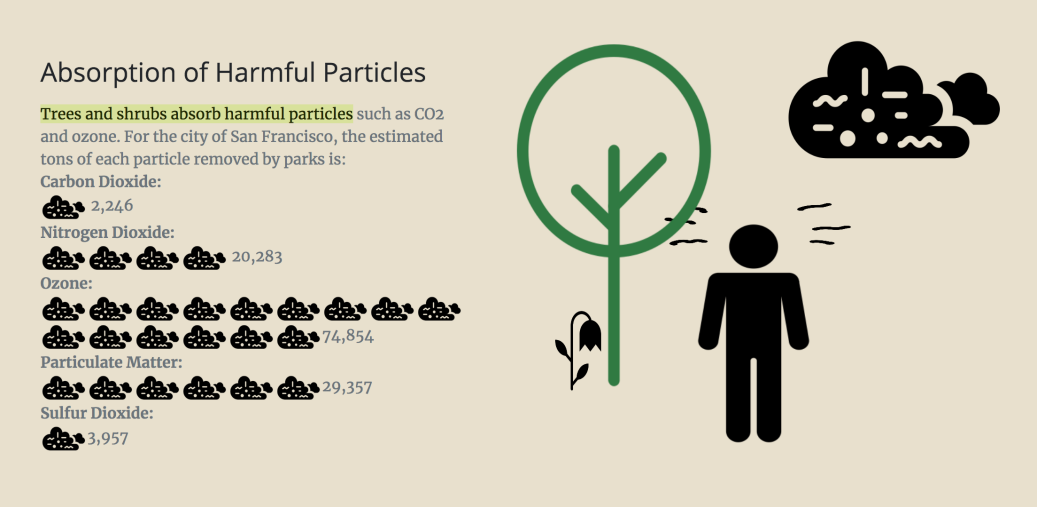


Figure 6: Harmful particles section, including use of isotypes and the animated story.

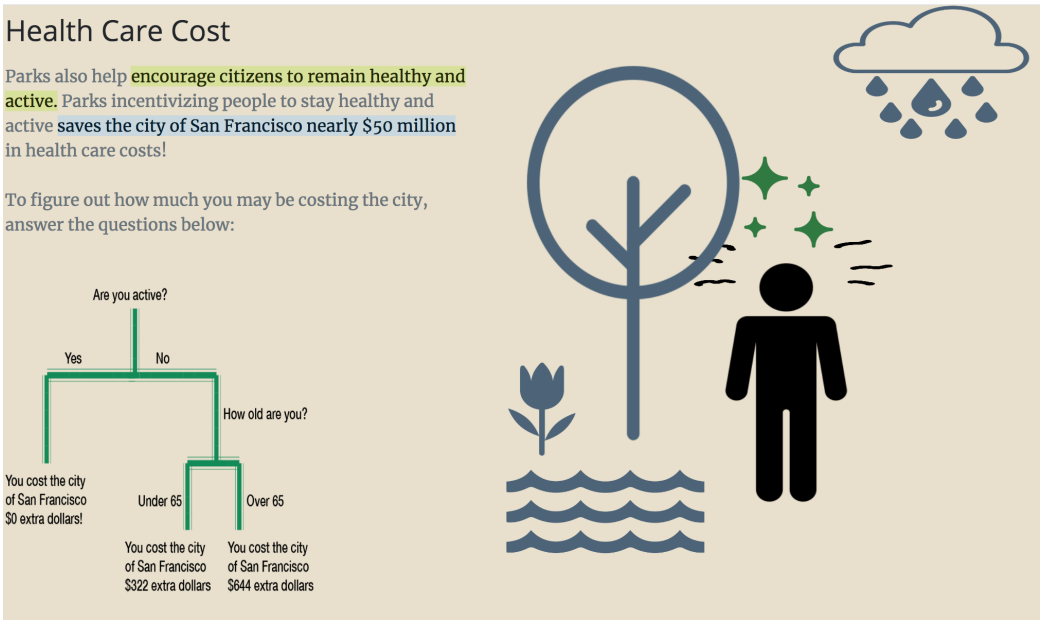


Figure 7: Health section, including use of decision tree graphic and the animated story.

3.5 Call to Action

We wanted to end our site with an inspiring call to action to encourage people to make a change while the motivation is there.

4 Data

See "Related Work" section and bibliography for complete data sources. In order to format the San Francisco City Survey Data [10], we followed a Tableau tutorial resource to format the survey data into the correct form [3]. We also removed unnecessary columns as this was a survey aimed at many city services provided by the government of San Francisco.

5 Tools

We utilized Tableau, D3, and Mapbox GL for interactive visualizations. We used Waypoints to enable much of our scrolly-telling and JQuery Animation for simpler animations. We used Adobe Illustrator and the Noun Project for many of the static images. We used Bootstrap for our base-level CSS theming. We used the Adobe Color CC to help us select the colors used in our theme. Lastly, we used Javascript and JQuery to stitch much of it together.

[3] http://www.datarevelations.com/reshaping-survey-data-with-tableau-9-0.html

6 Results

Below is a re-iteration of our relevant project goals.

- Education around existing outdoor activities, health benefits of participating in those activities, and accessibility of those activities
- Fill out a questionnaire to assess motivation towards engaging in outdoor activities
- ~~Generate an action plan for people to take their new-found excitement and information about hikes in the area to help plan an actual outdoor activity~~

6.1 Education around existing outdoor activities, health benefits of participating in those activities, and accessibility of those activities

We tested this with two questions about the content on our site.

- In the "Individual Benefits" section, did you know interact with moving the person between the city and forest? If so, what was that interaction trying to convey?
- What is one benefit to a city of having parks?

Below are some responses, indicating that people did retain some of the educational information from our visualization:

- "Walking in the forest increases immune functions while walking in the city increases stress"
- "[Having parks] costs the city less money for the health-care of the citizens"

6.2 Fill out a questionnaire to assess motivation towards engaging in outdoor activities

6.2.1 Attitude Towards the Environment

We gave some comparable questions from Jackson's study [7] to our users before and after viewing our site. Due to technical limitations, we did not

randomize which questions were in the pre-test vs. post-test, potentially affecting the validity of these results.

The pre- and post- test each had one positive question (e.g. "When humans interfere with nature, it often produces disastrous consequences") and one negative question (e.g. "Humans need not adapt to the environment because they can remake it to suit their needs") on a scale of 1 (strongly disagree) to 4 (agree).

By negating the negative question answers, viewing our site led from an average score of 2.5 to 2.875.

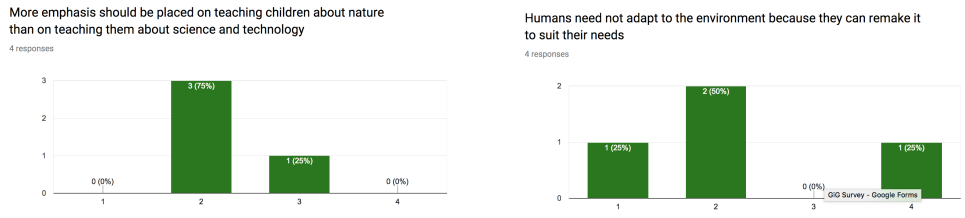


Figure 8: Sentiment towards nature, pre-test.

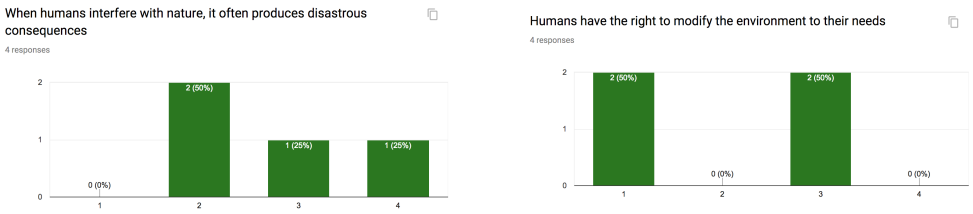


Figure 9: Sentiment towards nature, post-test.

6.2.2 Likelihood to Go Outside

In addition to testing the effect on general attitude towards the environment, we hoped our visualization might inspire our users to participate in an outdoor recreational activity. Before and after viewing our visualization, we asked them how likely and how excited they were to "participate in an outdoor recreation activity in the next week" on a scale of 1 (not at all) to 4 (very much).

For likelihood, both pre- and post- test scores averaged to 3.5. For excitement, both pre- and post- test scores averaged to 4. Though we saw no change from viewing our site, it's very likely these results were effected by a selection bias given how high the initial scores were.

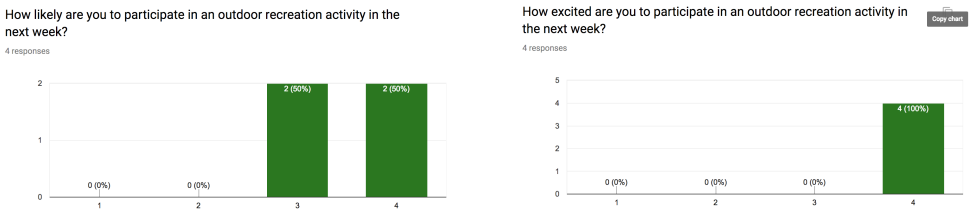


Figure 10: Left: Likelihood to go outside, pre. Right: Likelihood to go outside, post.

6.3 Design Feedback

Though not a goal of our visualization, we also wanted to take advantage of these user studies to iterate on the design. We did so by asking participants generally if any parts of the website were confusing. Additionally, we asked to see if they understood two complex visualizations on our site, the city-forest interaction and the bar-chart-navigation visualization.

6.3.1 City-Forest Interaction

We had mixed results for this, with 2/3 of our users realizing they could interact with it the city and forest buttons. Of those that interacted with them, only 1/2 of our users also realized the message being made by the interaction. Once they found the interaction, we found participants played with it for longer than expected, indicating that the interaction was playful and fun as we intended.

Based on these observations, we updated our design to more clearly instruct the user on how to interact with the visualization. We also added spatial grouping in addition to the existing color grouping to clarify how the text was explaining the visual effects in the interaction. We updated the pulsing circles to pulse much more dramatically, and added the text underneath so the instructions above stood out more. If we had more time, we'd update the images populating the person's body to be a positive shape (a

plus sign perhaps) for the healthy proteins, and a negative shape (an x) for the stress molecules. Additionally, we'd make the "mental health" and vision animations interactive rather than simply dynamic to keep the site consistent and increase engagement.

6.3.2 Bar-Chart-Navigation Visualization

This portion of the site regularly got some of the most enthusiastically positive responses. Introducing the easy-to-read data in a bar chart, and then using the bar chart as a navigation tool for the site was unique and appealing to many of our participants.

However, we similarly had mixed results for this interaction, with a different 2/3 of our users realizing that this was a smaller version of the bar chart connecting the refutations to the original survey results. One piece of feedback emphasized that it was hard to follow as it was not obvious which refutation was being focused on.

We have not been able to address this feedback yet, but would like to make the divisions in this section more clear and spaced out, which would help clarify which points were related to which complaints. Additionally, we could add some visual element (such as animation or coloring) to link the changes in the chart on the left to the text and visualizations on the right.

6.4 Bugs

We also got feedback around bugs in our site at different window widths. Due to priorities of the group, our site currently only works well on screens that are sufficiently wide. In the future, it would be nice to update it to work well on narrower screens.

7 Links

Links to demos, documents, or whatever is needed to show the visualization.
Our visualization is hosted publicly, available at https://kstats.github.io/GrassIsGreener/.
The code for our website is available at https://github.com/kstats/GrassIsGreener.
The Tableau graphs and non-annotated EDA are available at `https://public.tableau.com/profile/nathaniel.weinman#!/vizhome/GrassIsGreenerEDA_0/ParkVisitors-Kids` and `https://public.tableau.com/profile/molly.nicholas#!/vizhome/final-project/Dashboard1`

8 Contribution Breakdown

See table 1 for detailed breakdown of each team member's work.

	Katie	Molly	Nate
Initial Story Discussions	1/3	1/3	1/3
Data Scavenging	Benefits to Community Park Locations in SF SF Resident Park Survey	Demographics of Outdoor Participants National Parks Data New Ecological Paradigm Questions	Benefits to Individuals Reasons Why People Don't Participate
EDA	2/3 (Data Cleaning + Exploration)	(Demographics, result: not a rich data source)	1/3 (Exploration)
Story Flow	Benefits to Community*	Benefits to Individuals*	Reasons Why People Don't Participate*
Visualization Strategy	Benefits to Community* + SF Parks Map	Benefits to Individuals*	Reasons Why People Don't Participate* excluding SF Parks Map
Mid-Project Presentation	2/5	2/5	1/5
Implementation Building Blocks	1/4 (Bootstrap Template)	1/4 (Outdoor images, Hosting on github pages, Color scheme)	1/2 (Bootstrap Template + Waypoints + D3)
Implementation + SF Parks Map	Benefits to Community*	Benefits to Individuals*	Reasons Why People Don't Participate* excluding SF Parks Map
User Study Plan	1/4	1/2	1/4
Design Revisions	1/3	1/3	1/3
Final Report Preparation	1/3	1/3	1/3

Table 1: Contributions by Group Members.
** indicates who led ideation and development for these sections. However, the entire group helped critique, polish, and debug each other's sections*

References

[1] Archived Outdoor Participation Reports - Outdoor Industry Association.

[2] Outdoor Foundation Research Reports - Outdoor Industry Association.

[3] The Economic Benefits of San Francisco's Park and Recreation System.

[4] S. C. S. Auditor. Proposition C Compliance: Street, Sidewalk, and Park Maintenance Standards — Office of the Controller.

[5] M. G. Berman, J. Jonides, and S. Kaplan. The Cognitive Benefits of Interacting With Nature. Psychological Science, 19(12):1207–1212, dec 2008.

[6] O. Families. Celebrate the National Park Service Centennial - Outdoor Families Magazine, 2016.

[7] E. L. Jackson. Outdoor Recreation Participation and Attitudes to the Environment. Leisure Studies, 5(1):1–23, jan 1986.

[8] G. X. Mao, X. G. Lan, Y. B. Cao, Z. M. Chen, Z. H. He, Y. D. Lv, Y. Z. Wang, X. L. Hu, G. F. Wang, and J. Yan. Effects of short-term forest bathing on human health in a broad-leaved evergreen forest in Zhejiang Province, China. Biomedical and environmental sciences : BES, 25(3):317–24, jun 2012.

[9] M. Mutz and J. Müller. Mental health benefits of outdoor adventures: Results from two pilot studies. Journal of Adolescence, 49:105–114, jun 2016.

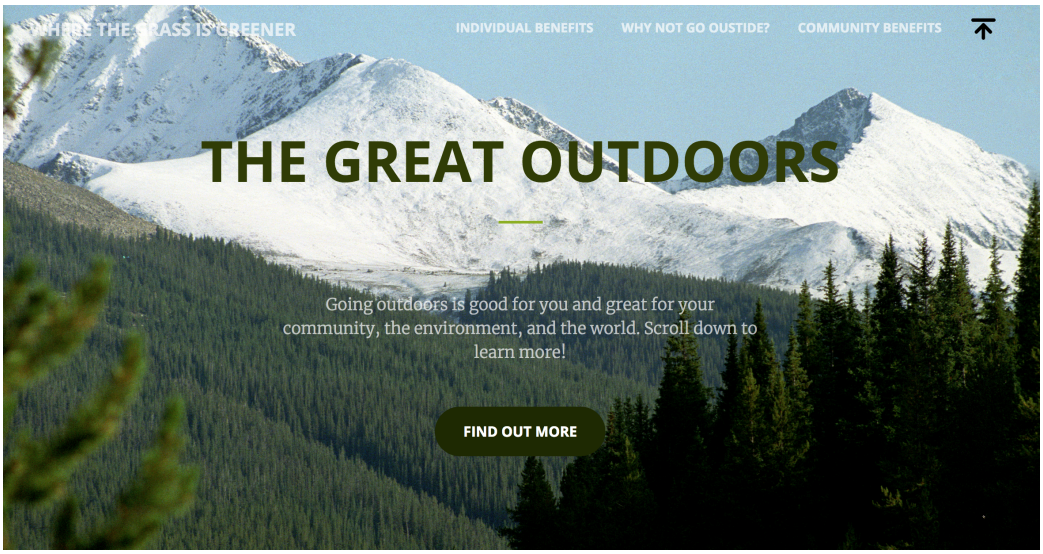
[10] S. C. Office. San Francisco City Survey Data 1996-2017 — DataSF — City and County of San Francisco.

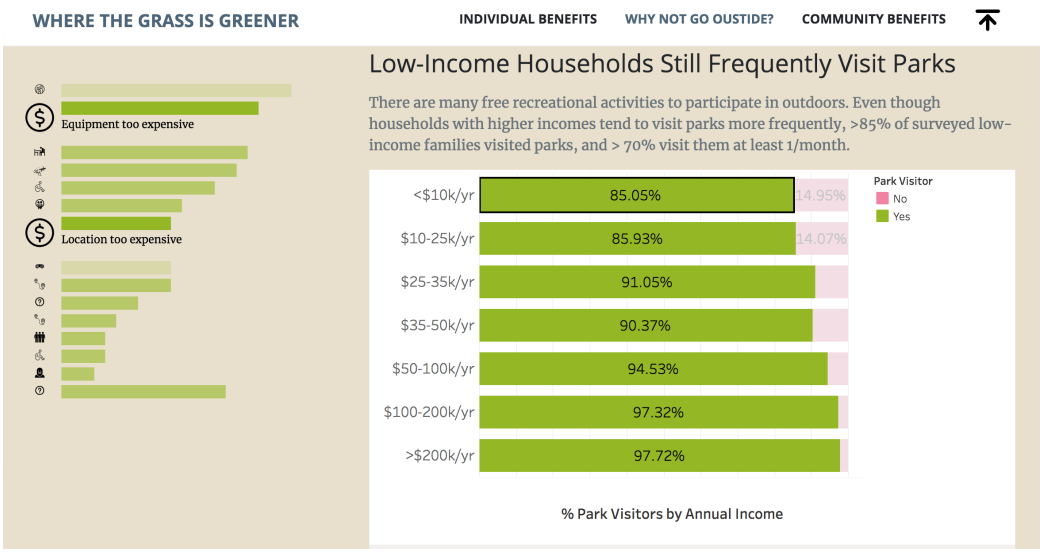
[11] N. Park Service. National Park Service Visitor Use Statistics.

[12] Recreation and P. D. S. Francisco. Recreation and park department park info dataset.

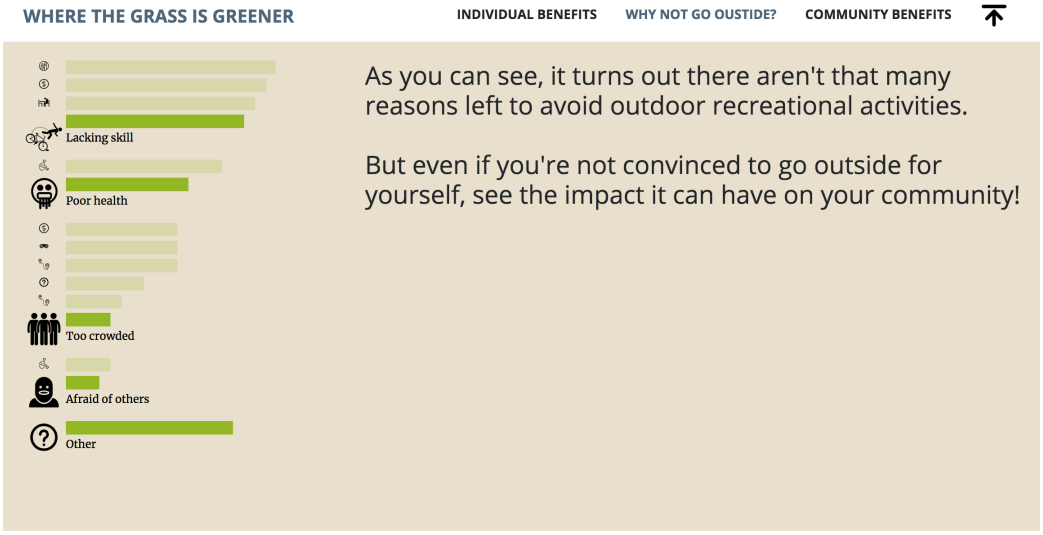
[13] K. A. Rose, I. G. Morgan, J. Ip, A. Kifley, S. Huynh, W. Smith, and P. Mitchell. Outdoor Activity Reduces the Prevalence of Myopia in Children. Ophthalmology, 115(8):1279–1285, aug 2008.

A Additional images






WHERE THE GRASS IS GREENER
INDIVIDUAL BENEFITS
WHY NOT GO OUSTIDE?
COMMUNITY BENEFITS
Physical disability
Family with physical disability
People With Physical Disabilities Still Frequently Visit Parks
There are many accessible recreational activities to participate in outdoors. Even though people with physical disabilities tend to visit parks less frequently, >80% of surveyed people with physical disabilities visit parks.
Disability
83.66%
16.34%
No Disability
93.08%
% Park Visitors by Physical Disability
Park Visitor
No
Yes
+ableau


WHERE THE GRASS IS GREENER
INDIVIDUAL BENEFITS
WHY NOT GO OUSTIDE?
COMMUNITY BENEFITS
Lacking skill
Poor health
Too crowded
Afraid of others
Other
As you can see, it turns out there aren't that many reasons left to avoid outdoor recreational activities.
But even if you're not convinced to go outside for yourself, see the impact it can have on your community!

Community Cohesion

Parks increase community cohesion within a local community. They allow for a free, local place for community groups to gather. Additionally, many people volunteer to improve parks, which can result in heightened social capital, especially in neighborhoods without safe public spaces.

Improved Stormwater Retention

Park vegetation also helps increase stormwater retention, which helps prevent flooding and erosion. The city of San Francisco saves 134 million cubic feet of runoff from parks annually. That's **30%** of its total annual rainfall!