Outdoor Exhibit Survey

About This Project

This data visualization was created by Carl Klutzke, Sarah Nikkhah, and Hawra Rabaan as our final project for H517: "Visualization Design, Analysis, & Evaluation" at IUPUI in Fall 2018, taught by Dr. Khairi Reda. The purpose of the assignment was to produce interactive and aesthetically appealing visualizations that would serve as analytical tools.

In a desire to work on a realistic assignment to help a real client, we contacted a prominent Indiana museum. They had recently opened a large outdoor exhibit, and their marketing department wanted to evaluate visitors' responses to the exhibit and determine the effectiveness of different forms of outreach. From May through July of 2018 they surveyed adult visitors as they left this exhibit. The data was captured on iPads, collected via SurveyMonkey, and compiled in Excel. This Excel data file was provided to us for our project.

The survey data contained almost 800 survey records with 46 different attributes, including:

- How long were you outside at the outdoor exhibit just now?
- How did you hear about the outdoor exhibit?
- Was visiting the outdoor exhibit the primary reason for your museum visit today?
- Are you a museum member?
- Based on the outdoor exhibit, would you consider becoming a member?
- How likely are you to recommend the outdoor exhibit?
- How likely are you to return to the outdoor exhibit before Labor Day?
- What are the ages of people in your group?
- Where do you live?

Upon examining the data, we decided to design a visualization that would attempt to answer the following questions for the museum:

- How did visitors of different demographics respond to the outdoor exhibit, based upon:
    - Museum membership?
    - Which age ranges represented in their group?
    - Where they came from?
- What forms of outreach were most effective at drawing visitors of different demographics to the outdoor exhibit?
- Did daily weather conditions affect visitors' responses to the outdoor exhibit?

To complete this assignment, we had to overcome the following challenges:

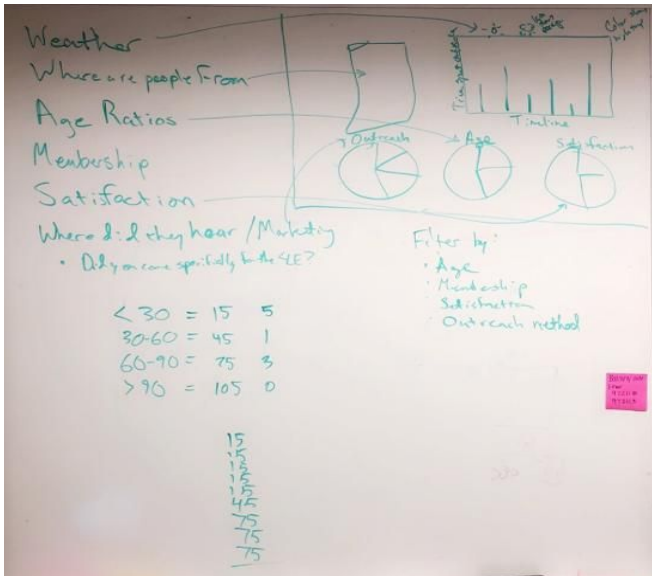
- We had two months to complete the project.
- We each had only a few months of experience with Javascript, and this was only our second project with the D3 library.
- The museum survey data were collected from at least five different survey instruments that each asked a somewhat different set of questions, so the same information was coded across different attributes for different records.
- Some of the data was poorly validated. For example, some records indicate that the surveyed group consisted only of toddlers, with no adults.

The Design Process

- We submitted a design proposal to the professor and obtained approval.

- Our group sketched initial designs to select different visualizations and filtering ideas.

- We analyzed the survey data to understand what information was available, cleaned up invalid data, and preprocessed it for loading as a CSV file.



- We obtained historical weather data for the survey dates and compiled it into an additional CSV file.

- We presented the low fidelity mockup below to the museum and received their approval before development. The bar graphs in the mockup were clipped from a marketing presentation that had also been provided by the museum.

Weather																											
High Temp	76	82	88	89	88	88	92	90	87	85	90	93	79	75	83	88	87	87	90	91	87	90	85	86	86	81	
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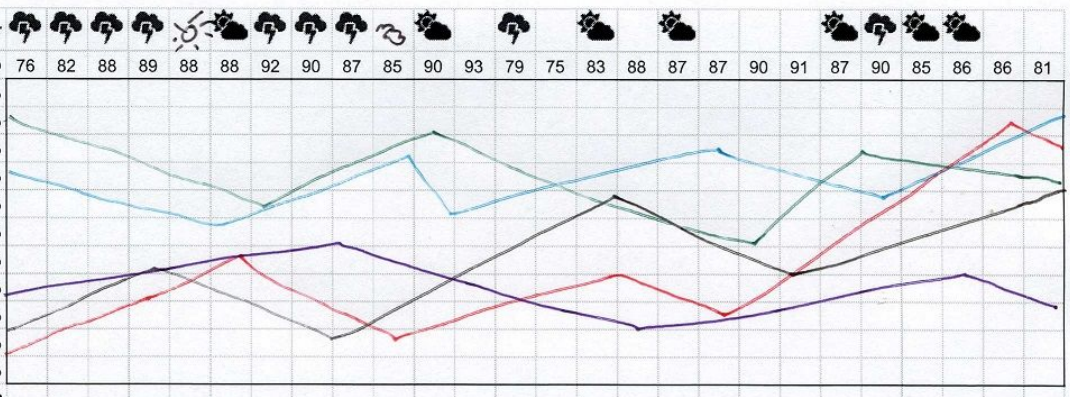
Day	Thu	Sun	Sat	Thu	Fri	Sat	Fri	Sat	Wed	Thu	Fri	Sat	Fri	Sat	Wed	Sun	Wed	Thu	Fri	Sat	Thu	Fri	Tue	Wed	Thu	Sat	
Date	3	6	26	31	1	2	8	9	13	14	15	16	22	23	27	8	11	12	13	14	19	20	24	25	26	28	
Month	May				June											July											
Select	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	



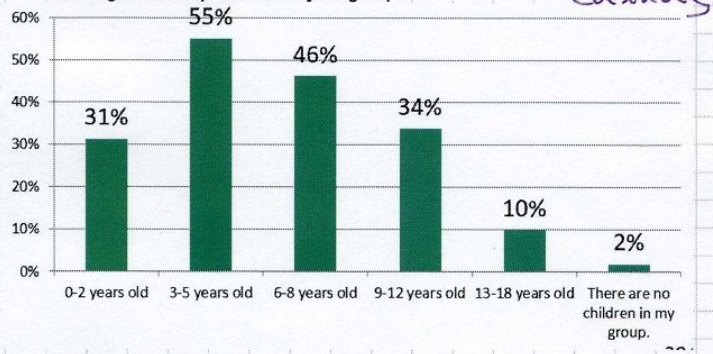
Filters:

Museum Member:	Yes	No			
Ages Represented:	0-2	3-5	6-8	9-12	13-18
Came From:	Marion County	Adjacent County	Elsewhere in Indiana	Out of State	

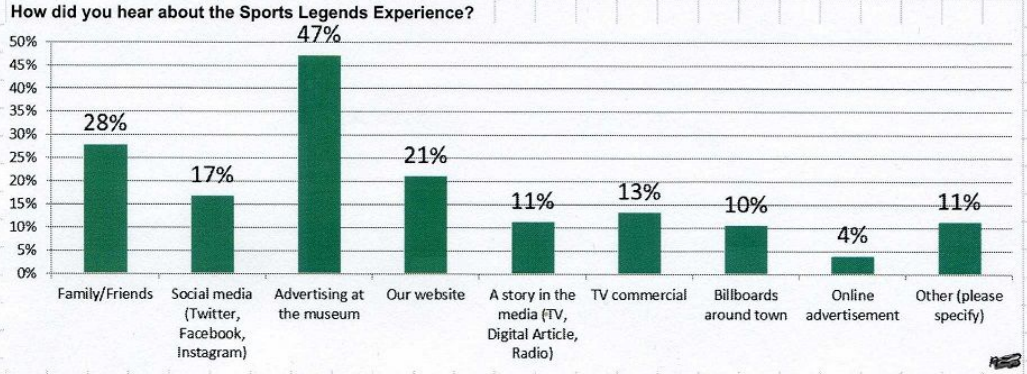
Came for SLE
Spent > X minutes
Would Recommend
Will Return
Considering Membership

Where did you come from?

What ages were represented in your group?



How did you hear about the Sports Legends Experience?



Design Rationale

The following explains the detailed rationale behind the current design:

Timeline / Line Graph

A timeline was chosen to display the different days the surveys were taken and was combined with local weather information from those days. The weather factors taken into consideration were: the general disposition of the weather (e.g. sunny, cloudy, rainy), the average temperature, and the average dew point. The dew point is an indicator of discomfort due to humidity: people accustomed to temperate climates begin to experience discomfort at a dewpoint of 60° or higher, and a dewpoint of 70° feels oppressive and tropical-like.

We selected a set of chart lines that portrayed visitors' responses to the exhibit:

1. Did they come specifically to see the outdoor exhibit?
2. How long did they spend in the outdoor exhibit?
3. How likely were they to recommend the exhibit?
4. How likely were they to return to the exhibit?
5. Were they interested in membership at the museum?

These attributes were not measured in every version of the survey instrument, which is why (for example) lines 3 and 4 are not drawn before July. Dotted lines are drawn where data values are missing, either because the attribute was not measured or because all records with values for that attribute have been excluded by filter selections.

Initially, colorblind-safe colors were chosen for the chart lines, but there was no palette that allowed non-colorblind viewers (at least 92% of the population) to easily distinguish the five different lines. As an alternative, colors that are readily discernible to typical viewers were selected, and distinct shapes are drawn on each point of the chart lines as an additional source of identification. Clicking on a

timeline key also dims the corresponding line, so that other lines can be examined more easily.

Filters were implemented to include/exclude the following factors: membership (current members, non-members, former members), demographics (Marion County, Marion-adjacent Indy metropolitan counties, all other Indiana counties, outside of Indiana), age groups (0-5, 6-12, 13-18 years), and specified dates. The visualization changes according to the checked boxes (e.g. only displaying number of respondents from within Indiana, only displaying the number of kids present ages 13-18 who are non-members of the museum, etc). The designer chose buttons rather than dropdown lists so as to allow any combination of filter options.

Barcharts

The group decided on bar graphs for age distributions as well as outreach efforts among members and non-members. The simplicity of bar charts communicated the data effectively while showing two different attributes in one visual: the percentage of membership across different age groups (for the one bar chart), and different advertisements channels (for the other bar chart).

Blue and red were chosen for members and non-members respectively. This contrast highlighted the difference between the two, where red could be seen almost as an alert to direct focused efforts towards non-members. Color blindness safety for the bar charts was assessed with the help of Color Brewer 2.0: http://colorbrewer2.org/#type=sequential&scheme=PuBu&n=3//

Map

A map was chosen to visually show the number of visitors from each state as well as from three regions within Indiana (Marion County, adjacent counties, the rest of Indiana). This allows seeing a glimpse of where visitors are mostly coming from.

The colors of the map were based on the sequential data color suggestions from colorbrewer2.org. The designer also verified the colors with ColorOracle, a color blindness simulator.

After compiling the data of the map, the designer chose red to represent Marion County due to the high number of visitors from the county and to differentiate it from the adjacent counties that had a dark hue due to their high number of visitors. The map is designed to show details of on a local and state level, this allowed for the survey data to be fully reflected in the visualization.

The map does not respond to the filter selections. It was our intent for it to do so, but we ran out of time.

Findings

Membership Interest

Of the respondents who are not currently members, only half of them expressed interest in acquiring a membership with the museum. Of the former members, one out of three respondents were interested in resuming their membership.

Age Groups

A higher number of members with kids under the age of 5 were interested primarily in the outdoor exhibit than non-members.

Interest in the outdoor exhibit was higher for members with kids between ages 6-12 than members with toddlers.

When asked whether or not the outdoor exhibit was the primary reason for their visit, responses from members and non-members with kids between ages 13-18 were spread across the spectrum.

The takeaway is that the outdoor exhibit was most appealing to parents of the age group 6-12 who are members of the museum.

Visitor Origin

Visitors respondents from Indiana were a total of 434, and 148 from outside Indiana. Outside visitors mostly came from adjacent states, where the highest number of visitor respondents were from Ohio with 28, Illinois and Kentucky with 16 respondents each, Michigan with 12, and Missouri and Kansas with 5.

The total number of visitors from Marion County was 154, adjacent counties were 140, and non-metro Indy respondents at 122. This shows that Marion County alone had more visitors than all other Indiana non-adjacent counties.

Satisfaction

Nearly all respondents expressed interest in returning to the exhibit, as well as recommending it to other people.

Outreach

For members:

- Ads at the museum appear to be the most effective across members of the museum (22%) to encourage them to visit the exhibit, whereas they were not as effective toward non-members (11%). However, online ads seem to be the least effective with (1%) for members and (2%) for non-members.
- (10%) of members reporting hearing about the exhibit through family or friends.
- Social media seems to have a higher impact on attracting members (7%) to the exhibit, compared to only (4%) for non-members.
- Also, the museum's website had an impact on (7%) of the member responses.

- (5%) of members reported a story on the media and billboards to be the way they learned about the exhibit.

For non-members:

- Friends and family or word of mouth seem to have the highest influence on non-members to visit the exhibit (16%), compared to (10%) for members.
- Second in order come the museum's website and ads at the museum at (11%) each.
- TV commercials and social media came in third, with (4%) of non-members reported them to be their sources of hearing about the exhibit.
- Lastly, only (2%) of non-members reported they heard about the exhibit via billboards.

In general, most respondents said the reason for their visit was not primarily to visit the outdoor exhibit.

Weather

The data does show some correlation between weather and time spent in the outdoor exhibit. On June 16th we see it was reported by 27 people that few spent more than 60 minutes outdoors, where the weather was sunny and at a high 82 degrees and the dew point was at 70 degrees (indicating high humidity). This was similarly true for the 9th of June (22 respondents) and 14th of July (42 respondents) with temperatures of 79, 80 degrees respectively.

Also, the proportion of respondents spending over 60 minutes outdoors increased on lower temperature days such as June 2nd (25 respondents), and lower dew point days such as July 19th (35 respondents).

Reflections

What did we learn?

- Real datasets are messy.
- A large amount of time is spent understanding the data, and preprocessing it.
- Visualizations can always be tweaked (making it hard to decide when to stop).
- Code collaboration is a skill that requires training and practice.

What limitations did we encounter?

- Inconsistency of survey instruments. The dataset included at least 5 different instruments, with only a handful of common questions among them. Also, of the questions asked, many were left unanswered by the visitors.
  Hence, findings were based on a partial sample of the museum visitors.
- Text boxes used in surveys are always prone to spelling errors, which makes for a laborious task to process the data quantitatively.

What would we do in the future?

- Produce a standalone tool for the client, where they are able to plug in the data and have it reflect on the visualizations in real time.
- Add an analysis summary box; where insights are provided along with the visualizations.
- Apply filtering to the map, for example:
    - When “Yes” is clicked for the membership filter at the top of the page, only the number of respondents who are members would reflect on the Indiana map.
    - If the “Outside Indiana” is clicked, only the states map would show.

- Show one map with multiple views; with zoom-in/zoom-out buttons, where the users choose the areas they want to examine, and level of detail (county vs state). Also, the map would expand to a universal view based on the data.

Credits

Historical weather data were obtained from Weather Underground:
https://www.wunderground.com/

The weather icons were obtained from the Weather Icons Project, by Eric Flowers:
http://weathericons.io/

Visualizations were created using D3.js version 4, Plotly.js, and stack.gl.
https://d3js.org/
https://plot.ly/javascript/
http://stack.gl/