Assessing the Quality of Tourist Experiences in Venice, Italy

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Abstract

The city of Venice, Italy experiences massive surges of tourists into their city on a daily basis for a total of 23 million tourists entering the city limits every year. The tourists cause overcrowding in the city that results in blocked roads, slow-moving traffic, and impassable bridges. Nonetheless, tourists continue to visit the city of Venice. This project focuses on researching the elements of the tourist experience. We designed a survey that will be administered to the tourists of Venice to assess their overall tourist experience. This information should answer questions of how tourists are affected by over-tourism in Venice. Additionally, we will redesign an online tool used to characterize and estimate the tourists entering Venice on a daily basis.

VENICE TOURIST EXPERIENCE [SURVEY]

Thomas King, Mike Laks, Ilona Regan, Connor Anderson

WPI
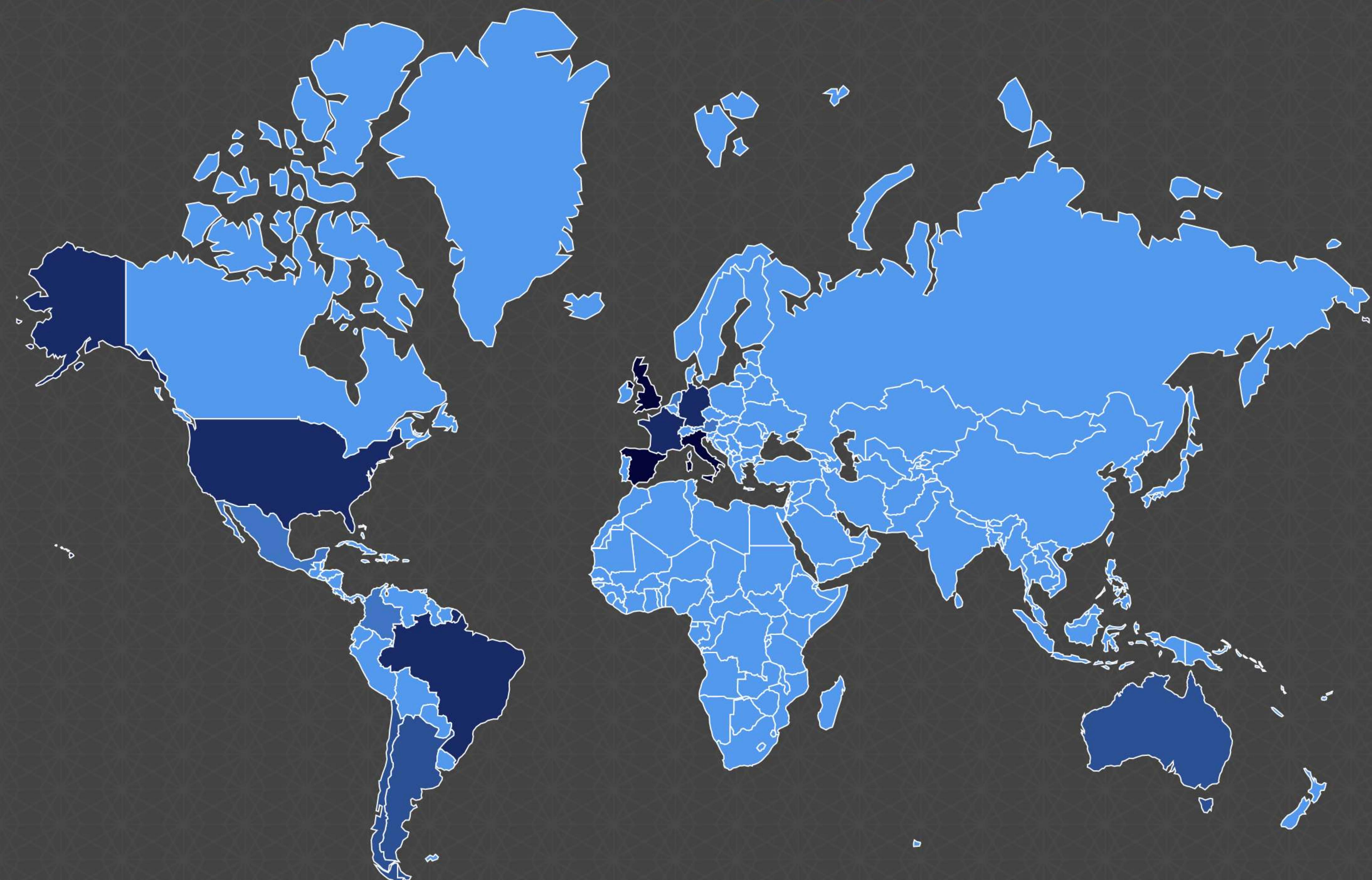
## TWO TYPES OF VISITORS

36% Day-Trippers

64% Overnighters

FROM 35 COUNTRIES
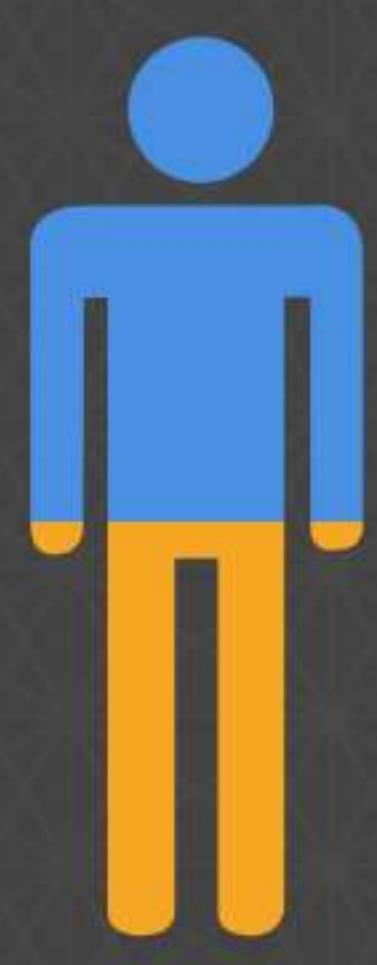
38-QUESTIONS SURVEY

54% Women

46% Men

Language of Survey Administration

- Italian (17.35%)
- French (7.82%)
- Spanish (21.43%)
- English (49.32%)
- German (4.08%)

61% Overnighters

39% Daytrippers

Age Distribution of Respondents
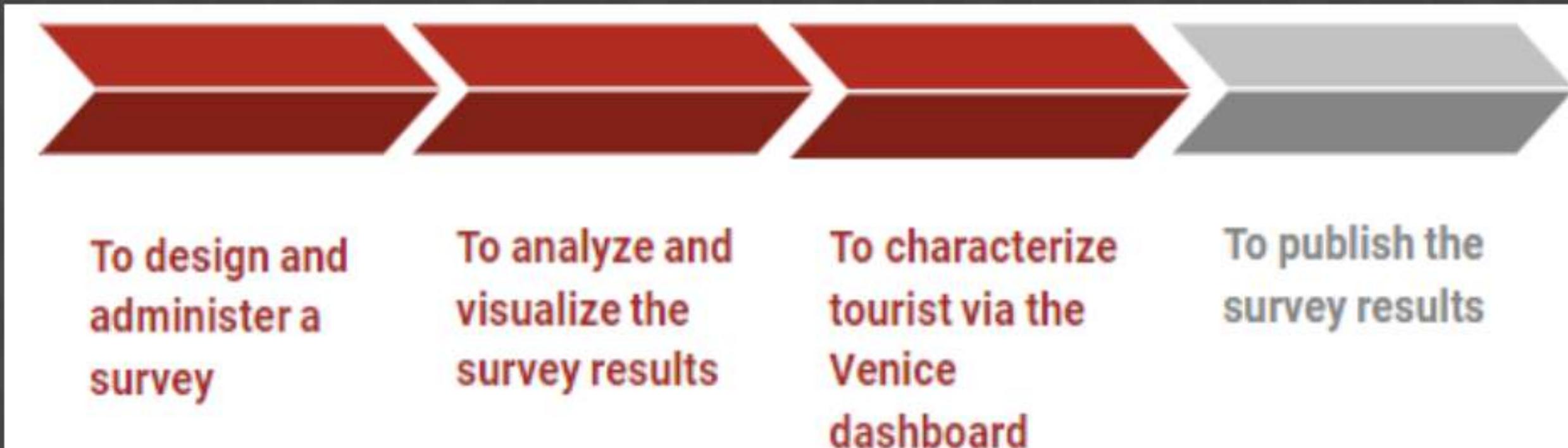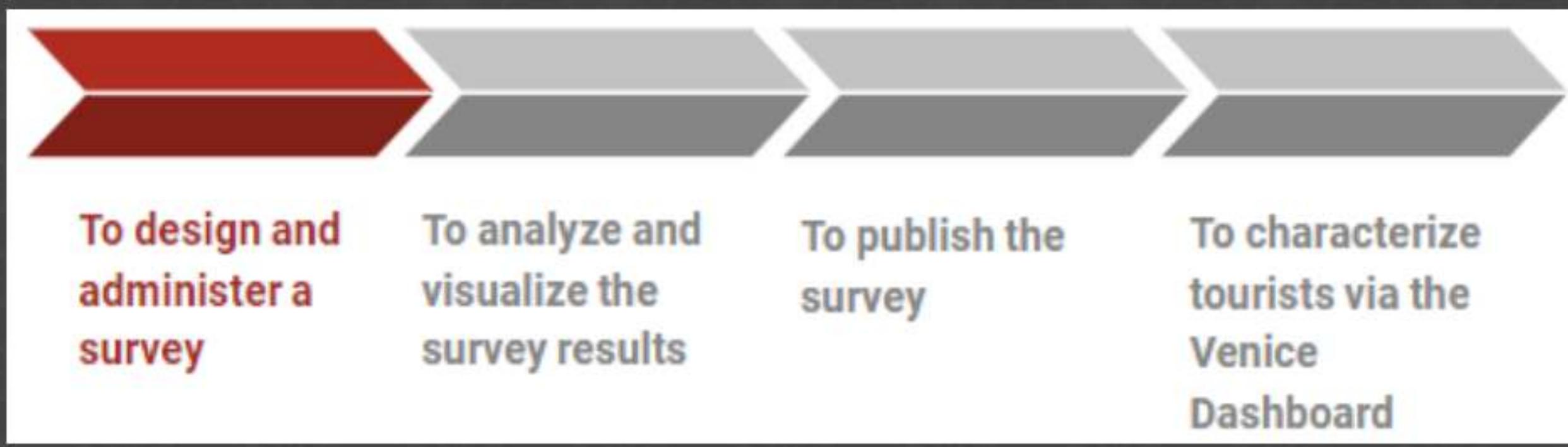
- 18 - 24 (17.69%)
- 25 - 34 (31.29%)
- 35 - 44 (15.31%)
- 45 - 54 (11.90%)
- 55-64 (10.88%)
- 65 or over (12.93%)
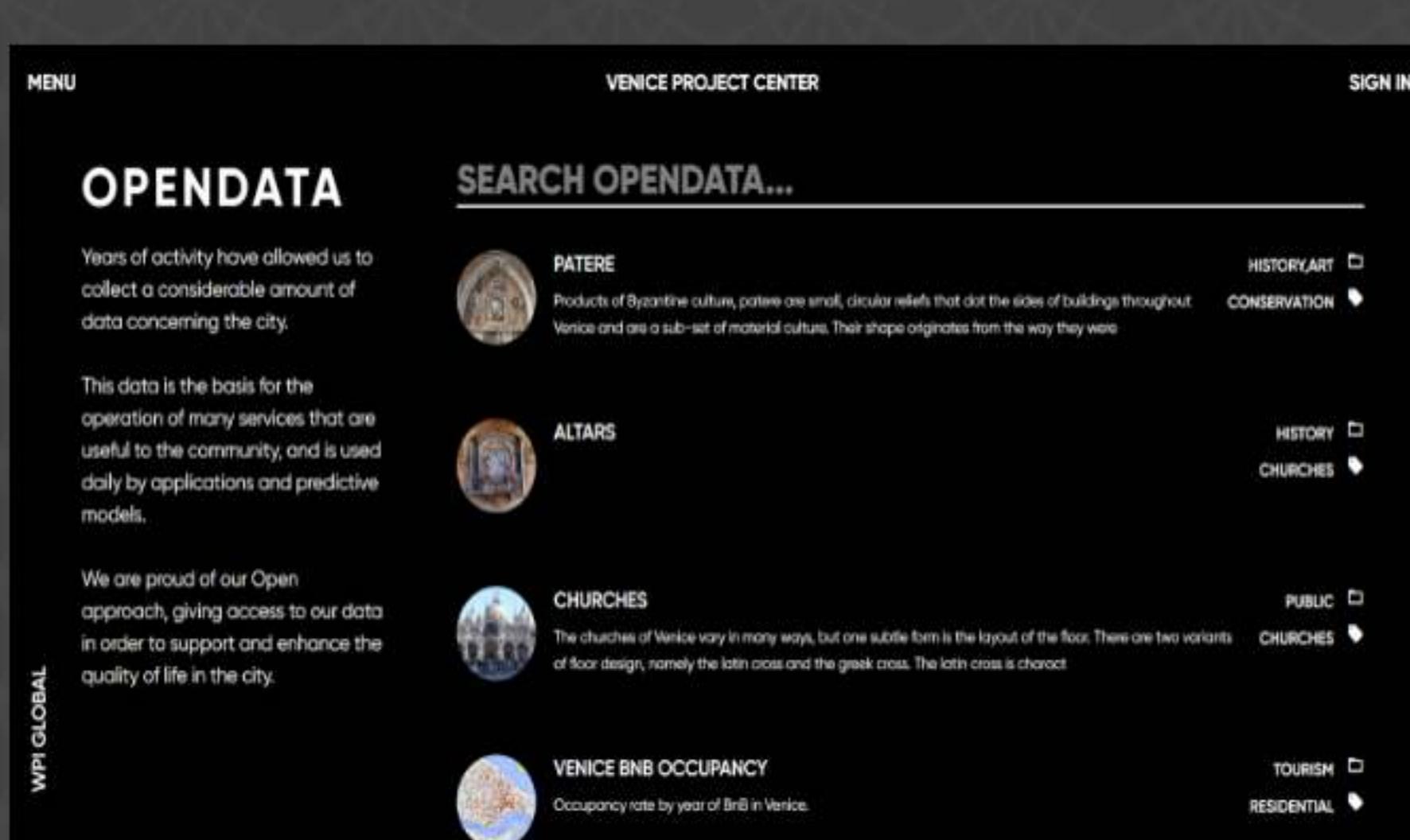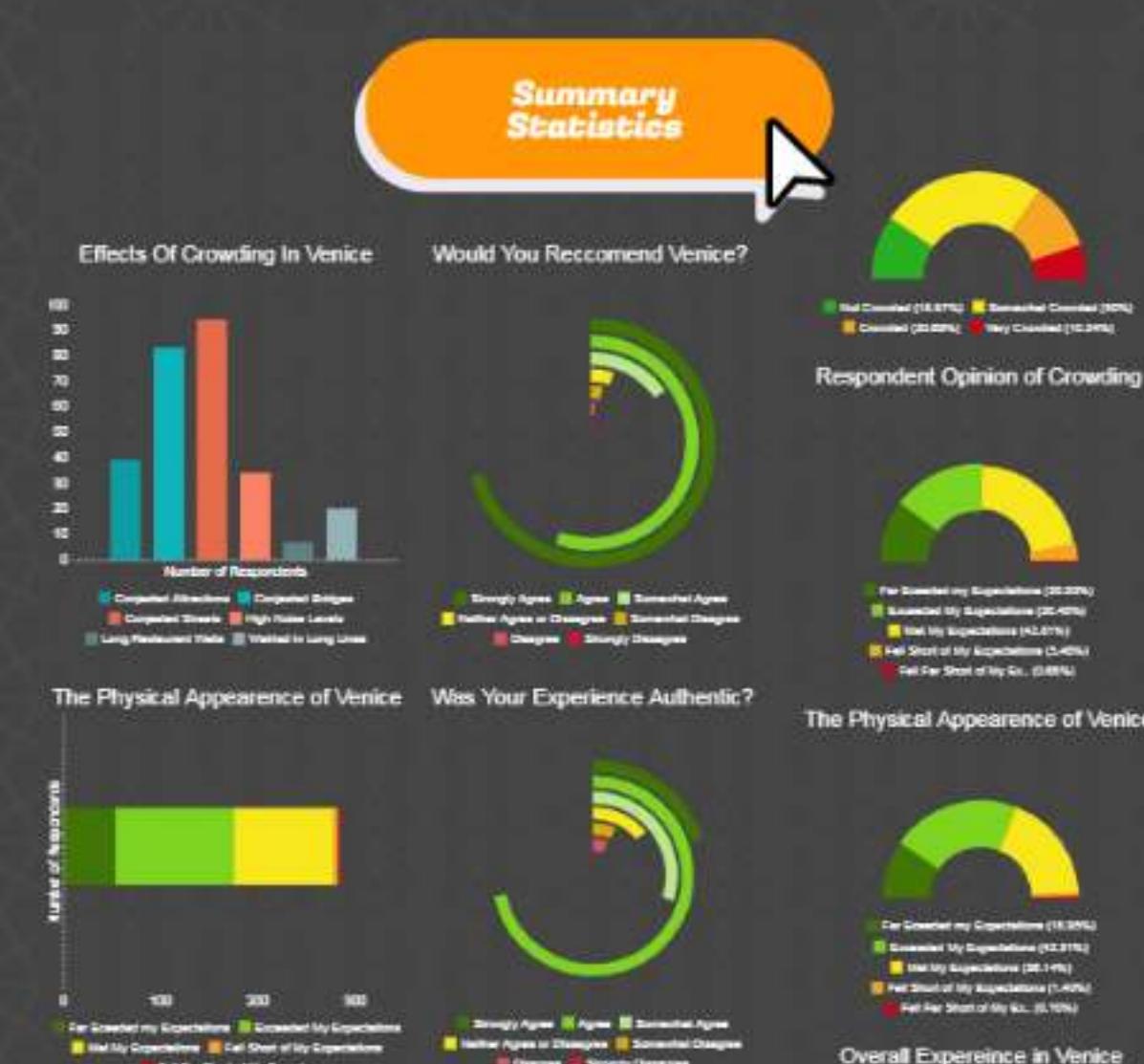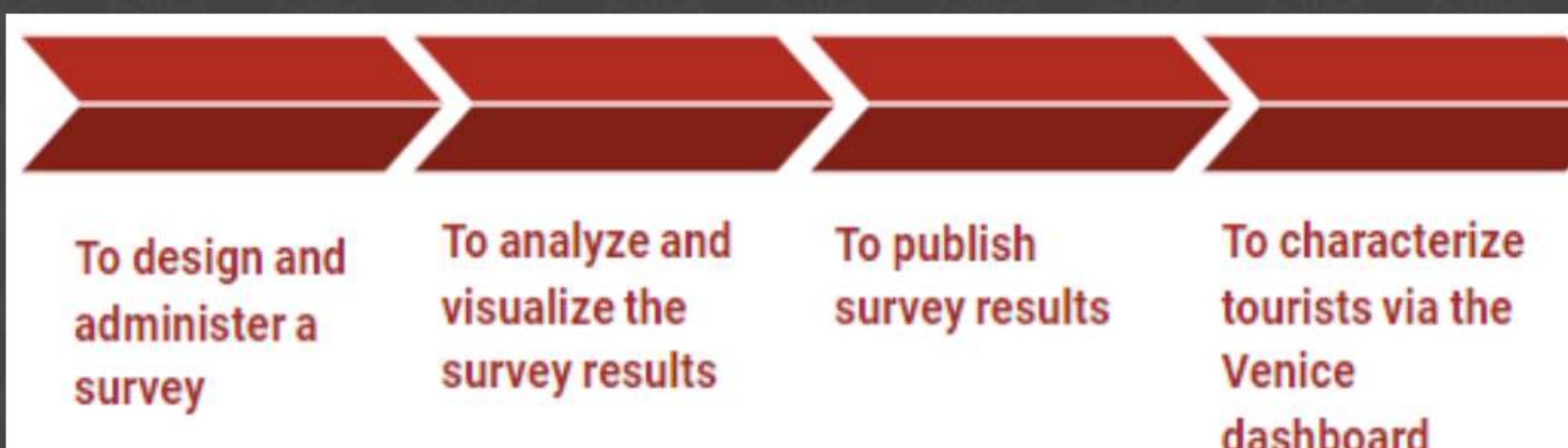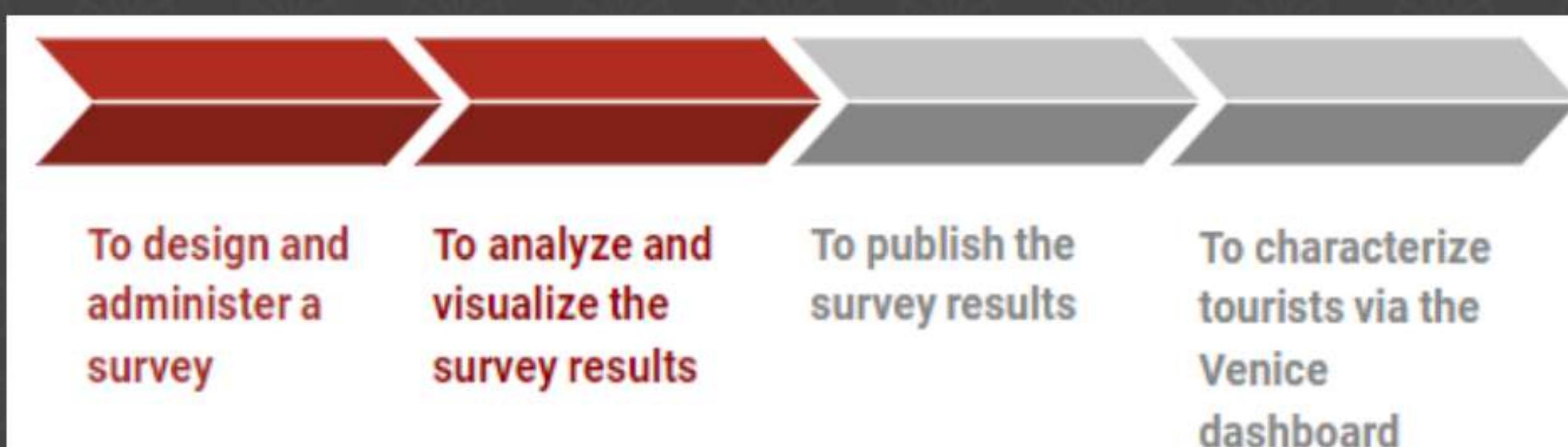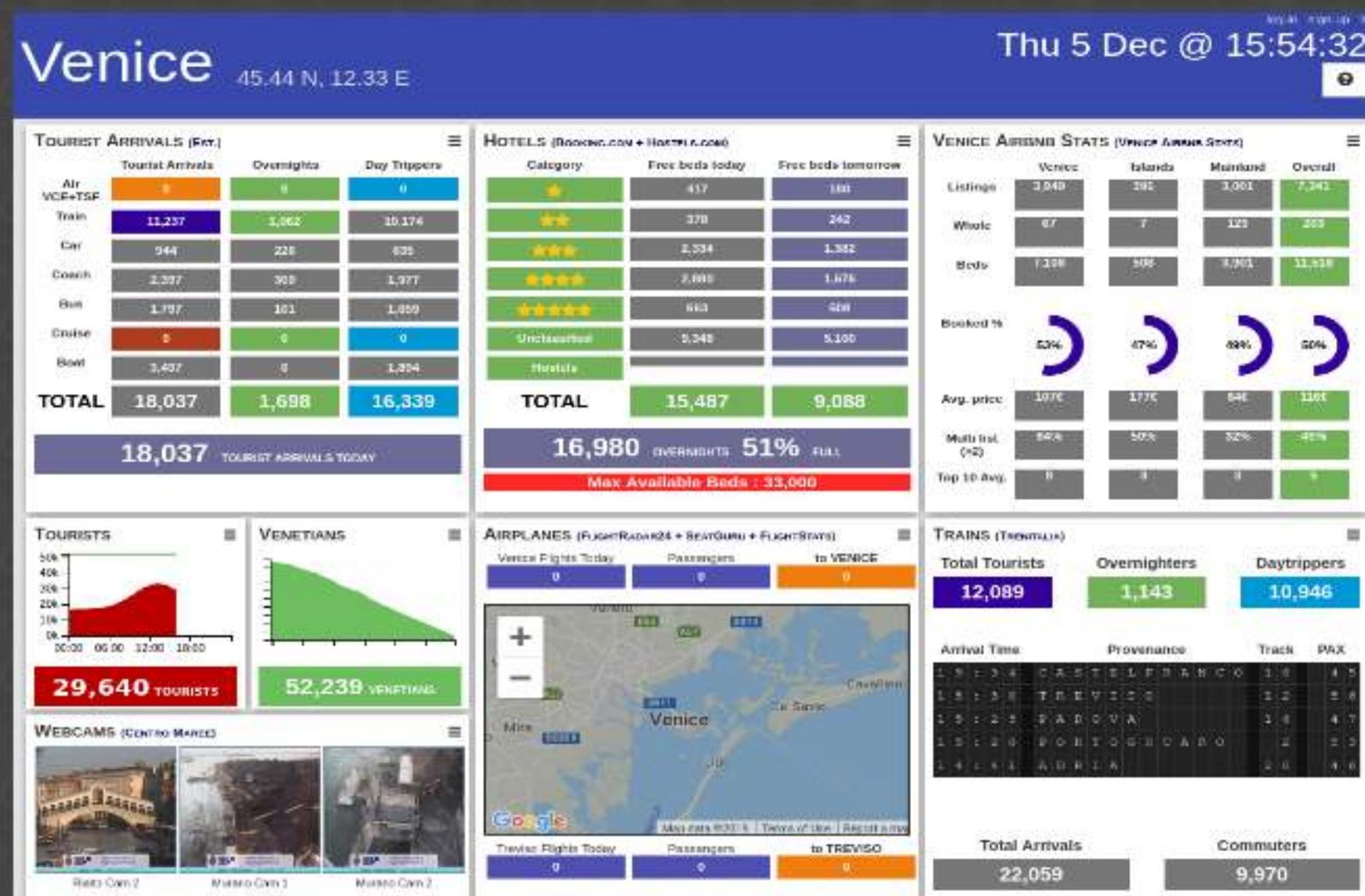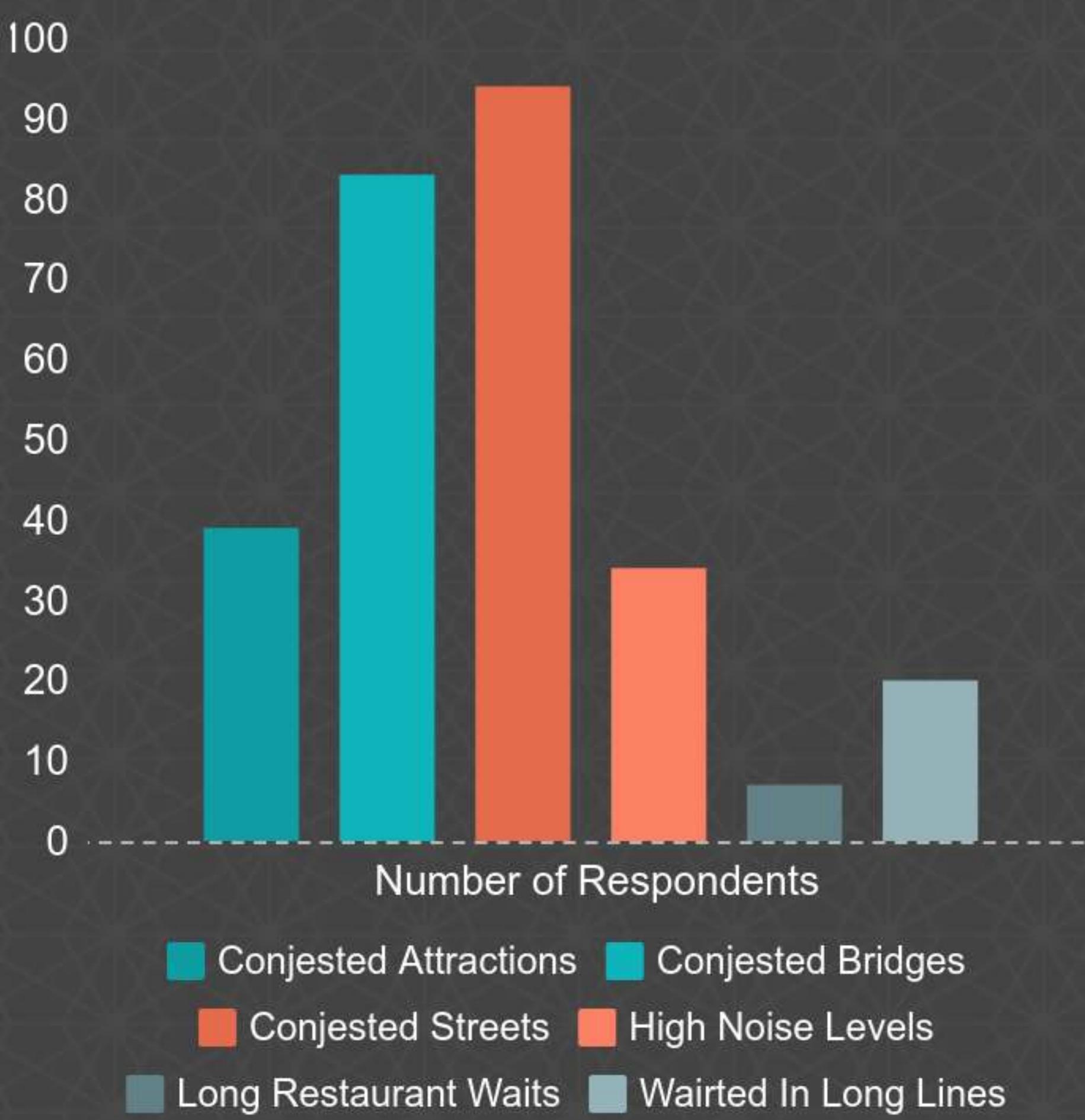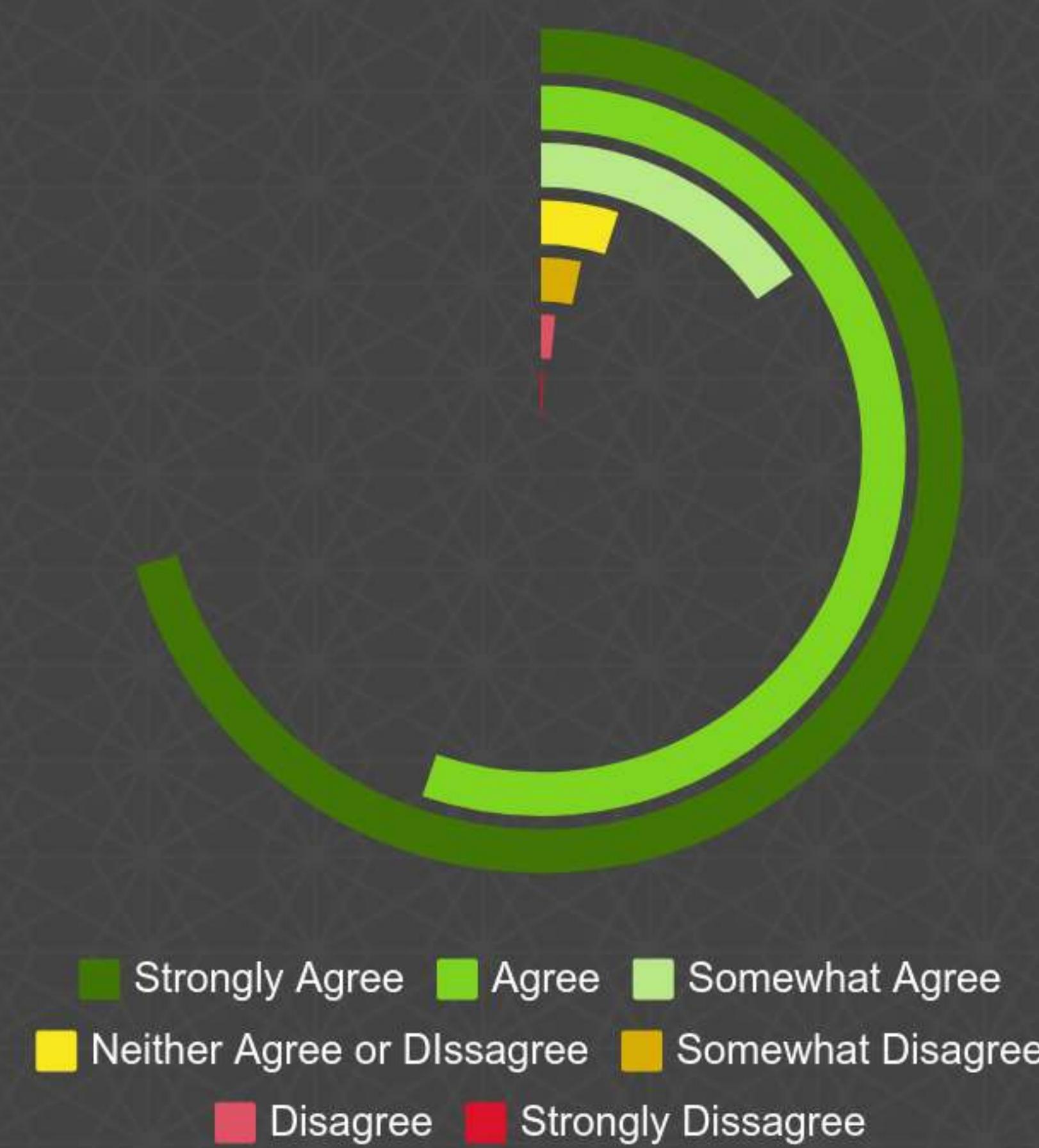
Summary Statistics

Effects Of Crowding In Venice

Number of Respondents

- Conjested Attractions
- Conjested Bridges
- Conjested Streets
- High Noise Levels
- Long Restaurant Waits
- Wairted In Long Lines

Would You Reccomend Venice?

- Strongly Agree
- Agree
- Somewhat Agree
- Neither Agree or DIssagree
- Somewhat Disagree
- Disagree
- Strongly Dissagree
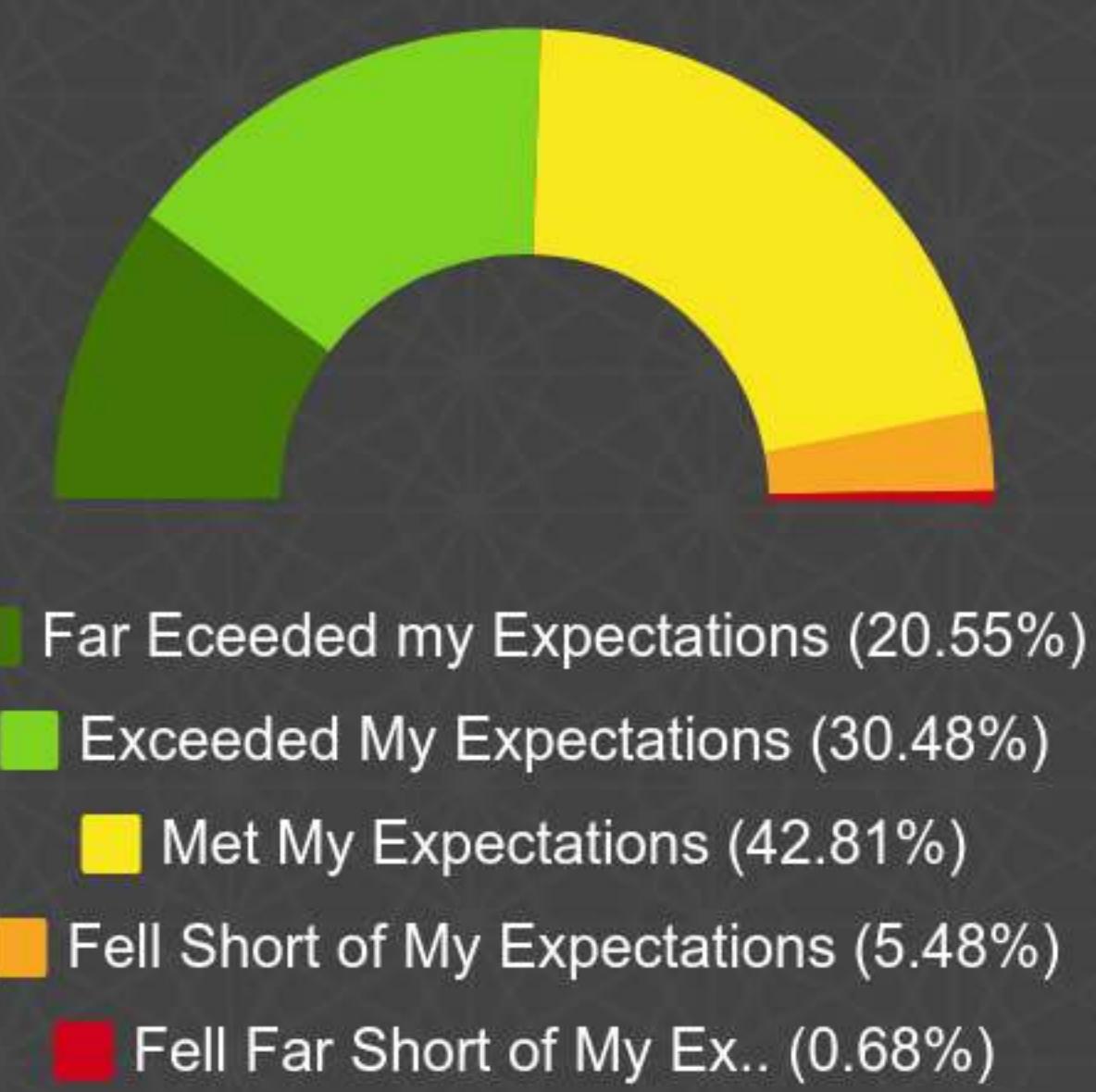
Respondent Opinion of Crowding
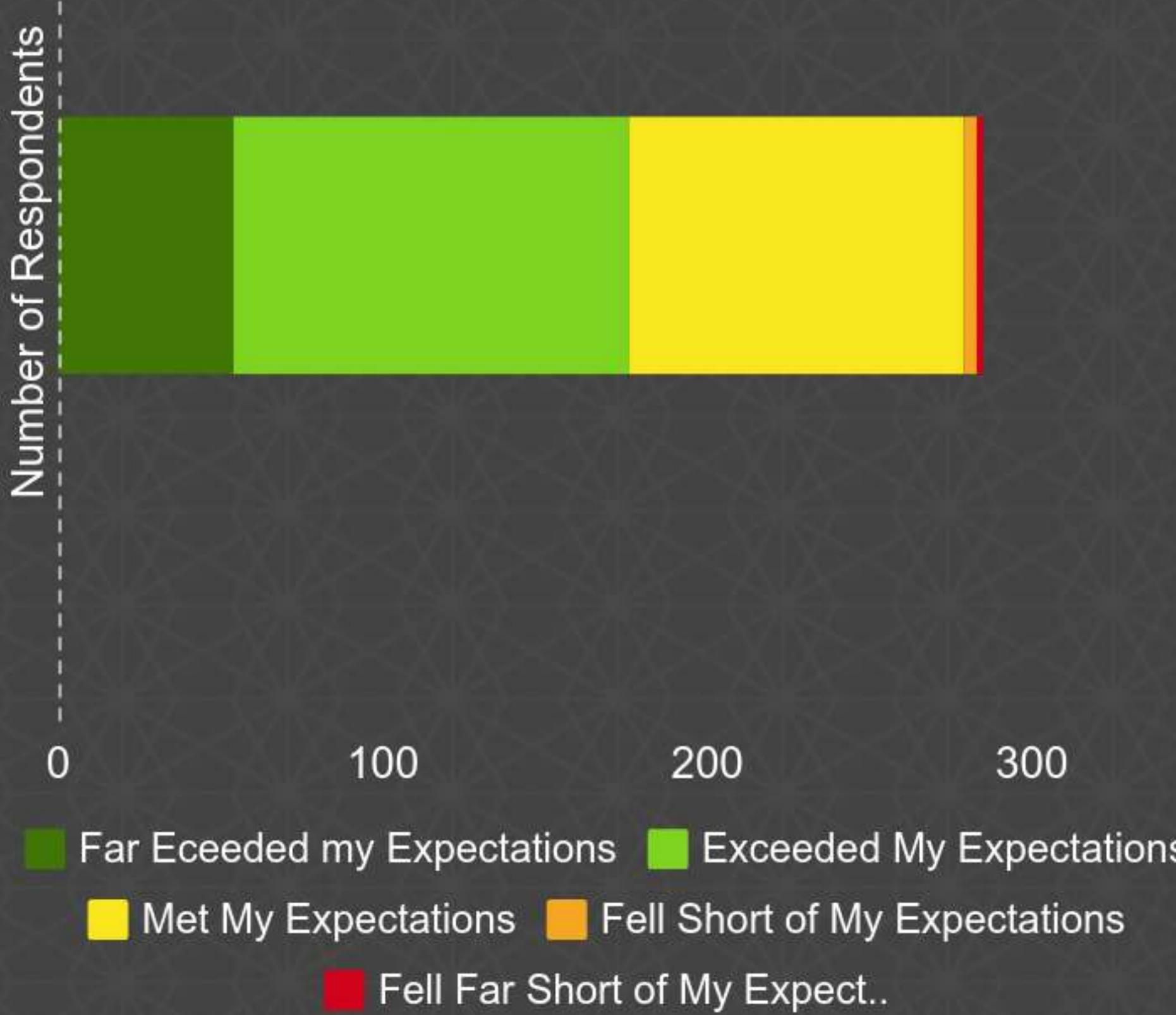
- Not Crowded (18.97%)
- Somewhat Crowded (50%)
- Crowded (20.69%)
- Very Crowded (10.34%)

The Physical Appearence of Venice

Number of Respondents

0   100   200   300

- Far Eceeded my Expectations
- Exceeded My Expectations
- Met My Expectations
- Fell Short of My Expectations
- Fell Far Short of My Expect..

Was Your Experience Authentic?

- Strongly Agree
- Agree
- Somewhat Agree
- Neither Agree or DIssagree
- Somewhat Disagree
- Disagree
- Strongly Dissagree

The Physical Appearence of Venice

- Far Eceeded my Expectations (20.55%)
- Exceeded My Expectations (30.48%)
- Met My Expectations (42.81%)
- Fell Short of My Expectations (5.48%)
- Fell Far Short of My Ex.. (0.68%)

The Physical Appearence of Venice
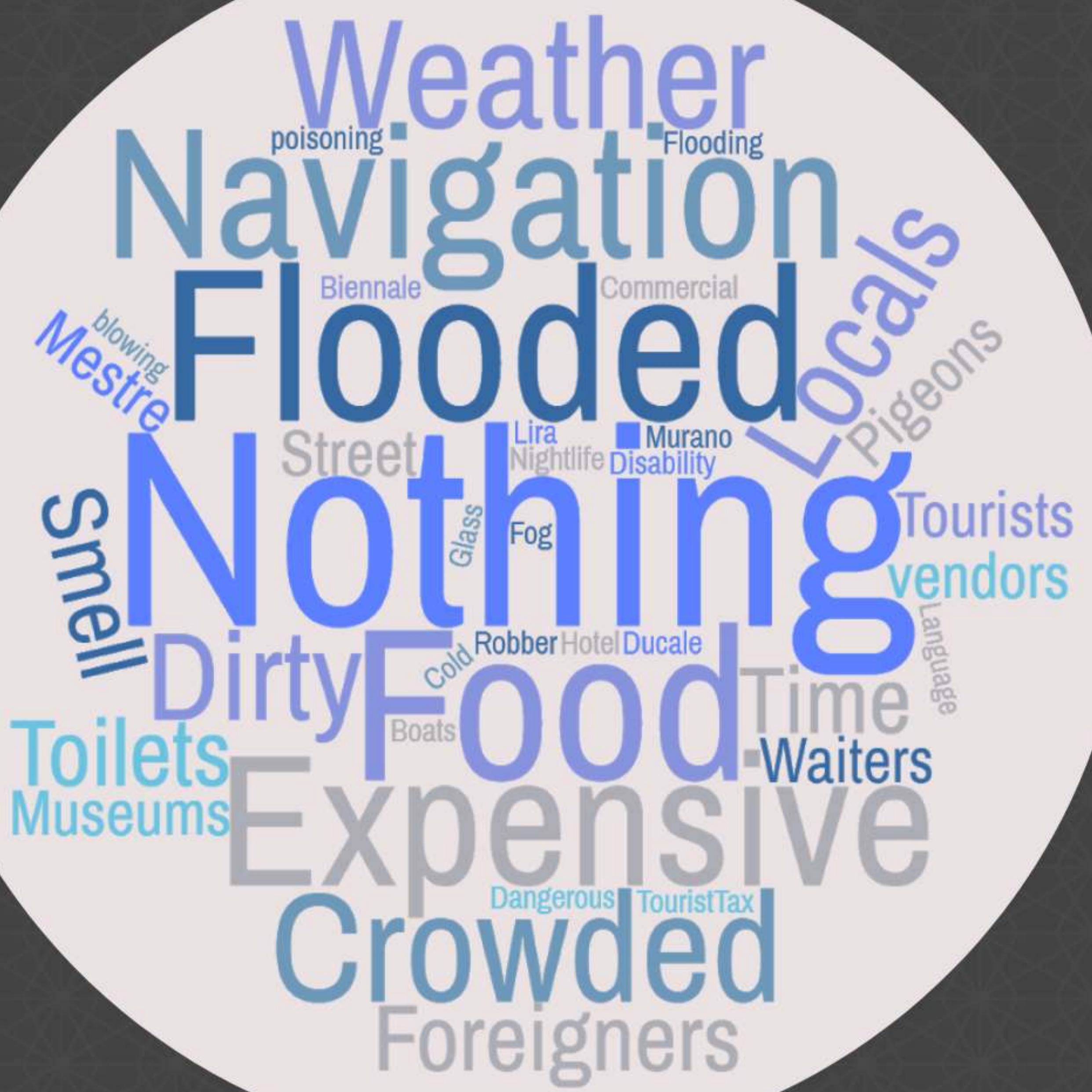
- Far Eceeded my Expectations (18.95%)
- Exceeded My Expectations (42.81%)
- Met My Expectations (36.14%)
- Fell Short of My Expectations (1.40%)
- Fell Far Short of My Ex.. (0.70%)

Overall Expereince in Venice

Respondent
Open Responses!

Squares
StMark's
Food
Beautiful
Streets
Churches
Art
Historic
Monuments
Museums
Water
Bridges
Murano
Burano
History
Tedeschi
Rialto
Ambiance
Super
Boats
View
Canals
City
Night
Culture
Opera
Romance
Walk
Biennale
Doge'sPalace
Architecture
Gondolas

Weather
poisoning
Flooding
Navigation
Biennale
Commercial
Locals
Flooded
Pigeons
Mestre
blowing
Lira
Murano
Disability
Tourists
Street
Nightlife
vendors
Smell
Glass
Fog
Language
Nothing
Dirty
Cold
Robber
Hotel
Ducale
Boats
Food
Time
Waiters
Toilets
Museums
Expensive
Dangerous
TouristTax
Crowded
Foreigners

Architecture
AcquaAlta
Romantic
Excellent
Churches
Unexpected
Magnificent
Weather
Unusual
Interesting
Surprising
Tourist
Impressive
Cultural
Historic
Good
Culture
Authentic
Historical
Art
Pretty
Wet
Friendly
Lovely
Bridges
Quiet
Charming
Relaxing
Old
Amazing
Exciting
Busy
Beautiful
Gorgeous
Flooded
Fabulous
Different
Fun
Unique
Magical
Water
Food
Nice
Great
Fantastic
Crowded
Incredible
History
City
Wonderful
Spectacular
Fascinating
Awesome
Expensive
Breathtaking

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Authorship

Connor Anderson was the primary author of all portions of this report that deal with the Venice Dashboard, including background, methodology, and conclusion. He was mainly responsible for working on the dashboard, fixing broken widgets, and writing about them. He also helped edit the full paper. He translated the survey and final presentation into Italian.

Thomas King was the primary creator of the infographic and executive summary. He contributed writing to the introduction, the methodology of survey design and administration, the recommendations, and designed the infographic. He helped to edit the full paper.

Michael Laks was the primary author of the introduction and the background on assessing tourist experience. He created numerous data visualizations. He also helped to edit the full paper.

Ilona Regan was the primary author of the background on tourists in Venice and the methodology of survey administration, data analysis, data visualization, and publishing results. She analyzed the data and wrote the conclusion. She acted as one of the main editors of the report.

All group members contributed equally to research for the report and to the creation of the survey.

1.0 - Introduction

　　　Venice is a set of 118 islands with a decreasing permanent residential population and a growing number of more than 60,000 tourists per day (UNESCO World Heritage, n.d.; Seraphin, Sheeran, & Pilato, 2018). The city of Venice struggles to manage the increasing number of tourists who are causing permanent damage to the cities' stairs and bridges (Connor, Hanna, Wingerter, & Van Rensselaer, 2015). Venetian economy is currently based around tourism and having a better understanding of the experiences and activities of tourists will allow Venice to better manage the millions tourists.

　　　The city of Venice publishes the *Annuario del Turismo* [Yearly Tourism Report], which details the demographics, accommodation preferences, transportation estimates, and overall presence of tourists in the municipality (Città di Venezia, 2017). Additionally, previous Venice Project Center (VPC) projects designed a tool, called the Venice Dashboard, which aggregates website data to provide daily estimates of tourists in Venice through a web interface (Couvertier, A., Egan, F., & Bremner, J. S., 2016). These publications from the City of Venice and the Venice Project Center do not include data about the tourist experience.

　　　Researchers have done extensive work to study tourism in cities around the world. This research has led to literature that classifies the tourist experience as a multiphased combination of individual experiences, memories, and emotions related to a place (Noy, 2007). These phases include the experiences a tourist has during the preparation, travel, and the entirety of their stay. In the city of Venice there has been no work done to quantify tourists' experiences using this conceptual research model. Surveying tourists using questions that assess the phases of the tourist experience allows us to quantify tourist behaviors and understand their thoughts about the city of Venice. Due to the all encompassing nature of the tourist experience, understanding the tourist experience is crucial in understanding the current state of and impact of tourists on Venice.

　　　The goal of this project is to understand how tourism affects residential and excursionist tourists in Venice by assessing the quality of their tourist experience. We accomplish this by designing and administering a multilingual survey to gather data on the tourist experience in Venice, Italy. We analyzed, visualized, and published our survey results to gain insight into the tourist experience. Then, through updating the Venice Dashboard, we quantify the number of tourists in Venice for future use with additional surveys.

2.0 - Background

The city of Venice is located in the Veneto region of northeastern Italy. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) lists the city and its lagoon as a World Heritage site because of its high concentration of artistic works and historical significance (UNESCO World Heritage, n.d.) . Venice is made up of 118 small islands interconnected by 435 bridges and 182 canals (Gardner, B., Bossalini, D., Wills, M., & Mathews, T., 2013; UNESCO World Heritage, n.d.). The historic island of Venice has one train station, Stazione di Venezia Santa Lucia, and one bridge into the city that accommodates cars and busses. The Vaporetto is a water bus and is Venice's only public transportation throughout the city. Due to the lack of roads and paths for cars and bikes, walking is the primary form of mobility in Venice. This chapter will explore the concept of tourists, their experiences, and characteristics of tourists in Venice.

2.1 - Tourism in Venice

Tourism is defined as "leisure consumption and participation with travel and accommodation" (Williams and Buswell, 2003, p.5). The 1880s marked the exponential trend of tourism in Venice (Laven, 2006). As it stands, between 1951 and 2015, there has been a 68% decrease in residents in Venice and a 504% increase in tourists (Carrera, 2016). As these numbers continue to rise, so do the adverse effects of tourism on the city, ranging from increases in vandalism and crime to congested and polluted streets and canals (Seraphin et al., 2018). The congestion due to tourists has caused Venetian officials to take action with new rules and fines for tourists, ranging from a €200 fine for eating or drinking while sitting on the ground at designated sites to a €450 fine for swimming in the canals (Dickinson, 2018). The growth of the tourism industry also causes replacement of residential areas and local businesses with tourism accommodations, traffic congestion, and damage to historical sites (van der Borg et al., 1996).

In the city of Venice, there are approximately 63,000 beds in places such as hotels, bed and breakfasts, and other alternative housing units compared to the near 63,000 tourists entering the city on average each day, creating a near one-to-one ratio (Città di Venezia, 2017; UNESCO World Heritage, n.d.). They visit some of the popular tourist sites, including Saint Mark's Basilica, the Doge's Palace, Santa Maria Della Salute. With an 18.4% increase in tourists arriving from 2013 to 2017 and an increase of 19.5% in tourists staying overnight from 2013 to 2017, tourism in Venice shows no signs of slowing its growth (Città di Venezia, 2017, p.17). When considering overnight tourists and those who only stay for the day, it is important to define arrivals and presences. Presences count as the number of nights spent in the city whereas arrivals counts the number of physical people entering the city (Città di Venezia, 2017, p.12). Therefore, all presences are overnight tourists, but not all arrivals are overnight tourists. As shown in Figure 1 below, the summer months of June, July and August are when the tourist presences in Venice peak. Between the months of October and November the tourist presence in Venice falls significantly until it starts to pick back up in the spring.
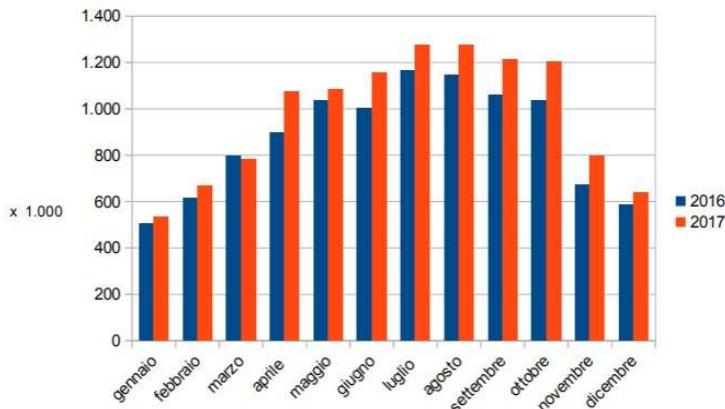
Figure 1: The monthly attendance trend of presences in 2017 in Venice (Città di Venezia, 2017)

2.1.1 - Residential Tourists

　　　Residential tourists, or "overnighters", are tourists that stay overnight in the municipality of Venice. Residential tourists can stay in three sections in the city of Venice: terraferma [mainland], lido [shore], which includes Malamocco, Alberoni, and Pellestrina, or città storica [historical city] which includes Murano, Burano, and other Venetian minor islands. These sections are illustrated in Figure 2. Foreigners are more likely to stay in città storica whereas Italians are more likely to stay in terraferma (Città di Venezia, 2017, p.38). Staying in città storica allows for tourists to be on the islands where the major tourist attractions are located. Alternatively, staying overnight in terraferma requires using a water taxi or bus to get to città storica.
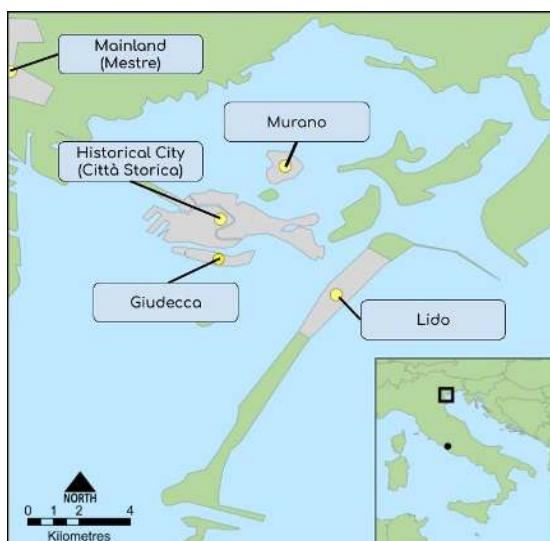
Figure 2: A map of the region of Venice, Italy depicting the different sections.

　　　Residential tourists can stay in traditional hotels or non-traditional housing. From 2013 to 2017, 900 more beds across three new hotels have been added to the city of Venice. This addition has resulted in 40% more beds in città storica, 10% more beds in lido, and 50% more beds in terraferma (Città di Venezia, 2017, p.48). Of all residential tourists in the year 2017, about 68% stayed in a traditional hotel (Città di Venezia, 2017, p.15). Residential tourists come from the following countries most frequently, as shown in Figure 3: Italy, the United States, the United Kingdom, France and Germany, Spain, China, Australia,

3

Canada, Brazil, Japan, South Korea, and Argentina. Exact frequencies can be seen below (Città di Venezia, 2017, p.40).

Top 13 Countries Visiting Venice, Italy in 2017
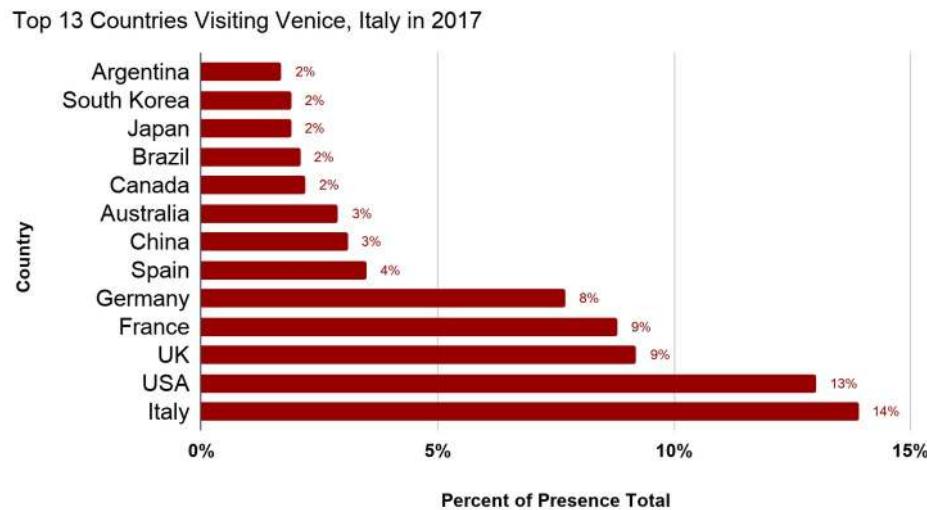
Figure 3: Most frequent countries that visit overnight to Venice, Italy (Città di Venezia, 2017, p.44)

2.1.2 - Excursionists

Excursionists, or "daytrippers", are tourists that enter their destination city for only a day at a time, but their residence is elsewhere. For the purpose of this paper, people that stay overnight in *terraferma* and enter the historical city of Venice are considered excursionists. This is because we are considering the historical city of Venice to be the destination of tourists; therefore, people staying on *terraferma* will only enter the historical city limits for up to a day at a time. Excursionists are less likely to buy meals, overnight services, and other items (Russo, 2002). Many walk in large groups around Venice and stop at interesting locations. This makes it difficult for others to navigate Venice's streets (Connor, Hanna, Wingerter, & Van Rensselaer., 2015).

A specific type of excursionist tourist is the cruise ship passenger. Venice receives two and a half million tourists from cruise ships every year (González, 2018). Cruise ship passengers are characterized as excursionists because they do not stay overnight in the city, but still visit for some time during the day.

2.2 - Assessing the Tourist Experience

The tourist experience is a complex conglomeration of experiences that encompasses all the parts of a tourist's trip. The experience is unique for every tourist, as the key phases of the overall tourist experience defined below varies for each person.

2.2.1 - Defining Tourist Experience

The narrative of the interaction between the tourist and the destination can be defined as the tourist experience (Stamboulis & Skayannis, 2003). It is a combination of individual experiences, memories, and emotions related to a place (Noy, 2007). The interpretation of tourist experiences is dependent upon each individual's circumstances (Jennings et al., 2006). Therefore, a tourist's emotions at a particular moment can affect the interpretations of their experience, resulting in two tourists having different interpretations of the same activity in the same place at the same time (Kim, Ritchie, & McCormick, 2012).

The tourist experience is made up of three individual phases, each phase having a different level of importance to the individual (Clawson & Knetsch, 1966). Figure 4 below shows the three phases of the tourist experience which are anticipation, travel to and from site, and on-site activities. Anticipation is the first phase of the experience and includes the research and planning of a trip. In this phase, the tourist builds expectations about their

experience. If the site does not live up to their pre-arrival expectations, the trip can become a disappointment (Quan & Wang, 2004). The second phase of the tourist experience is travel to and from a site. This phase consists of the physical act of travel and everything that happens during travel. The third phase of the tourist experience is on-site activity. It is the act of visiting attractions, eating at local restaurants, and any other activity a tourist decides to partake in.

The Tourist Experience

Phase 1	Phase 2	Phase 3
Anticipation Planning Expectations Built	**Travel To and From** + Physically Traveling +	**On-Site Activity** Enjoying Tourist Attractions Eating at Local Restaurants Expectations Met or Failed
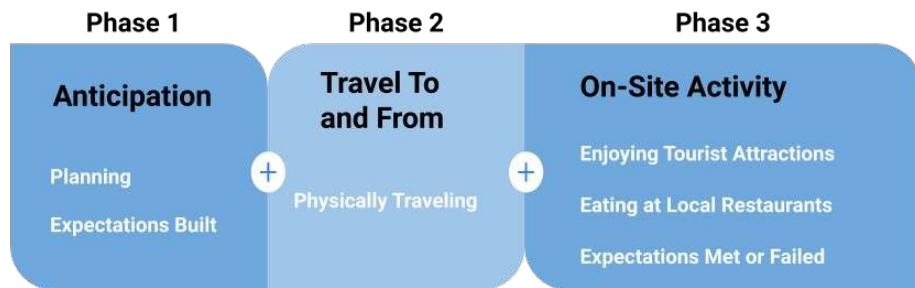
Figure 4: A graphic showing the three phases of the tourist experience (adapted from Morgan, Dr. M., Lugosi, Dr. P., & Ritchie, Prof. J. R. B., 2010, p.8).

Each on-site activity a tourist partakes in can also be described by the three phases of the overall tourist experience. For example, if a tourist decides they want to visit a local attraction such as Saint Mark's Basilica in Venice, they feel anticipation while planning the outing and build expectations in this phase of how the experience will be. Then in the second phase, the tourist travels to and from the attraction; this would be walking or taking public transportation from the tourist's accommodation to the attraction. The third phase is the actual act of visiting the attraction and this is where the expectations the tourist built-in phase one are evaluated and make or break the tourist's experience. The three phases of the overall tourist experience is made up of these smaller three phased experiences.

Figure 5 is a conceptual model of the tourist experience that incorporates the three main phases of the experience defined above and the other influential factors that can affect this experience (Morgan, Lugosi, & Ritchie, 2010, p.8). The tourist's social background, which includes their previous knowledge, memories, perceptions, and emotions, shapes a tourists expectations and influences the way that the individual experiences a place (Morgan, Lugosi, & Ritchie, 2010, p.10). The tourist experience then changes a tourist's social background once experiences are complete.
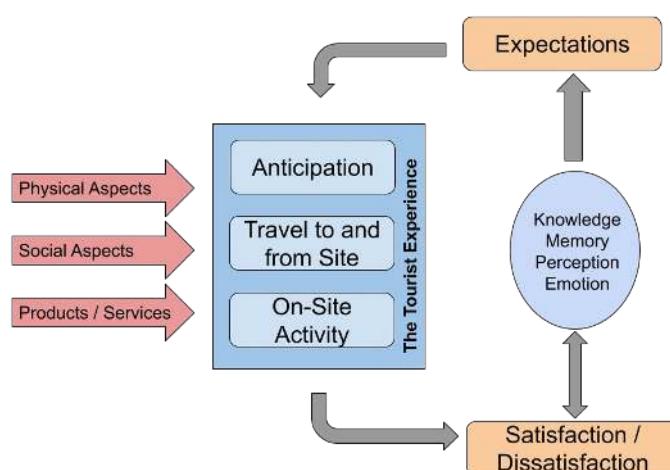
Figure 5: Figure 5: The tourist experience conceptual model of influences and outcomes (Morgan, Dr. M., Lugosi, Dr. P., & Ritchie, Prof. J. R. B., 2010, p.8)

The overall tourist experience has influential factors that affect the three phases discussed. Each phase is influenced by the person's social background and previous knowledge, expectations, and travel experiences (Morgan, Lugosi, & Ritchie, 2010, p.7). Additionally, physical aspects, social aspects, and products and services influence the tourist experience (Morgan, Lugosi, & Ritchie, 2010, p.8). Physical aspects include the condition, sights, and sounds of the destination. Social aspects include the interactions that tourists have with other people. The overall attitude and sense of place fostered by the local population have a significant effect on the tourist's experience (Jennings et al., 2006). Products and services include the experiences at local restaurants and stores. These are the most commonly studied type of influence on tourist experience because the data is used to improve the service industry.

2.2.2 - Surveying the Tourist Experience

The majority of tourist experience research is done using quantitative methods (Morgan, Lugosi, & Ritchie, 2010, p.83). Tourist experience research is often motivated by attracting consumers to experience-oriented products and increasing market share (Morgan, Lugosi, & Ritchie, 2010, p.81). The problem is that existing systems to measure customer experience fall short of attempting to understand the experiential factors that influence customer experience (Kim, Ritchie, & McCormick, 2012)

When assessing the tourist experience, it is essential to consider the cyclical nature of the three phases of anticipation, travel, and on-site activity of the tourist experience. Investigating a single aspect of the experience leads to an incomplete understanding of the experience as a whole. To assess anticipation, researchers must gauge tourist expectations. Research has found that if tourist expectations are met or surpassed, satisfaction occurs but if their expectations are not met, dissatisfaction occurs (Morgan, Lugosi, & Ritchie, 2010, p.13). Assessing the travel to and from phase consists of assessing the physical aspects of the travel experience. Previous research has focused on the main legs of travel of tourists (i.e their flights to and from a destination), but focusing on the elements of travel such as walking about the city will allow for a more full understanding of the tourist experience. The final stage of the tourist experience to asses is the on-site activity of tourists. In an extensive review of literature on tourist experience, we found that little research has been done to study the effect of tourists on other tourist's experience in Venice (Ritchie & Hudson, 2009). Our research varies from past studies because we want to understand how tourists are affecting others' tourist experiences.

2.3 - The Venice Dashboard

The Venice Dashboard is a dashboard provided by City Knowledge's PlaceKnowledge Dashboard platform. The CK Dashboard is a platform that provides a set of widgets used to collect and display information about cities. The primary concern of this paper is the Venice Dashboard, but the widgets are meant to be generalized to be used for multiple cities. Eight widgets are featured on the Venice Dashboard containing information pertaining to tourism in the city. Each widget with its title and the information it produces can be seen in Table 1.

Widget Title	Information Produced
Trains	an estimation of tourists entering by train
Airplanes	an estimation of tourists entering by plane
Cruise Ships	the number of cruise ships in port and an estimation of the amount of tourists on the ships
Hotels	a count of free hotel and apartment beds
Venice AirBnB Stats	a compilation of statistics (such as percent booked and total available) on AirBnBs in the city
Tourists	an estimate of the current number of tourists in the city
Tourist Taxes & Costs	an estimation of tourism taxes and costs
Tourist Arrivals	a summary widget providing an estimate of how many tourists have arrived in the city today

Table 1: The tourism-related widgets of the Venice Dashboard

The widgets collect data from various sources, for example the Comune di Venezia [Commune of Venice] and Booking.com, through a method called web scraping or simply scraping. Scraping involves extracting data from websites by sending requests for information. It uses the often consistent structure of web pages, for example tables with known columns, to copy data automatically from its exact position on a page. The web scrapers used by the Venice Dashboard began to fail between 2015 and 2018, depending on their data source. The exact cause of failure is unknown. The Venice Dashboard's widgets thus presented the user with either outdated or no data, rendering the Dashboard near useless.

3.0 - Methodology

The goal of this project was to understand how over-tourism affects residential and excursionist tourists in Venice by assessing the quality of their tourist experience. This goal was achieved by completion of the following objectives:
1. To design and administer a survey.
2. To analyze and visualize the survey results.
3. To publish the survey results.
4. To quantify tourists via the Venice Dashboard.

Our survey gathered information about the demographics of tourists and their experiences in the city. We only surveyed tourists and did not include residents in our analysis. Using data from past IQP's, we used specific visual identifiers to target tourists in addition to a survey question confirming that they were tourists. Our survey questions first identified characteristics such as age, country of origin, and length of stay. We then identified positive and negative aspects of their visit. To collect responses, we targeted high density tourist locations in Venice, such as Saint Marks Square, the Tronchetto bus station, and the Santa Lucia train station.

The following sections will give the reader an accurate depiction of the thought process and methodology followed to create, administer, analyze, and visualize our survey and its results. The process is detailed so that it can be improved upon or recreated to continue our work.

3.1 - Designing and Administering a Survey

Survey design is critical to collecting desired data. When creating a survey, one must consider which survey style will collect their desired data most efficiently. To investigate tourist experience, a questionnaire or an interview could be conducted. A questionnaire can be completed quickly and allows for questions to have scripted, definitive answers yielding clear data. Interviews with open-ended questions may obtain more detailed data, but take longer to collect and analyze data. Our survey is a questionnaire with a few open response questions at the conclusion of the questionnaire.

Throughout the process of collecting data, a level of consistency in survey administration must be kept so that the data is not skewed by the administrators (Guyette, 1983). This includes consistency in environment, speech, and body language. The administrators had guidelines to follow to ensure consistency throughout the collection period.

3.1.1 - Survey Design

Our team created a questionnaire survey to collect the data necessary to investigate tourist experience. This survey was conducted using Qualtrics, an advanced survey and analysis program. Qualtrics allows for the inclusion of logic such that some questions are conditional and are only shown if a previous question received a specific answer. The survey consists of primarily close-ended questions, with answers such as multiple-choice, check-boxes, or drop-down selections. Thirteen questions will ask for respondents to identify with a statement by choosing an answer offered in a Likert scale. The Likert scale provides variations of the response from "Strongly Agree" to "Strongly Disagree" so that the person can pick a neutral option. This rating scale attempts to "...transform an individual's subjectivity into an objective reality" (Joshi, Kale, Chandel, & Pal, 2015). Optional open-ended questions will be included at the end of the survey to gather additional data allowing participants to describe their best, worst, and overall experiences. When designing our questions, we referenced a survey done by Yuan Yao, which surveyed tourists in Nanjing (Yao, 2013). All of our survey questions about tourist experience are inspired by this survey. The survey questions first ascertain the demographics of the participant, including age and

country of residence; physical aspects of the tourist experience, such as transportation to and from sites; social aspects of the tourist experience, such as interactions with locals; anticipation, such as motivation for travel and expectations about sites and culture; and overall tourist experience.

After testing the survey, we added emphasis to certain parts of questions, especially those which limited the type of response we were asking for in open-response questions. For example, we noticed that respondents failed to respond with only three adjectives if none of the prompt was bolded and would instead provide full sentences. After adding bold font to the "three adjectives" portion of the question, respondents began limiting their responses properly. Our survey, at this point, took an average of 5 minutes and 15 seconds to complete. We did not want to increase response time beyond this to ensure completion of the survey by the respondent.

Our second major edit was the reformatting of our agree-disagree questions to a matrix table. The matrix table is comprised of seven-point Likert-scale questions ranging from "Strongly agree" to "Strongly disagree". We made this change as early research showed this was a common way of presenting these questions. Additionally, the rating scale we chose prevented empty responses from being misinterpreted. We found in our second round of testing that the matrix table did not increase response time, yet allowed us to get more detailed responses for our analysis. All survey questions and possible answers can be found in Appendix A as they appear when someone responds to the survey.

The finalized survey was translated into five languages, including English, Italian, German, Spanish, and French, based on the most frequent countries visiting Venice in 2016 (Città di Venezia, 2017). Translations were first done using Qualtrics software that relies on Google Translate. Then, this translation was proofread by our group for grammatical errors. Finally, the survey was read by a native speaker to ensure full translation between English and the other language. The survey in Appendix A is in English. QR Codes can be found in Appendix B that route to the final translations of the survey in Spanish, German, French, and Italian. All data collected from the survey is anonymously stored and will be accessible to the next group through the VPC.

3.1.2 - Administering the Survey

The survey was administered on tablets provided by WPI. These tablets had Qualtrics installed. We downloaded the survey in the app so that we did not require an internet connection to administer the survey. After each day of testing, the administrators uploaded the responses when connected to wifi. All responses were collected on the Qualtrics website, where they were then exported for analysis or analyzed with Qualtrics software, as described later.

In Venice, there were four administrators, which are the authors of this paper. Between the four administrators, there were only three tablets, due to a fourth tablet breaking upon arrival to Venice. To ensure consistency in administration, the team wrote and followed guidelines, described in Appendix C. This standardization ensured that all tourists received similar treatment. The results are a convenience sample, since we approached people who appeared most likely to answer our survey. These were people who were sitting down, not eating, and in groups of three or less. After each day of testing, we discussed our methods so that we increased the effectiveness of our survey distribution and increased the response rate.

We administered the survey in three high-density tourist locations in Venice. We surveyed in Saint Mark's Square (see Figures 7 and 8), the Santa Lucia train station, and the Tronchetto bus terminal (see Figure 6). These transportation stations are main entrance and exit points in the city. It was determined that it was not feasible for our team to survey in the airport and the cruise ship terminal due to problems with security. However, as we will further discuss in results, it was discovered that excursionists and residential tourists were surveyed in equal ratios at Saint Mark's Square compared to other locations. Therefore, it was only necessary to survey in Saint Mark's Square, and both excursionist and residential

tourists were captured. Very few cruise ship passengers were surveyed at any of the three locations. It is beneficial to find another location or receive clearance to administer surveys at the cruise ship terminal if there are ships at port to increase the number of cruise ship passenger responses.
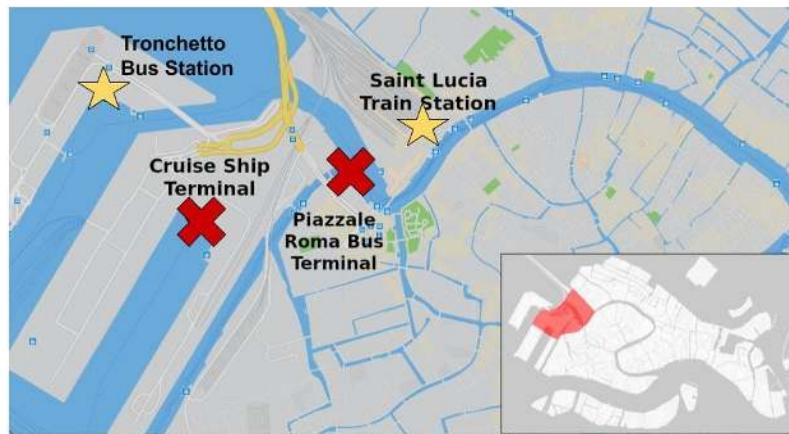

*Figure 6: Exit Point Survey Locations, including Tronchetto Bus Station and Santa Lucia Train Station*
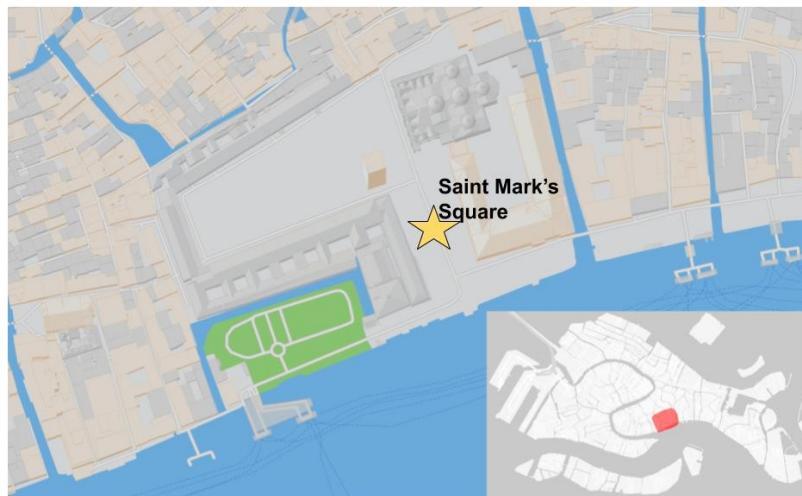
Figure 7: Main survey location, Saint Mark's Square

Figure 8: Pictures of the survey locations at Saint Mark's Square

Additionally, we focused on certain hours when tourists are most likely to be active in the city. Trains leave the station at regular intervals throughout the day and through watching the station it was determined that between 2pm and 5pm on weeknights yields about 4 valid responses per hour (Train schedule | Venezia S. Lucia., n.d.). On the other hand, administering the survey at Saint Mark's between the hours of 10 am and sunset yields about 12 valid responses per hour. Therefore, we focused most of our efforts on Saint Mark's Square.

Our team kept a record of how many acceptances and rejections we received at each location, as seen in Appendix D. By administering the survey in various exit point locations and a highly-populated area, we hoped to target both residential and excursionist tourists so that both types of experiences can be analyzed. After completing the initial survey testing, due to our denial of access by a public official, we determined that going to the actual cruise ship loading area would not be possible. Therefore, we did not survey at the cruise ship terminal, especially because there was a lack of cruise ships in port in November. Additionally, we did not survey at the Piazzale Roma bus station. The bus station was hard to access due to crowding. To add another location, we surveyed at Tronchetto bus station, in hopes that we would receive more excursionists in our respondent pool. In our administration of the final version of the survey, we decided to only administer the survey at the Santa Lucia train station, the Tronchetto bus station, and Saint Mark's Square.

The survey was finalized on November 1st and translations were completed on November 6th. Our first day of survey administration was November 7th where we found that the number of tourists had changed since our test runs in October. There were fewer people to survey and people in general were less likely to stop moving and complete a survey due to the cold weather. In light of this, we responded by working on the weekends to access more tourist dense days to obtain more data. During the third week of our survey administration we had to work around one of Venice's worst flooding seasons, where we witnessed the second highest recorded flood in history. People became more agitated and were less likely to take our survey. However, just after the rain and flooding passed, we found that tourists were still present and we were able to administer the survey.

3.2 - Data Analysis and Visualization

Once the survey was conducted and results were obtained, the raw survey data was organized and cleaned for analysis and visualization. In order to extract our data we needed to identify incomplete responses which would only skew our data. We classified an incomplete survey as surveys in which the respondent did not answer more than 50% of the likert-scale questions. This resulted in deletion of three results. We also searched for contradictory and inconsistent answers in survey responses or answers (Gitlin, n.d.). For example, a respondent who answered that they were travelling alone and with a significant other is contradictory. If the mistake could be fixed, the result was saved; otherwise, it was removed. There was no removal of results due to contradiction. We also removed any results that were from residents or minors. Valid results are those that met all of the aforementioned qualities. Once the survey data was cleaned, it was ready to be analyzed.

3.2.1 - Data Analysis

Qualtrics provided data analysis tools, but we did not utilize them due to not having a Qualtrics analytics subscription. Instead, we downloaded our data from Qualtrics as an Excel spreadsheet in two ways: with text values and with coded numeric values, which are found in Appendix E. Python was then used to read the spreadsheet, create summary statistics for each question, and create contingency tables for comparisons between each pair of questions. Contingency tables, or cross-tabulations, display frequency distribution dependent on two variables, or the joint distribution (NCSS, n.d.). Cross tabulations were used to find a correlation between variables, as well as differences between different groups. Confidence intervals were also calculated to investigate the accuracy of our data. Using an

online calculator, confidence intervals were calculated with a minimum sample size of 270 given a population size of 24 million tourists per year, 90% confidence level, and a 5% margin of error (Qualtrics, n.d.). The confidence levels themselves will be calculated with an online calculator after using Excel to find averages, standard deviation, and sample size (Social Science Statistics, 2019). However, due to convenience sampling methods, the confidence intervals cannot be used to make conclusions about the general tourist population. New survey administration methods will be necessary to use this methodology to draw conclusions about the tourist population.

The downloaded Excel spreadsheets were uploaded to Jupyter notebook, an environment that can be used to program in Python. The Python library called pandas was used for data analysis. Functions in Python were used to create summary statistics for each question. Then, cross-tabulations were calculated for every question against every other question. To investigate the differences between excursionists and residential tourists, the data was filtered such that it only contained one category. Then, summary statistics and cross-tabulations were calculated for that filtered data set. This was repeated for the other portion of the filtered data set. The entire process of screening the data and calculating summary statistics and cross-tabulations was repeated for happy and unhappy categories. The filtering for happiness was dependent upon answers to the question, "I would visit Venice again." If a respondent answered "somewhat agreed", "agreed", or "strongly agreed" with the aforementioned statement, then they were classified as a "happy" respondent. If the respondent answered "somewhat disagree", "disagree", or "strongly disagree", then they were classified as an "unhappy" respondent. Respondents that answered "neither agree nor disagree" were not considered in either data set. Examining the differences between happy and unhappy visitors allowed us to identify contributing factors to the overall tourist experience. In general, filtering responses by happiness levels and by type of tourist enabled us to find trends then within each specific group (Mason, 2014). All data sheets gathered by this filtering was collected and stored on the team's Google Drive.

3.2.2 - Data Visualizations

The previously created spreadsheets that contain summary statistics and cross tabulations served as the foundation for data visualization. The primary method of data visualization was creating bar graphs, pie charts, and other graphs in Excel. Visual bias is caused by using visuals to prove or identify a correlation (Verbeiren, Sakai, & Aerts, 2014). To avoid visual bias, we calculated a confidence interval or correlation coefficient for any graph that we believed showed an interesting statistic or revealed a relationship between variables. This confidence interval was only calculated if the sample size was large enough, as described in section 3.2.1. These statistics were calculated using Python. Python was also used to create visualizations of the correlation coefficients. In this way, it represents the statistical significance of the findings in a more visual way. It is still important to remember in these graphs that the findings cannot be applied to the whole tourist population due to the convenience sampling method.

In addition to various graphs created in Excel, we recognized the visual nature of our project's findings and decided to create an infographic that summarizes our results. The platform used to create this infographic was the website Piktochart and the tool called Data Wrapper that creates interactive graphs. The graphs created by Data Wrapper will change and display new information as your mouse hovers over them so that you can look at the data more closely. The infographic depicts an overview of the tourist experience project, essential statistics, and graphics taken from the report. The infographic starts by reviewing the demographics of those surveyed. It then examines the methodology followed by the team to complete their four main objectives. After the methodology, the summary statistics taken from the final presentation depict some of the most critical data discovered. The last section of this infographic is a collection of word art made from the open responses of our respondents. This art depicts their responses to their best, worst, and overall experiences

while visiting Venice. This infographic will be published in various ways, as described in the next section.

3.3 - Publishing Results

Publishing the results of the survey online will aid the Venice Project Center and other organizations. The results of the survey, including visualizations and inferences about tourist experience, will be published online in the format of an IQP Report and an infographic. This IQP report that will be available through the WPI Gordon Library, the VPC website, and the team website. Additionally, a corresponding Venipedia webpage will be developed. This page will contain the visualizations and summary statistics from the data. Any responses from the question about experience will be anonymized and unidentifiable, as done in the word clouds.

The Venipedia page and VPC website page will be created under the advisement of the VPC. The TSV raw data will be kept by the VPC for future use by projects that have permission to access it. This is in accordance with our agreement with the WPI IRB that we would not publish any data that could be used to identify any of our respondents.

3.4 - Quantifying Tourist Presence

In order to quantify the tourist presence, our team updated the tourism-related widgets of the Venice Dashboard. The front-end of the Dashboard is powered by AngularJS, a platform which provides several library packages to create web applications. The back-end is powered by web scraping scripts which place data into a Firebase database. In order to revive this dashboard, working code was recovered from the old widgets and updated to use a new back-end design. The Venice Dashboard codebase uses git as a version control system that keeps track of a history of differences between versions of the platform. It is available on GitHub, a cloud-based repository host, allowing for collaboration on the codebase.

3.4.1 - Updating Dashboard Widgets

Our first step in updating the Dashboard widgets was to understand the new planned back-end design for the Dashboard platform. We did so through discussions with the programmers who worked for SerenDPT. The new design separates the data collection into five parts: data sources, web scrapers, a log database, calculator scripts, and an interface to the calculated values. The log database collects data in a table with the following columns: dashboard name, type of data, timestamp, and data in JSON format. We decided to use PostgreSQL for the log database because of its compatibility with JSON in relational queries and Firebase as the interface to the calculated values for compatibility with the front-end of the Dashboard Platform as it is currently programmed.

To determine which widgets needed to be updated, we performed two types of tests. The first test was to look at the widgets as they appear on the application. The widget was marked as broken if it displayed incorrect data, such as an entry of zero in a tourist count, or if it had aesthetic issues, such as a graph extending beyond its containing pane. The second test was to run the back-end script corresponding to a widget. If the script ran into an error which prevented it from running, or failed to grab data, the corresponding widget was then marked as broken. Once we determined which widgets were broken, we looked through their old corresponding back-end scripts. These scripts provided insight into which data sources the widgets used and how they were scraped. The logic behind the old scripts was then used as a base for the new web scrapers and calculators.

To ensure our code would be useful for further generalization of the widgets to other dashboards, we followed a few set guidelines and good practices for our web scraper and calculator code. The most important of these guidelines is not to use hard-coded, magic numbers. The term "magic number" refers to the anti-pattern of including numbers in code
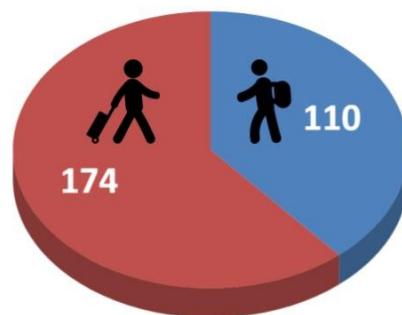
with no backing explanation, leading to a lack of clarity. This is solved through the use of clearly-labeled constant variables in code which makes its purpose more obvious and is designed to be replaceable if needed. We also ensured that the data stored in the log database was given an intuitive format so that new calculator scripts would not need to be rewritten for different dashboards. Through these guidelines we have provided a strong template for others to base their new dashboards off of and for the future repairs of the Venice Dashboard.

4.0 - Results & Analysis

To ensure that our survey would yield data that could be analyzed, our team conducted multiple rounds of test surveys. By testing the survey questions and formatting, we were able to identify questions that needed clarification or were not useful. Then, we made data visualizations from the test data to have a foundation for the final analysis. We detail the results of the final survey below. Their implications will be discussed in the conclusions portion of this report.

4.1 - Survey Results

We collected 313 total responses, of which 294 were valid. Of those 294 responses, eight responses were collected from the Tronchetto Bus Station, 44 responses from Santa Lucia Train Station, and 242 valid responses from Saint Mark's Square. The ratio of approximately 65% overnighters to 35% excursionists was found at each location (see Figures 9 and 10). This data suggests that for our survey, there was no relationship between where we collected surveys and what type of tourist responded. Overall, we surveyed 174 residential tourists and 110 excursionists. A 2015 IQP found that the ratio of residential tourists to excursionist tourists was approximately 1 to 3 (Connor, Hanna, Wingerter, & Van Rensselaer., 2015). Our rate of 1.6 residential tourists per 1 excursionist tourist does not match this ratio. However, the ratio could have changed since 2015 or may be affected by the survey locations, time of day, or time of year. The residential tourists that we surveyed stayed for an average of 3.19 days. This is slightly higher than the official average length of stay, which is approximately 2.32 days (Città di Venezia, 2017, p.19). This slight difference can be visualized in Figure 11.

Figure 9: The ratio of residential tourists
(with a suitcase, red) and excursionists
(with a backpack, blue) overall
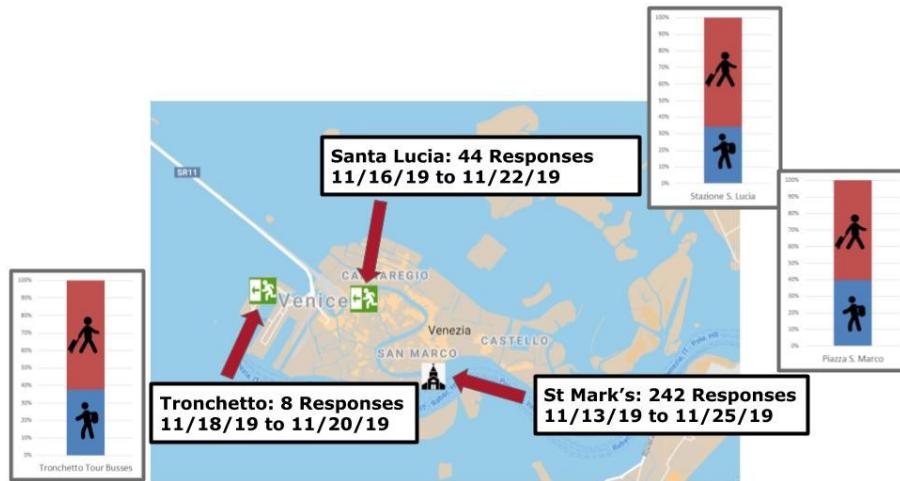
Figure 10: The ratio of residential tourists (with a suitcase, red) to excursionists (with a backpack, blue) at each survey location
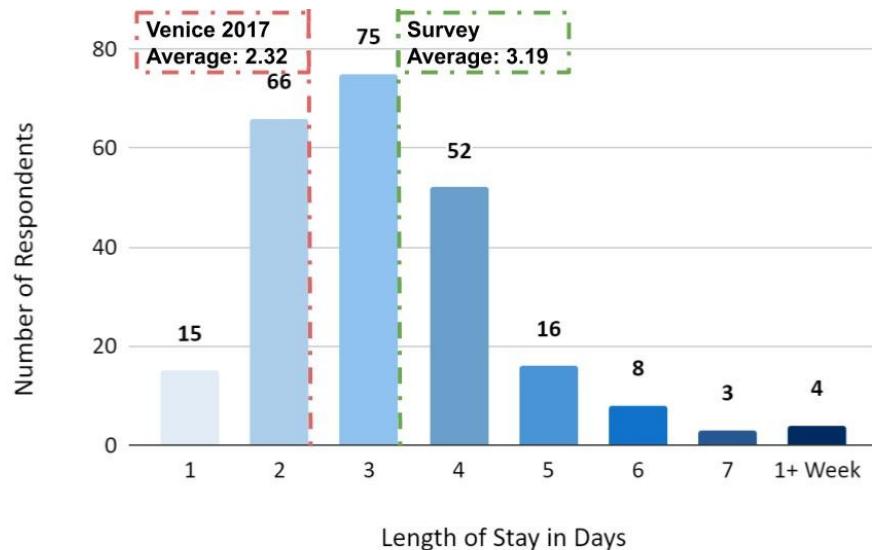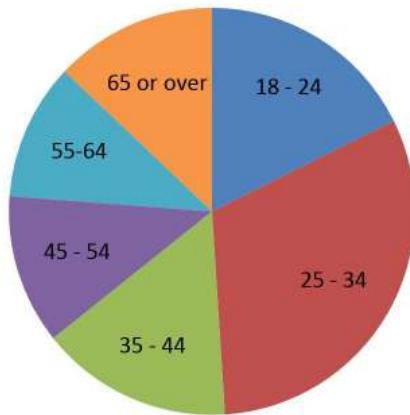
Figure 11: Length of stay of our respondents compared to the Venice 2017 average stay

Our respondents were evenly split throughout other demographics as well. Forty-six percent of people surveyed were male and 54% were female, represented in Figure 12. Responses were evenly split amongst age brackets as well, which is shown in Figure 13 below.

Male
46%

Female
54%
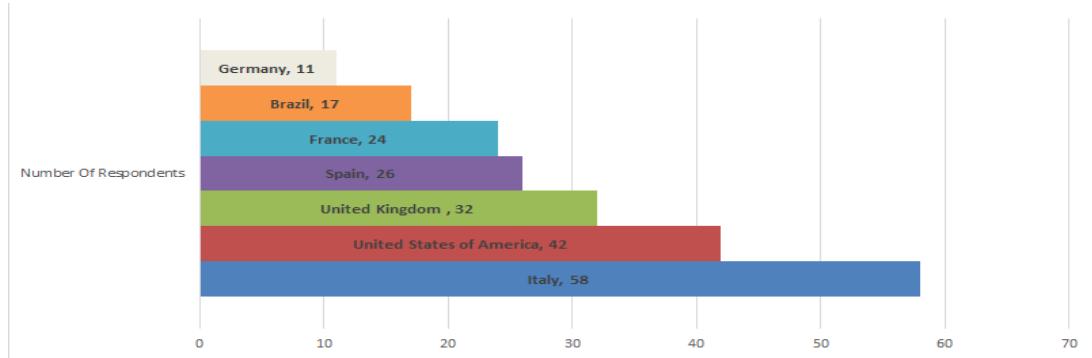
Figure 12: Gender distribution of respondent pool
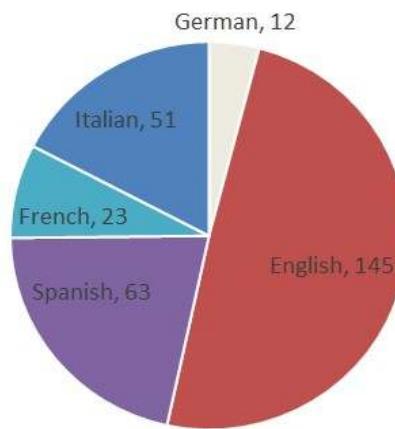
Figure 13: Age group distribution of respondent pool

Our respondents came from 35 different countries around the world, with Italian tourists being the largest group surveyed. The distribution of tourists by country was similar to the 2017 *Annuario* report of the top visitors by country shown in an earlier section of this report. The distribution of respondents from the top seven countries is shown below in Figure 14.

Figure 14: Most frequent countries of permanent residence amongst our respondents
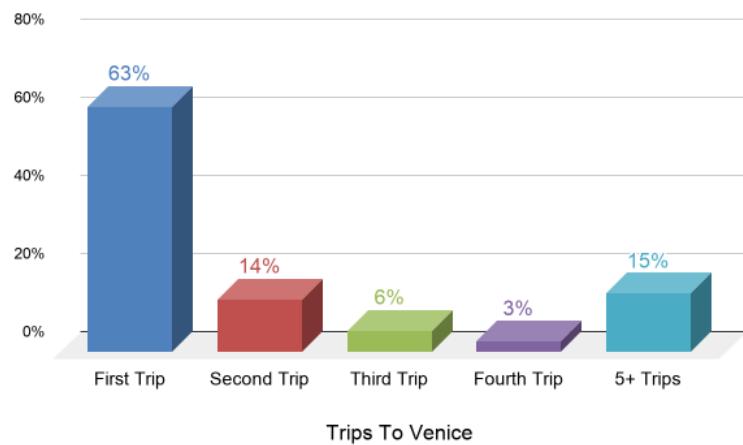
An interesting finding was that some people chose to answer the survey in different languages other than their native language. For example, 58 of our respondents were from Italy. However, in Figure 15 below, it can be seen that only 51 of our responses were in Italian. Therefore, some Italian natives answered the survey in a language other than Italian. This suggests that administering in English will yield more results than originally thought, due to other people occasionally speaking enough of the language to complete the survey.
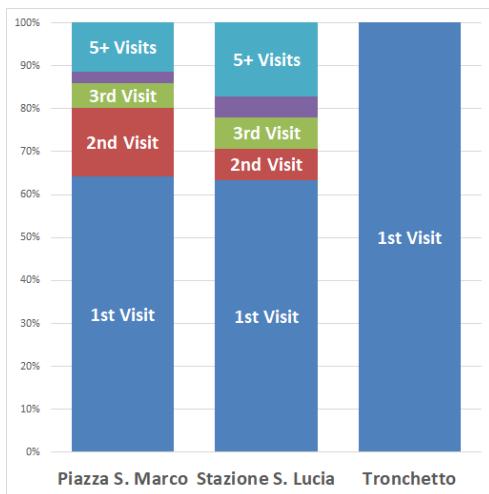
Figure 15: Distribution of respondents
selected survey language

An unbalanced part of our data was that 63% of respondents were in Venice for their first visit, shown in Figure 16. We believed this to be due to survey location bias at Saint

Mark's Square. However, when looking at the relative percentages of people visiting each location in Figure 17 below, it was found that first-time visitors make up the majority of responses at each location.

Figure 16: How many times the respondent pool has visited to Venice

Figure 17: Number of trips by respondents per survey location

Additionally, of our 294 respondents, 185 traveled to Venice with a significant other, as shown in Figure 18. This large portion of couples relates to the numerous open responses that described Venice as "romantic" and people whose responses said they were on their honeymoon. Respondents primarily visited churches, historic sites, and restaurants in Venice; they were allowed to choose as many attractions for this question, leading to a total sum of over 294 responses for the question. As expected, churches were the most visited sites with 219 responses. Seventy-seven respondents visited art exhibits, which, when analyzed with open responses, is related to the Biennale contemporary art exhibit that is in Venice every two years. A graph depicting the variety of attractions that respondents visited can be seen in Figure 19.

Figure 18: Type of group that respondents travelled with during their trip to Venice
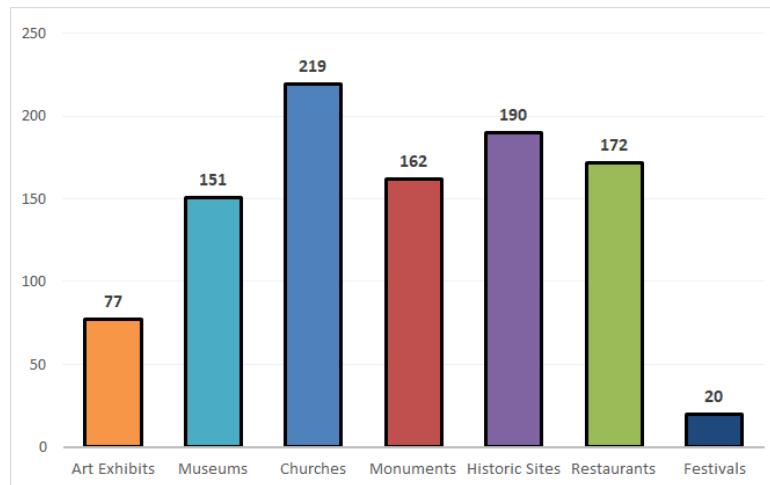
Figure 19: Attractions in Venice that the respondent pool visited during their trip

Additionally, we analyzed the most popular transportation methods around the city. In a question where respondents could choose multiple answers, the results showed that the most popular mode of transportation in Venice was boats, including the Alilaguna boat, water taxis, and the ACTV vaporetti boats. This is represented in Figure 20. Busses were used amongst a lot of people, as was the option "None". We are unable to assume that people are walking, but if they choose no methods of public transportation around the island, then they are probably walking between each site they see. Of the respondents that did use public transportation, they described the transportation as simple, crowded, quick, and clean, in the order of most frequently chosen words, which is shown in Figure 21. Overall, public transportation in Venice received positive reviews, except for crowding.
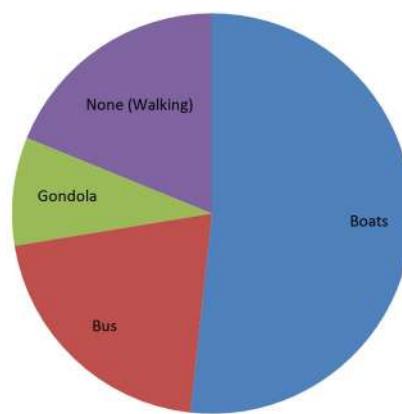
Figure 20: Methods of transportation used by the respondent pool during their trip in Venice
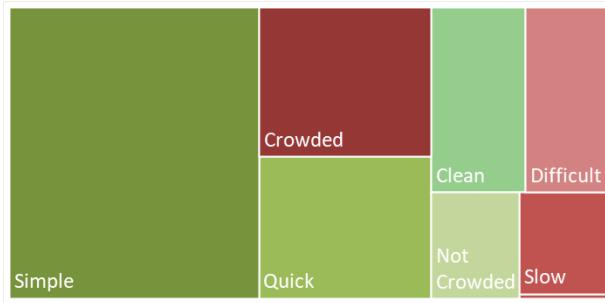
Figure 21: Respondents' opinion of Venice's public transportation system

In general, a statistically significant amount of people found that Venice was "somewhat crowded" and that the crowding was "less than expected", determined with a 90% confidence interval with a 5% margin of error. We hypothesize that the opinions on crowding resulted from a massive drop in the tourist population from October to November, which is when we surveyed. All calculated confidence levels can be found in Appendix F. It was also found that whether physical expectations of Venice were met correlated with whether overall experience expectations were met, with r^2 = 0.66. This correlation is visualized by the graph shown in Figure 23. Whether food expectations of Venice were met correlated with whether overall experience expectations were met with r^2 = 0.48. Whether dining expectations of Venice were met correlated with whether overall experience expectations were met with r^2 = 0.53.
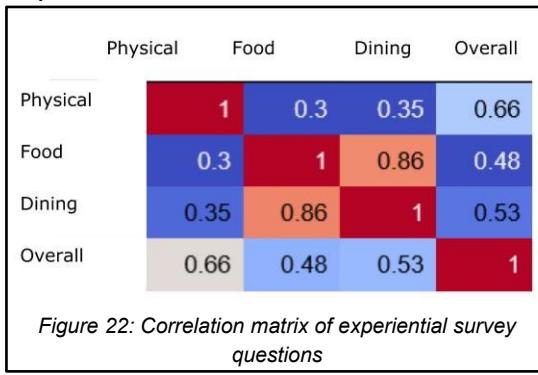
Figure 22: Correlation matrix of experiential survey questions
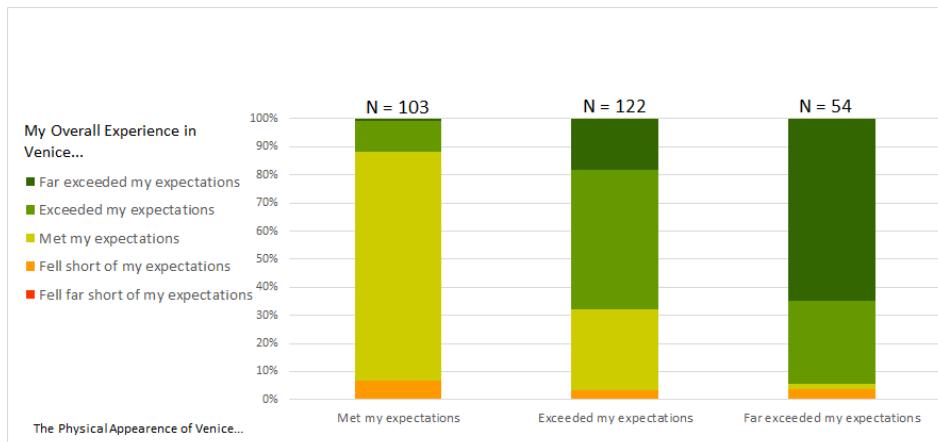
Figure 23: A graph representing the correlation between physical appearance and overall experience

It is important to note that because of our sampling methods, this correlation is only true for our respondents. On the contrary, as depicted in Figure 24, crowding does not appear to correlate with whether the overall experience met expectations. A correlation coefficient could not be calculated due to insufficient sample sizes.
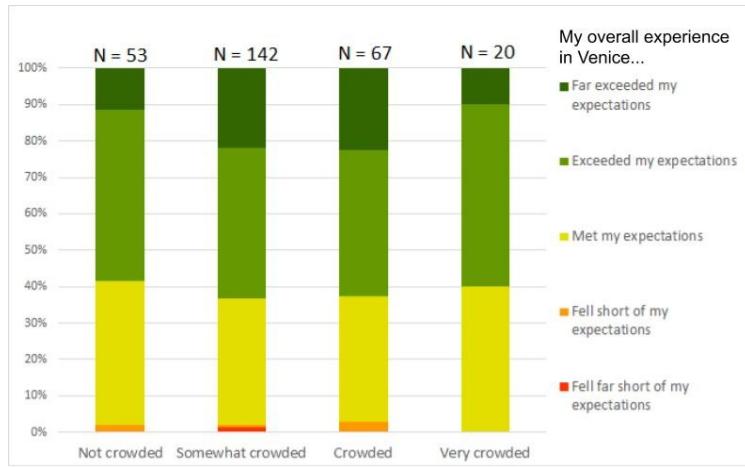
Figure 24: "What is your opinion of crowding in the city of Venice?" compared with overall experience in Venice

We calculated cross tabulations between every question based on two splits: between excursionists and residential tourists and between happy and unhappy visitors. The groups of excursionists and residential tourists revealed no significant differences in answers per question, as shown in Figure 25 below. In fact, with regards to the questions, "How did you first enter Venice?", "What is your primary purpose for visiting Venice?", and "Did you participate in a guided tour?", the response distributions were remarkably similar between both groups for each question. Again, statistics could not be calculated due to insufficient data. This suggests that for the questions asked in our survey, there are no significant differences in the opinions of respondents dependent upon whether or not they stayed in Venice overnight.
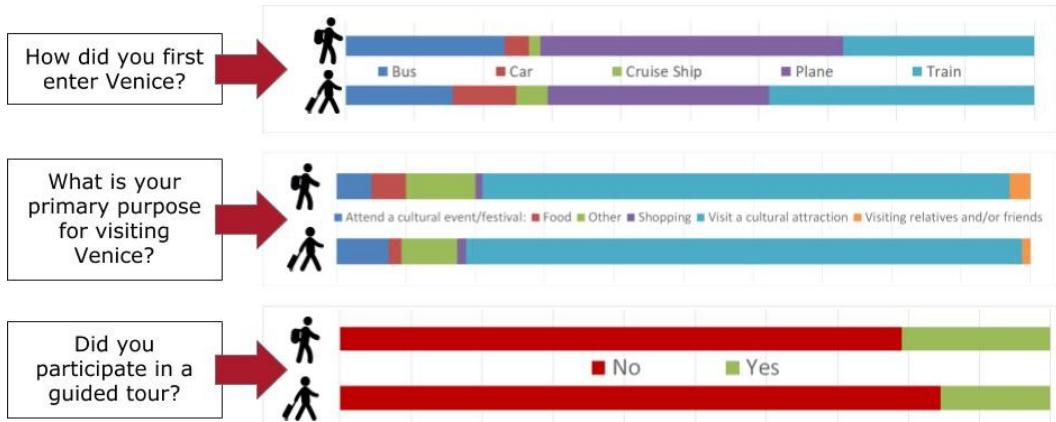
Figure 25: Similarities in responses between excursionists and residential tourists

We believe that if another question was asked, such as "How much money did you spend in Venice?", that the distribution would be different between the groups. On the contrary, the group of happy visitors compared to unhappy visitors had different opinions. When asked to rate the statement "The locals made me feel welcome in Venice" on a scale from "strongly disagree" to "strongly agree", it was found that happy respondents were more likely to have positive experiences with locals than unhappy locals as seen in Figure 26 below. This supports research from section 2.3.1 about the relationship between locals creating a welcoming environment for visitors and tourists' overall satisfaction.

A similar relationship was found between happy visitors rating the food in Venice as "exceeding" or "far exceeding" their expectations more often than unhappy visitors. It is important to note, however, that the sample size for happy visitors was 249 people and the sample size for unhappy visitors was 16, so no statistical significance could be found between these relationships.

Our survey included open ended questions to gauge respondents' thoughts on the city of Venice in their own words. Figures 27 and 28 below show the word clouds for open response questions requesting information about best and worst experiences. It is interesting to note that in Figure 28 for worst experience the word "nothing" is the most frequent response, indicating that a large portion of our respondents found it hard to recall any bad experiences in Venice.
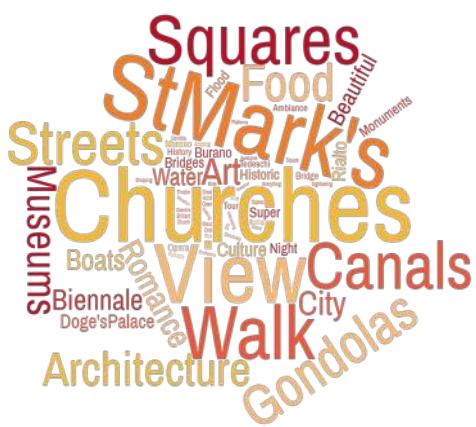
Figure 27: A word cloud created from responses to the question, "If you can describe your best experience in Venice, what would it be?"

Figure 28: A word cloud created from responses to the question, "If you can describe your worst experience in Venice, what would it be?"

We also created a word cloud from the question: "If you can describe your **overall** experience in Venice with **three words**, what would they be?" This word cloud is shown below in Figure 29. The majority of the words in this word cloud positively describe Venice showing that our respondents were overall happy with their time in Venice.

Figure 29: A word cloud created from responses to the question, If you can describe your overall experience in Venice with three words, what would they be?"

4.2 - Survey Efficiency

In total, we collected 313 total responses. Of those 313 responses, only 294 responses were valid, since we chose only to collect information on tourists that were over the age of 17. Additionally, we did not analyze surveys from people that said they were residents; these responses were ignored towards the count of valid results. Therefore, we had a 94% rate of targeting tourists for our survey. In general, our rejection rate was 28%. At Saint Mark's Square, the rejection rate was 27%, the lowest of rejection rates. The rejection rate at Tronchetto was 33%, and the rejection rate at Santa Lucia was 35%. Additionally, when examining how many surveys were collected by days of the week, we found that Friday was the most productive day to collect surveys. Of the 294 surveys, 74 surveys were collected on Friday, 40 surveys were collected on Saturdays or Sundays, and 180 surveys were collected on Mondays through Thursdays. We spent seven total hours surveying on Fridays, six total hours surveying on the weekends, and twenty-five hours surveying on weekdays. This leads to efficiency rates of twelve surveys per hour on Fridays, six surveys per hour on weekends, and seven surveys per hour on Mondays through Thursdays. All calculations in Appendix G show the calculations for rejections rates and efficiency rates.

Anecdotally, we found that response rates increased when there was a female administrator present. Ilona collected 149 responses, Mike collected 128 responses, Connor collected 14 responses, and Tom collected two responses because his tablet broke early in the process.

4.3 - Fixing the Venice Dashboard

Upon our arrival in Venice, we were given access to the City Knowledge Dashboard Platform codebase. Our team began by fixing the Tides widget in order to understand how the platform worked. The Tides widget (pictured in Figure 30) gathers data from the Centro Previsioni e Segnalazioni Maree [Tide Prediction and Warning Center], which provides a log of the tide level at Punta Salute in a table every ten minutes, and the Comune di Venezia Open Data project, which provides the center's predictions in JSON format. The JSON format made the predictions easy to process in code, allowing us to write a new web scraper and calculator scripts for this widget. The web scraper script reads the latest entry of the tide level log and filters the prediction output for the next high tide, placing the information in the log database. The calculator script then ensures that the units between the two are

consistently in meters and determines the direction of the tide. These scripts run every ten minutes, with the calculator running five minutes after the web scraper begins running to keep the widget updated in real time.

Figure 30: The Tides widget functioning, displaying information on the tides in Venice at 12:30 on December 6, 2019

The next widget that we worked on was the Webcams widget (pictured in Figure 31). These webcams were accessed through The Centro Previsioni e Segnalazioni Maree which has cameras around the city. These cameras take periodic photos of different areas in the city, for example in Piazza San Marco and the Rialto bridge, in order to monitor activity and flooding. We found that the site hosting these photos had merged with the main Comune di Venezia website, so any previously used URLs to these photos were made invalid. By updating the webcam URLs, the Webcams widget was brought back to full functionality without requiring a web scraper. Repairing the Webcams widget proved to be the least technical task.

Figure 31: The Webcams widget

Having now familiarized ourselves with the back- and front-end of the Dashboard Platform, we moved on to the Airplanes widget (pictured in Figure 32). The Airplanes widget gathers data from the Venezia Airport and Treviso Airport websites which contain tables of the current day's scheduled flights. Our new web scraper script parses this table for the flight number, time of arrival, and flight status. Using the flight number, the scraper then references SeatGuru, an online flight seat map service, to check how many seats there are available on the plane. All of this information is placed in the log database. The new calculator script then estimates the number of arrivals by taking the total number of seats and multiplying it by 0.9. It then estimates the number of tourists heading to Venice by taking the estimate of the number of arrivals and multiplying it by 0.7. Both of these ratios were

those used in the previous iteration of the Venice Dashboard and remain unchanged for consistency purposes. The scripts are run hourly to make sure that flight cancellations are reflected in the arrival count, helping to prevent overestimates.
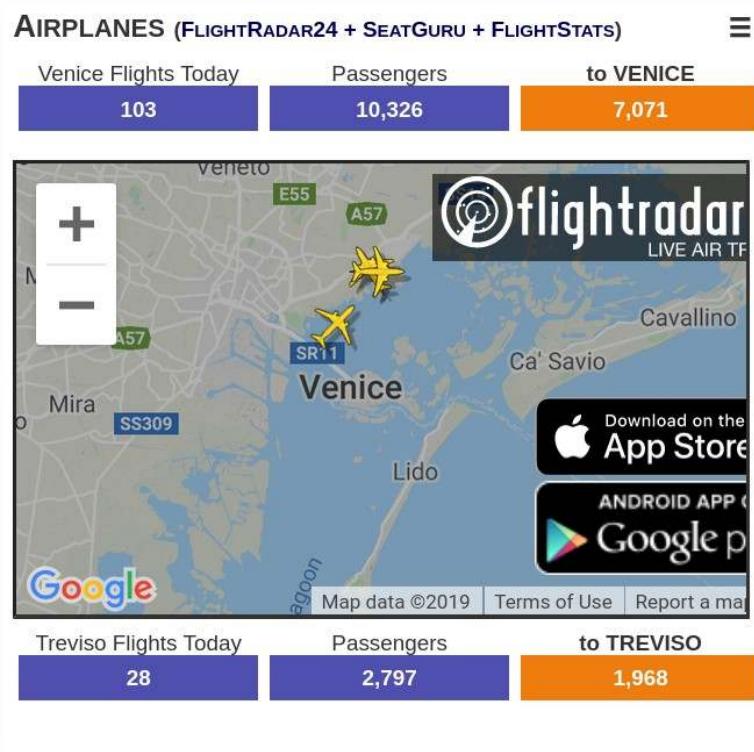
Figure 32: The Airplanes widget displaying flight information for December 6, 2019

The Airplanes widget also features a map of Venice with planes in flight animated live from Flightradar24. This map, however, would not always display. We suspect this is because Flightradar24 is attempting to prevent abuse of their service. By instructing the user's browser not to send the "Referrer" field in the request to Flightradar24, we stop notifying Flightradar24 that the Venice Dashboard is embedding their map. Using this method, the map was able to function once again. In order to keep this widget functioning, the Venice Dashboard must be sure that embedding FlightRadar24's map does not break any of their terms and conditions.

The Trains widget (pictured in Figure 33) gathers data from the Rete Ferroviaria Italiana website, which contains a table of the current day's scheduled train arrivals. The web scraper script parses this table for the train type, train number, and time of arrival and places these in the log database. The calculator then uses the train number to determine the capacity of the train by referencing a list of trains used previously by the dashboard (this list remains unchanged for consistency purposes) and places this data in the log database. The calculator script finally estimates the number of arrivals by multiplying the capacity by the typical fill-rate per day of the week stored in the same train list. All further estimates (e.g. number of tourists) are done on the front-end and remain unchanged. The scripts run daily.

TRAINS (TRENITALIA)   ≡

Total Tourists	Overnighters	Daytrippers
10,436	987	9,449

Arrival Time	Provenance	Track	PAX
1 1 : 4 1	A D R I A	2 0	4 6
1 1 : 3 4	C A S T E L F R A N C O	1 8	4 5
1 1 : 2 5	P A D O V A	1 6	4 7
1 1 : 2 0	P O R T O G R U A R O	2	1 5 9
1 0 : 5 6	T R E V I S O	1 2	

Total Arrivals	Commuters
19,042	8,606
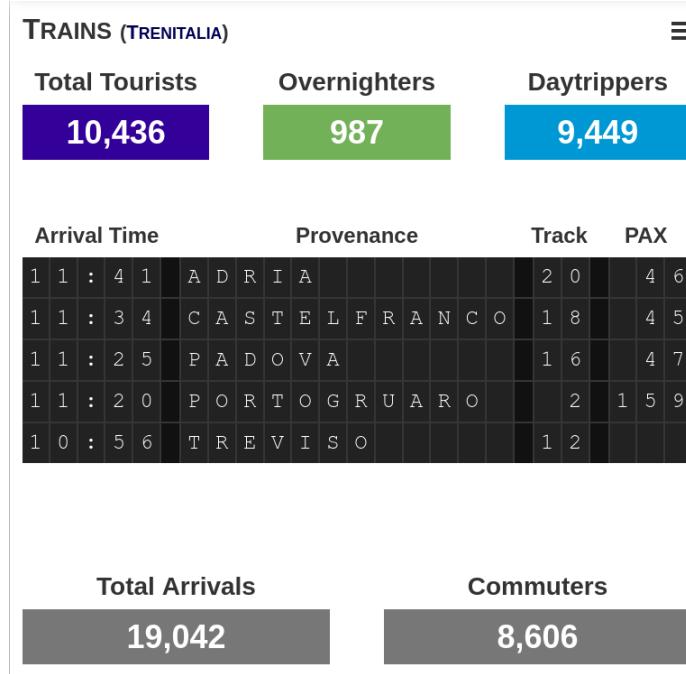
Figure 33: The Trains widget displaying information about train arrivals on December 6, 2019

The Hotels widget (pictured in Figure 34) gathers data from Booking.com, a service which provides hotel and apartment booking. The web scraper script uses the service's search feature to obtain a list of hotels and apartments in Venice, and then examines each of their entries on the site. Each entry contains a table of available rooms, from which we determine the number of available rooms for the following day in the hotel/apartment. The scraper takes this number and adds it to the total number of free rooms for the corresponding hotel/apartment's star rating, if available, and places the totals in the log database. The calculator script then directly copies this data to the Firebase database without further calculation for compatibility with the current front-end of the Dashboard Platform. The scripts run daily.

HOTELS (BOOKING.COM + HOSTELS.COM)   ≡

Category	Free beds today	Free beds tomorrow
★	270	285
★★	363	354
★★★	2,073	1,647
★★★★	2,514	2,268
★★★★★	762	708
Unclassified	7,650	6,633
Hostels		
TOTAL	13,215	11,895

19,368 OVERNIGHTS 59% FULL

Max Available Beds : 33,000

Figure 34: The Hotels widget, displaying the number of free beds for December 6 and December 7, 2019

The Venetians widget (pictured in Figure 35 and Figure 36) gathers data from the Comune di Venezia Open Data project. The Open Data project contains a table of population by neighborhood in the *comune*. The web scraper filters this table for the neighborhoods which make up the historic city of Venice and places the total population of these neighborhoods in the log database. The calculator script then directly copies this data to the Firebase database without further calculation for compatibility with the current front-end of the Dashboard Platform. The scripts run daily.
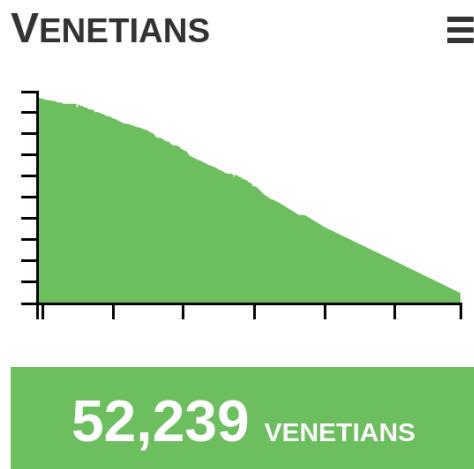
Figure 35: The Venetians widget, displaying the population on December 6, 2019
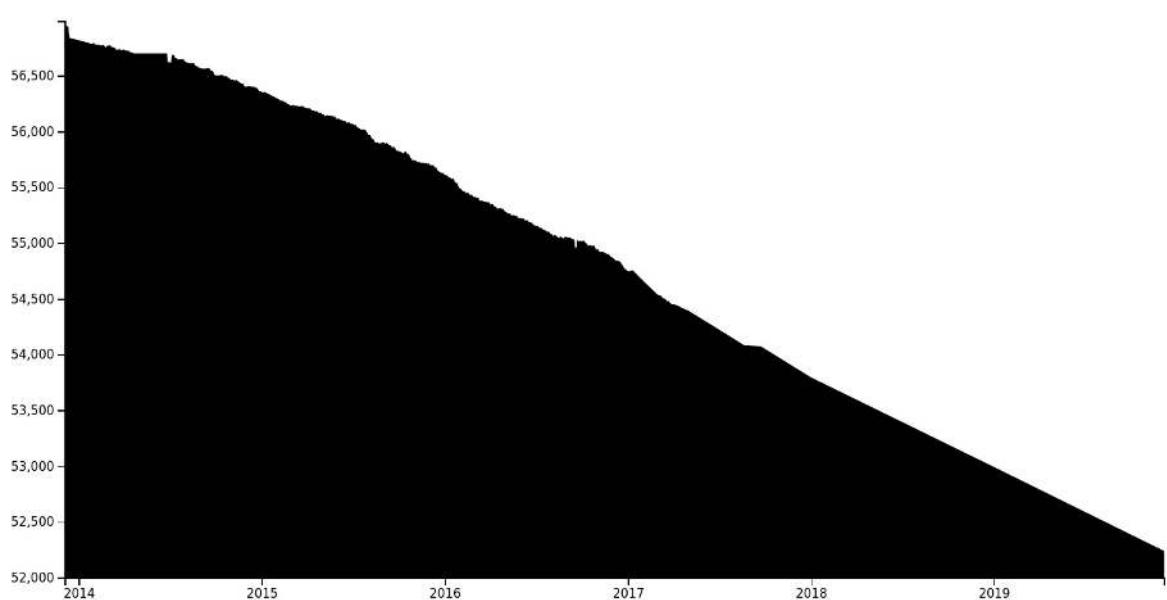
Figure 36: The larger graph provided on-click by the Venetians widget

The Venetians widget also required a fix on its front-end. The graphs of the population had a hard-coded minimum of 54,000 Venetians. Since the number of Venetians fell below this number years ago, the graph did not draw correctly. The front-end code now dynamically updates the minimum to be the next multiple of 1,000 Venetians under the current population.

5.0 - Conclusions and Recommendations

This project was multifaceted and complex. Before we make conclusions about the tourist experience survey, it is important to note that our sample of tourists was a convenience sample and the conclusions following can only be taken into account for the current survey sample. We hypothesized that our survey would allow us to find a factor that could be used to predict overall tourist experience, but our findings did not reveal one factor. Instead, we realize now that no single variable can be used to predict overall experience. There was a positive correlation between how our respondents' food met their expectations and how their overall expectations were perceived as well as a positive correlation between how our respondents' expectations of physical aspects of Venice and their overall expectations. It was interesting to find that the latter correlation was stronger than the former, suggesting that the physical aspects of Venice contribute more to our respondents' overall tourist experience.

Another interesting finding in our survey was that excursionists and residential tourists had similar responses to questions about guided tours, expectations, and opinions. This suggests that our survey did not contain questions that prompted a different response from each type of tourist. We recommend that in the future, a survey trying to discover differences between excursionists and residential tourists focus more on questions where they will differ, including food, spending habits, and how many attractions they visited. On the other hand, we found differences in how respondents answered based on whether we categorized them as happy or unhappy visitors. The problem with this analysis is that the sample sizes were unequal, with 249 happy visitors and 16 unhappy visitors. In the future, it would be helpful to have more equal sample sizes, or a larger sample of unhappy visitors, to see if this imbalance in opinions stays.

We found that survey administration methods are equally as important as what survey questions are included. Maintaining a smile and friendly composure received positive responses. Informing the respondent that you are a college student first makes them more likely to listen to the remainder of your pitch; if omitted, our rejection rates increased. Being in groups of at least two increases confidence in the administrators and allows them to feel more comfortable, especially in the beginning stages of survey administration. This group needs to include at least one female because when it was only males administering the survey, the rejection rate was approximately 40%, whereas only females received a rejection rate of about 10% and mixed groups received a rejection rate of about 27%. We recommend the continuation of tablets and name tags for administration because it gives a more cohesive and professional appearance.

We recommend the continuation of administering the survey at Saint Mark's Square, as this had the highest response rate and we received responses from each type of tourist at this location. Saint Mark's Square had a rate of 9 valid surveys per hour, whereas the Santa Lucia Train Station had four valid surveys per hour, and Tronchetto had one valid survey per hour. Moreover, response rates vary from weekdays to weekends, but we found that Friday has the most significant number of responses. If surveying at Saint Mark's, it is important to include a question asking how long the tourist has been in Venice, as they may have only arrived a few hours before and not have many opinions about the city yet.

We believe that surveying earlier in the term will result in increased response rates. During the test phases of our survey, we saw more people at Saint Mark's Square, who were more likely to sit down because the weather was warmer and sunnier. However, during November, which is when we collected our responses, the weather was rainier and people were more likely not to sit down. Additionally, during the earlier time frame, there may be more excursionists that are on cruise ships in port or at the train station at the end of the day. To ensure that the survey is administered early on, it is important to edit the survey early and efficiently. Thinking first about what the analysis will show will reveal which questions should be asked in the survey. For example, we could not analyze differences in excursionists and residential tourists because we did not ask questions that showed

differences. This suggests that we should have asked different and more detailed questions should be implemented.

Our survey failed to target a major portion of the tourists in Venice: Chinese. Early in our survey design process we found that learning enough Chinese to be able to translate and administer the survey would be extremely difficult and time consuming. Additionally, we found that the Chinese often visit in large guided tours and do not stop for long enough to be surveyed. A different survey methodology will be necessary to target these types of tourists. We feel an entire IQP should be conducted in order to gain information about these tourists, as they seem to have a unique tourist experience. The entire 7-week preparatory phase of the project should be spent in intensive Chinese lessons to ensure being capable of basic communication with Chinese tourists since the language is remarkably different from the languages in the Indo-European language tree most WPI students are familiar with.

Overall, we feel that our survey can serve as a basis for future surveys about tourist experience. Our survey revealed general insights about survey methodology as it pertains to college students in Venice, and we feel that with proper adjustments, a larger sample size can yield valid results to investigate variables of the tourist experience. As shown by our results, trying to capture the entirety of the complex tourist experience does not allow us to make any useful conclusions about tourists in Venice. It would be better for future groups to identify an individual factor or phase of the tourist experience such as food, or interactions with locals and design a survey to gauge just that in detail and combine the results of many such surveys to look at the overall tourist experience in Venice.

For use alongside future surveys, we updated the Venice Dashboard to quantify tourists. We successfully updated six of the Venice Dashboard widgets, using a new back-end design proposed by SerenDPT, easing further generalization of widgets, and revitalizing the Dashboard in general. To future teams and SerenDPT employees, we recommend looking into the web scraper for the Hotels widget, as it fails to collect information on hostels like the widget suggests it would. While working on the Hotels widget, our team found that the hostels data source did not change its format, but that it would eventually deny our requests, preventing data collection. We also recommend looking into updating the AirBnB statistics widget. Updates done to the AirBnB website in 2019 have broken the AirBnB scraping scripts used by sites like Inside AirBnB, meaning a lot of work is required before more data can be collected systematically.

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Appendices

Appendix A - Tourist Experience Survey Questions and Answers in English

Tourism Experience Survey with Likert Scales

Start of Block: Pre-survey Questions

Q1 Where is this survey being administered?

◯ Piazza S. Marco (1)

◯ Stazione S. Lucia (2)

◯ P.le Roma (3)

◯ Cruise Ship Terminal (4)

◯ Marco Polo Airport (12)

◯ Tronchetto Tour Busses (13)

◯ Other (14) _____

_____

Q2 Who is administering this survey?

◯ Connor Anderson (1)

◯ Ilona Regan (2)

◯ Michael Laks (11)

◯ Thomas King (12)

_____

Q3 Timing
First Click (1)
Last Click (2)
Page Submit (3)
Click Count (4)

Q4
We are a group of students from Worcester Polytechnic Institute (WPI) in the United States. Our mission is to understand the tourist experience in Venice, Italy. This project is completed as a university degree requirement. This survey should take about 5 minutes to complete. Your participation in this survey is voluntary and completely confidential. All responses are anonymous and unidentifiable.

If you have any questions or concerns about this survey, please contact the Venice Tour Team at ve19.tour@gmail.com

Q5 Are you a visitor in Venice?

◯ Yes (1)

◯ No (2)

Skip To: End of Survey If Are you a visitor in Venice? = No

Q6 Why are you in Venice?

◯ Business (1)

◯ Academics (4)

◯ Leisure (2)

Q7 What age group do you belong to?

○ Under 18 (20)

○ 18 - 24 (21)

○ 25 - 34 (22)

○ 35 - 44 (23)

○ 45 - 54 (24)

○ 55-64 (30)

○ 65 or over (31)

Skip To: End of Survey If What age group do you belong to? = Under 18

Q8 What is your gender?

○ Female (2)

○ Male (1)

○ Other (3)

JS X-

Q9 In which country do you permanently reside?

▼ Afghanistan (1) ... Zimbabwe (1357)

---

*

Q10 How many times have you visited Venice **including this trip**?

_____

Q11 Does your trip to Venice include an overnight stay? (Cruise Ships NOT included)

◯ Yes (1)

◯ No (2)

Q12 Timing
First Click (1)
Last Click (2)
Page Submit (3)
Click Count (4)
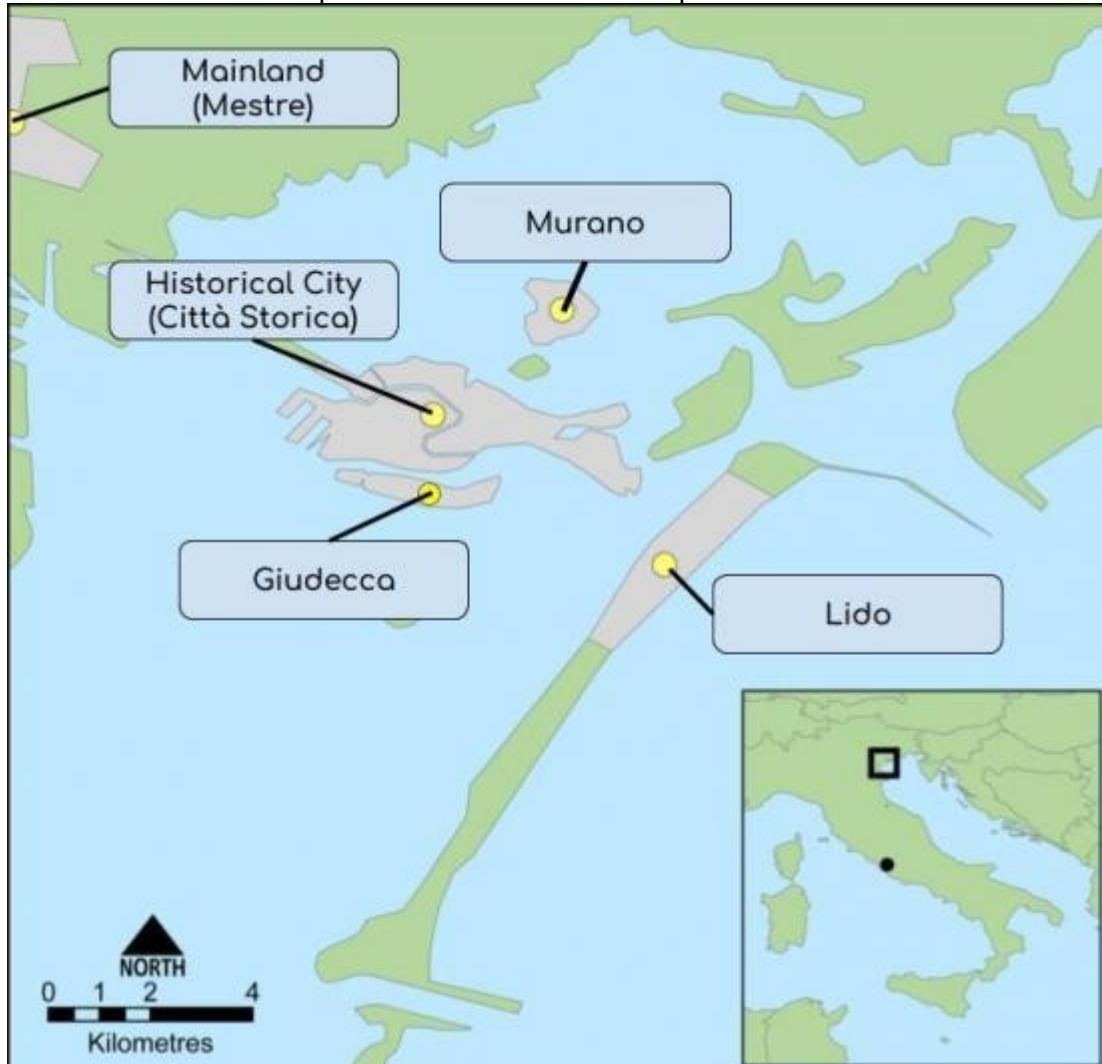
Q13 Please use this map as reference for the next question

Q14 In what style of accommodation are you staying?

○ Hotel (1)

○ Hostel (2)

○ AirBnB (3)

○ Bed and Breakfast (4)

○ Apartment (5)

○ Staying with friends/family (6)

○ Other (7) _____

Q15 In which section of Venice are you staying?

○ Mainland (1)

○ Historical City (2)

○ Lido (3)

○ Giudecca (4)

○ Murano (7)

○ Cruise Ship (8)

○ Other (5) _____

✱

Q16 What is your total length of stay (in days)?

_____

Q17 Timing
First Click (1)
Last Click (2)
Page Submit (3)
Click Count (4)

End of Block: Overnight Information

Start of Block: Travel Information

Q18 What kind of group are you traveling with? (check all that apply)

☐ Alone (1)

☐ Significant Other / Partner (9)

☐ Friends (3)

☐ Family Members (2)

☐ Organized Group (4)

☐ Other (8) _____

Display This Question:

If What kind of group are you traveling with? (check all that apply) = Family Members

Or What kind of group are you traveling with? (check all that apply) = Friends

Or What kind of group are you traveling with? (check all that apply) = Organized Group

Or What kind of group are you traveling with? (check all that apply) = Other

✱

Q19 How many people are in your group?

_____

Q20 How did you first enter the Venice area?

○ Plane (7)

○ Train (3)

○ Cruise Ship (4)

○ Bus (2)

○ Car (6)

○ Other (8) _____

Q21 What methods of transportation have you used?

☐ ACTV Boat (1)

☐ Alilaguna Boat (2)

☐ Water Taxi (3)

☐ Bus (4)

☐ Gondola (5)

☐ None of the above (8)

Q22 Which of the these best describe your overall impression of the public transportation system? (check all that apply)

☐ Difficult (3)

☐ Simple (4)

☐ Crowded (6)

☐ Not Crowded (12)

☐ Quick (7)

☐ Slow (8)

☐ Clean (9)

☐ Dirty (10)

Q23 Timing
First Click (1)
Last Click (2)
Page Submit (3)
Click Count (4)

End of Block: Travel Information

Q24 What is the primary purpose of your visit to Venice?

○ Visit a cultural attraction (2)

○ Attend a cultural event/festival: (3)

_____

○ Visiting relatives and/or friends (5)

○ Sports Event (8)

○ Shopping (9)

○ Food (10)

○ Other (11) _____

Q25 What is the primary purpose of your visit to Venice?

☐ Meetings (2)

☐ Conference (1)

☐ Research (3)

☐ Other (4) _____

Q26 What is the primary purpose of your visit to Venice?

☐ Studying abroad (1)

☐ Conference (2)

☐ Research (3)

☐ Other (4) _____

_____

Q27 What type of Venetian attractions have you visited so far? (check all that apply)

☐ Churches (1)

☐ Museums (2)

☐ Art Exhibits (3)

☐ Theater (4)

☐ Restaurants (5)

☐ Monuments (13)

☐ Historic Sites (14)

☐ Traditional Festivals (15)

_____

Q28 Timing
First Click (1)
Last Click (2)
Page Submit (3)
Click Count (4)

Q29 Did you participate in a guided tour while in Venice?

○ Yes (1)

○ No (2)

_ _

Q30 What type of guided tour(s) did you participate in? (check all that apply)

☐ Walking Tour (1)

☐ Self-Guided Tour (3)

☐ Boat Tour (5)

☐ Cruise Ship Excursion Tour (6)

☐ Guided Museum Tour (7)

☐ Guided Art Tour (8)

☐ Food and/or Drink Tour (10)

_ _

Q31 I feel that the guided tour(s) improved my overall experience in Venice.

○ Strongly agree (20)

○ Somewhat agree (21)

○ Neither agree nor disagree (22)

○ Somewhat disagree (23)

○ Strongly disagree (24)

_ _

Q32 Timing
First Click (1)
Last Click (2)
Page Submit (3)
Click Count (4)

Q33 What is your opinion of crowding in the city of Venice?

○ Not crowded (1)

○ Somewhat crowded (2)

○ Crowded (4)

○ Very crowded (6)

Q34 How does the number of tourists in Venice compare to the number you expected?

○ Less than expected (26)

○ As expected (25)

○ More than expected (24)

Display This Question:

If What is your opinion of crowding in the city of Venice? = Somewhat crowded

Or What is your opinion of crowding in the city of Venice? = Crowded

Or What is your opinion of crowding in the city of Venice? = Very crowded

Q35 How did other tourists impact your experiences? (check all that apply)

☐ Congested bridges (2)

☐ Congested streets (3)

☐ Congested attractions (4)

☐ Waited in long lines (5)

☐ High noise level (6)

☐ Long restaurant waits (10)

_____

Q36 Timing
First Click (1)
Last Click (2)
Page Submit (3)
Click Count (4)

End of Block: Overcrowding Opinions

Start of Block: Expectations

Q37 Please rate the following statements about your expectations of Venice.

	Fell far short of my expectations (52)	Fell short of my expectations (51)	Met my expectations (50)	Exceeded my expectations (49)	Far exceeded my expectations (48)
The physical appearance of Venice... (1)	○	○	○	○	○
The food in Venice... (5)	○	○	○	○	○
My dining experience in Venice... (2)	○	○	○	○	○
My overall experience in Venice... (3)	○	○	○	○	○

_____

Q38 Timing
First Click (1)
Last Click (2)
Page Submit (3)
Click Count (4)

Q39 Please rate the following statements about your experience in Venice and your opinion of the city.

	Strongly disagree (62)	Disagree (63)	Somewhat disagree (64)	Neither agree nor disagree (65)	Somewhat agree (66)	Agree (67)	Strongly agree (68)
I was able to visit all of the attractions I planned to visit. (5)	○	○	○	○	○	○	○
I was able to experience Venetian culture. (11)	○	○	○	○	○	○	○
The locals made me feel welcome in Venice. (4)	○	○	○	○	○	○	○
My overall experience was authentic. (1)	○	○	○	○	○	○	○
I would visit Venice again. (9)	○	○	○	○	○	○	○
I would recommend Venice to my friends and family. (10)	○	○	○	○	○	○	○

Q40 Timing
First Click (1)
Last Click (2)
Page Submit (3)
Click Count (4)

Q41 If you can describe your **overall** experience in Venice with **three words,** what would they be?

_____

Q42 If you can describe your **best** experience in Venice, what would it be?

_____

Q43 If you can describe your **worst** experience in Venice, what would it be?

_____

Q44 Is there anything else about your experience in Venice that you would like to share?

_____

Q45 Timing
First Click (1)
Last Click (2)
Page Submit (3)
Click Count (4)

Appendix B - Tourist Experience Survey Questions and Answers (Translated)

Italian:
https://drive.google.com/file/d/1vNlr9YUOWxASaKkoHWC0wymnglJ4mRSD/view?usp=sharing

Spanish:
https://drive.google.com/file/d/1ic5sDTJMk6kmI8hYhm5HQXe14lMsW6Qc/view?usp=sharing

French https://drive.google.com/file/d/1w1WOlctWAddIz9PKHq9szSIO11KXyJHy/view?usp=sharing

German
https://drive.google.com/file/d/1PhLouSuxfqSKao3P4HH6CgdsuMTIsYU_/view?usp=sharing

Appendix C - Guidelines for Administration

All administrators will wear name tags that includes names, "Survey Researcher", and the WPI logo. Semi-professional attire will be worn, including: jeans and a t-shirt, jacket, or sweater. When approaching people, all administrators will smile, say "Hello", and one person will say the script below. When saying the script, administrators will speak slowly, and say the entire script unless stopped by the prospective participant. If stopped, researchers will offer all languages, and if one is spoken, will hand the tablet with the translated survey description to the prospective participant.

"Hello! We are university students from right around Boston, Massachusetts. We have a quick six-minute survey about tourist experiences here in Venice. Would you be interested in answering the survey?"

Appendix D - Response Rates at Each Location

Saint Mark's

Date & Time	Total Number of Acceptances	Total Number of Rejections
11/7/19 10am to 3pm	29 total, valid	20
11/10/19 2pm to 3pm	2 total, valid	15
11/13/19 3am to 5pm	5 total, valid	3
11/14/19 5pm to 7pm	10 total, valid	1
11/16/19 2pm to 5pm	13 total → 11 valid	7
11/21/19 2:30 pm to 5:30 pm	34 total → 30 valid	5
11/22/19 10:30am to 5pm	76 total → 72 valid	15
11/23/19 12pm to 2pm	27 total → 26 valid	2
11/25/19 11am to 3pm	59 total → 57 valid	21

Tronchetto Bus Station

Date & Time	Total Number of Acceptances	Total Number of Rejections
11/18/19 5:30pm to 6pm	2 total, valid	2
11/19/19 3:30pm to 6pm	3 total, valid	0
11/20/19 3pm to 6:30pm	5 total → 3 valid	2

Santa Lucia Train Station

Date & Time	Total Number of Acceptances	Total Number of Rejections
11/14/19 4pm to 5pm	5 total, valid	8
11/16/19 5pm to 6pm	2 total, valid	5
11/18/19 4pm to 6pm	12 total, valid	1
11/19/19 2:30pm to 3:30pm	12 total → 10 valid	0
11/20/19 2pm to 5pm	15 total → 13 valid	7
11/22/19 2:30pm to 3:00pm	2 total, valid	3

Appendix E - Coding for Survey Results

https://docs.google.com/spreadsheets/d/
1tVYqjjX51OiN1qos32YkmOrNEXXQBFheFx6LtHkDZWY/edit?usp=sharing

Appendix F - Confidence Intervals

Q37_4:	M=3.7789	90%	CI [3.601967, 3.855833]	1=fell far short	5 = far exceeded
Q37:	M=3.6495	90%	CI [3.563587, 3.735413]	1=fell far short	5 = far exceeded
Q33:	M = 2.191	90%	CI [2.11081, 2.27119]	1=not, 2=somewhat	3=crowded, 4=v crowded
Q34:	M = 1.8194	90%	CI [1.763165, 1.875635]	1=less, 2=as	3=more
Q37:_2	M = 3.1993	90%	CI [3.109438, 3.289162]	1=fell far short	5 = far exceeded
Q37_3:	M = 3.2	90%	CI [3.11, 3.29]	1=fell far short	5 = far exceeded
Q39_1:	M = 66.0667	90%	CI [65.915523, 66.217877]	62 = strongly disagree	68 = strongly agree
Q39_2:	M = 66.1127	90%	CI [65.971584, 66.253816]	62 = strongly disagree	68 = strongly agree
Q39_3:	M = 66.1454	90%	CI [66.000493, 66.290307]	62 = strongly disagree	68 = strongly agree
Q39_4:	M = 66.4321	90%	CI [66.310819, 66.553381]	62 = strongly disagree	68 = strongly
Q39_5:	M = 66.9024	90%	CI [66.778296, 67.026504]	62 = strongly disagree	68 = strongly agree
Q39_6:	M = 67.1923	90%	CI [67.091449, 67.293151]	62 = strongly disagree	68 = strongly agree

See more at:
https://drive.google.com/file/d/1zrIxgnCsK3LvhJWocBNJp4nv4WKhSMo3/view?usp=sharing

Appendix G - Efficiency Rates of Survey Administration Methods

- 294 valid responses / 313 total responses = 94 % rate of finding who were actually tourists
- Weekend vs Friday VS weekday efficiency
  - Friday was 74 in 7 hrs, so 10.6 surveys/hour = 10 surveys/hour
  - Weekend was 40 in 6 hours, so 6.7 surveys/hour = 6 surveys/hour
  - Weekday was 180 in 25 hours, so 7.2 surveys/hour = 7 surveys/hour
  - Overall efficiency was 294 valid surveys in 35 hours = 8 valid surveys/hour
- Rejection Rate
  - S Marco had 89 total rejections → 89 / (242+89) = 27%
  - Tronchetto had 4 total rejections → 4 / (4+8) = 33%
  - S. Lucia had 24 total rejections → 24 / (44+24) = 35%
  - Overall rejection rate = 117 rejections and 313 positives → 117 / (117 + 294) = 28%
- Overall Efficiency Rates
  - S Marco → 242 valid surveys / 24.5 hours = 9.9 surveys/hour = 9 surveys/hour
  - Tronchetto → 8 valid surveys / 5 hours = 1.6 surveys/hour= 1 survey/hour
  - S. Lucia → 24 valid surveys / 6 hours = 4 surveys/hour