

# Capturing Change:

Creating an online platform to analyze  
Venetian Commerce

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December 10, 2020



# ACKNOWLEDGEMENTS

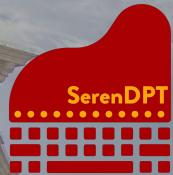
We would like to thank our advisors, Professor Jennifer deWinter and Professor Fabio Carrera for their guidance and support in all areas of our project. Their suggestions have been crucial in the development of our project. We would also like to thank Professor Ingrid Shockey for her feedback during our preparation period that helped shape our proposal and presentation.

Furthermore, we would like to thank our sponsors SerenDPT and SMARTDEST, and their representatives for this project: Daniele Scaranco and Filippo Rossi. We would have not been able to complete this project without their technical guidance and helpful feedback.

# AUTHORSHIP

The different sections of this report were written collaboratively by all team members: Kavim Bhatnagar, Lucas Fernandes, Taylor Ostrum, and Nathan Morin. The report was edited by Professor Jennifer deWinter and Professor Fabio Carrera. Team members divided the report into sections, coming together at the end to provide feedback. We followed the same method for the authorship, appendices, table of contents, and other sections as well, which were also edited by our advisors.





# Capturing Change:

## Creating an online platform to analyze Venetian Commerce

SMARTDEST



An Interactive Qualifying Project submitted to the Faculty of Worcester Polytechnic Institute in partial fulfillment of the requirements for the degree of Bachelor of Science

Date: December 14, 2020



# WPI

**Sponsor  
Organization:**

SerenDPT  
SMARTDEST

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# ABSTRACT

In this project we have produced a **web application** capable of **visualizing all Venetian shop data** collected by the Venice Project Center (VPC) between 2004 and 2018. Using **eight datasets** from past WPI teams, we created one unified dataset housing all Venetian shop data and displayed it on an **interactive map** in order to enable easy **analysis** of Venetian shops. We built our web application with the intent of it being **useful to future teams** collecting shop data in Venice. Additionally, we have made **recommendations** for future teams on how to **update and improve** our application. These recommendations include new ways to analyze the data and improved data collection methods.



(Santorini, 2020)



# EXECUTIVE SUMMARY

Shop data provides an invaluable look into the bigger picture of a city's economic status. Being the main contributors to the production of goods and services in an economy, shops can act as an **economic indicator**. In the case of Venice, Italy, tourism plays a big role in its economy as approximately **25% of shops cater toward tourists** alone. This **socially excludes** local Venetians and causes a divide between them and visitors.

However, for the first time in history, tourists are no longer able to visit the city due to the **COVID-19 pandemic**. Because of this, Venetian commerce has been greatly affected.

In order to see how Venice's economy has been affected, it is imperative to

**understand and visualize** its **commercial history**, which has been quantified for over **15 years** by the Venice Project Center. Starting in 2004, **eight WPI teams** have collected shop data from various *sestieri* all over Venice, taking note of attributes such as **shop names, addresses, and geographical location**.

For our project, we worked with our **sponsors SMARTDEST and SerenDPT**. The former is a research project focused on **social exclusion** and more recently, the **sustainable return of tourism** to European cities **post COVID-19**, and the latter is a Venetian start-up organization in charge of the Venice case study of the **SMARTDEST project**.

With their help, we have built a **web application** from the ground up that can **visualize** the history of **Venetian commerce**.

In order to do this, our team **found, consolidated, and cleaned eight datasets** on shops. This process took all previously recorded shop records, **11,312** to be exact, and **unified** them into one collective dataset, which now houses all shop data ever collected by the VPC. This work was done remotely, over the course of seven weeks, with the help of our advisors, Professors Fabio Carrera and Jennifer deWinter.

Our dataset houses three subsets of data, **"Venice Shops", "Store Locations", and "Venice Shops Images"**.

# EXECUTIVE SUMMARY

The “**Venice Shops**” dataset houses information on the **name** and **type** of a shop while the “**Store Locations**” dataset contains information on a **shop’s location**. This includes its address, which *sestiere* it’s located in, and its longitudinal and latitudinal coordinates. Lastly, our team also found and consolidated any and all photos of shops and stored them in our “**Venice Shops Images**” dataset.

Once cleaned, this data was then **visualized** on our **web application**. It allows users to **filter** shop data by the year the data was collected, the type of shop, as well as **filter** shops by their target audience based on the shop type.



(Nextvoyage, 2017)



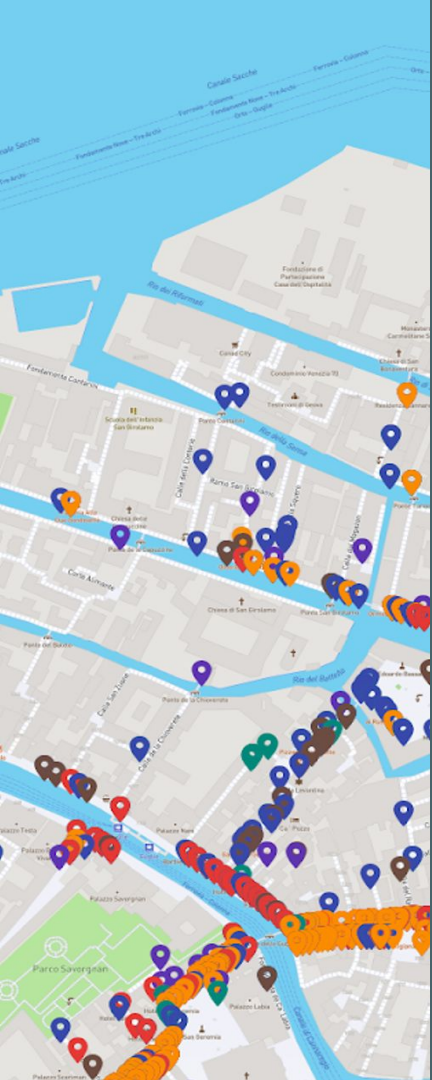
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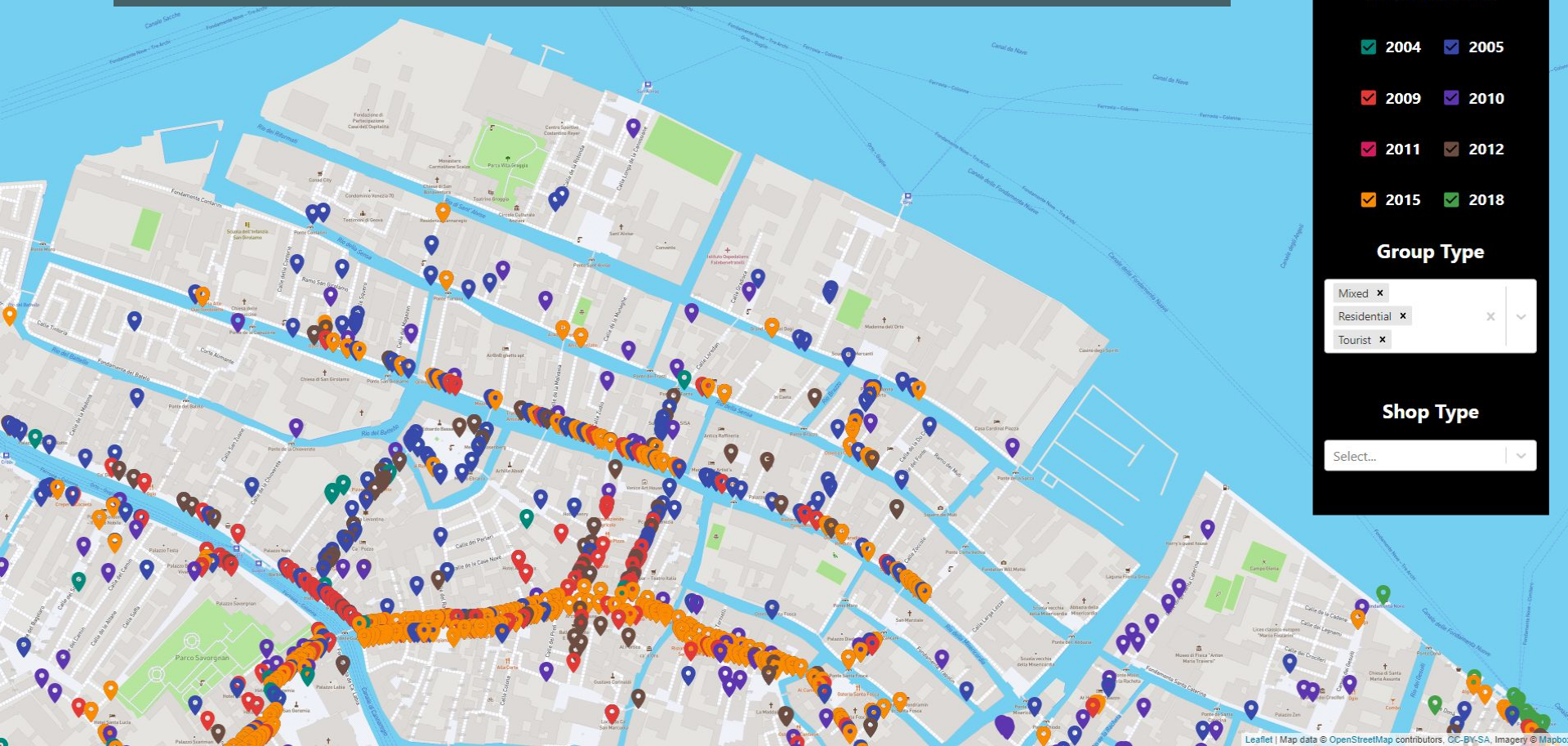


# THE “VENICE SHOPS” WEB APPLICATION

Our application allows users to visualize longitudinal and contemporary data on **Venetian shops**. The data has been consolidated from previous WPI teams who have been collecting data since 2004.

# VENICE SHOPS

This is a screenshot of our web application. It houses an immense volume of data and has the ability to filter through all of it. Its features and the data it houses will all be explored in much further detail throughout this booklet.



## Filters

### Year Collected

- ☒ 2004 ☒ 2005
- ☒ 2009 ☒ 2010
- ☒ 2011 ☒ 2012
- ☒ 2015 ☒ 2018

### Group Type

Mixed ☒ ☐

Residential ☒ ☐

Tourist ☒ ☐

### Shop Type

Select...





# THE IMPORTANCE OF SHOPS

Why is it important to track shops and visually see where they're located within a city or region, such as Venice?

**This section details their importance**, their link to the economy, and **how our web application can be used by our sponsors and any other interested party.**

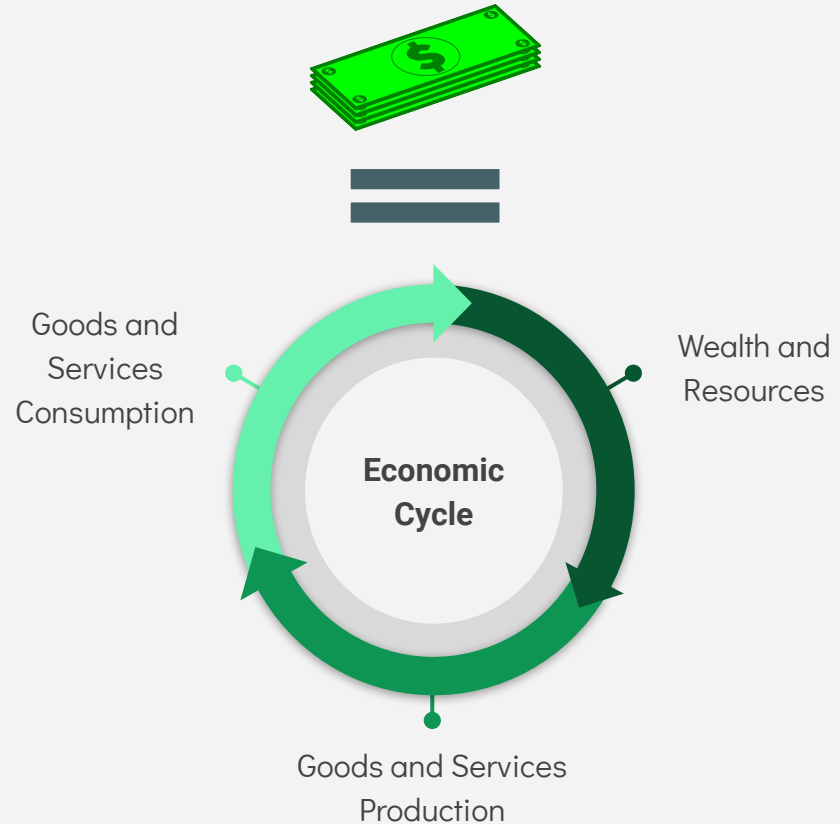
# SHOPS AND THE ECONOMY ARE LINKED

The importance of shops and the reason for tracking them over time stems from the fact that they are **linked to the economy**. The Oxford English Dictionary describes an economy as the following:

**“The wealth and resources of a country or region, especially in terms of the production and consumption of goods and services” (Economy, 2020).**

Simply put, an **economy depends on the goods and services provided by a country or region**. When thought of in this way, an economy can be seen as a simple cycle, which can be seen in the figure on the right.

In this cycle, a country or region will start with an initial quantity of wealth and resources which will be used to produce goods and services. These will then be consumed by the local residents and hopefully lead to an increase in wealth and resources for the country or region in question.





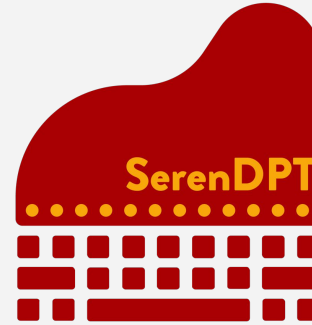
# SHOPS ARE ECONOMIC INDICATORS



When focus is put on the bottom portion of this cycle, it becomes evident that the **production of goods and services is facilitated through shops**. When seen in this light, it's evident that shops and the businesses they encapsulate help stimulate an economy and in essence, can act as a **reflection of the larger economy** of a city or region. In this way, shops can act as an **economic indicator**.

# OUR APPLICATION AND SUSTAINABLE TOURISM

SMARTDEST



**SMARTDEST is a research project leading the way in urban transformation and social exclusion.** Their goal is to contribute towards urban policy agendas that take tourism and its social effects seriously. Since the COVID-19 pandemic, **SMARTDEST is focusing on a 'sustainable' return of tourism** (Universitat Rovira, 2020) . **SerenDPT is a Venetian-based organization whose mission is to create more employment opportunities for Venetian residents** (SerenDPT, 2020). They aim to open new, innovative startups throughout Venice that will not only create new employment, but also solve some of the city's problems. It is currently in charge of the Venice case study of the SMARTDEST Project. **Working with SerenDPT directly, we intend to help contribute to both of these goals by providing them our web application so they may visualize and analyze Venice's commerce.**

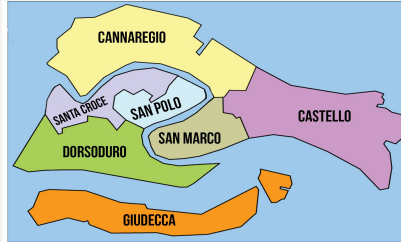
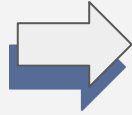


# WPI HAS BEEN COLLECTING DATA SINCE 2004

Past WPI research teams have understood the importance of shop data and have already collected a vast quantity of information since 2004. **This section details from where the data was collected, how it was collected, and the specific attributes collected.**



# OUR APPLICATION LEVERAGES A LARGE DATASET

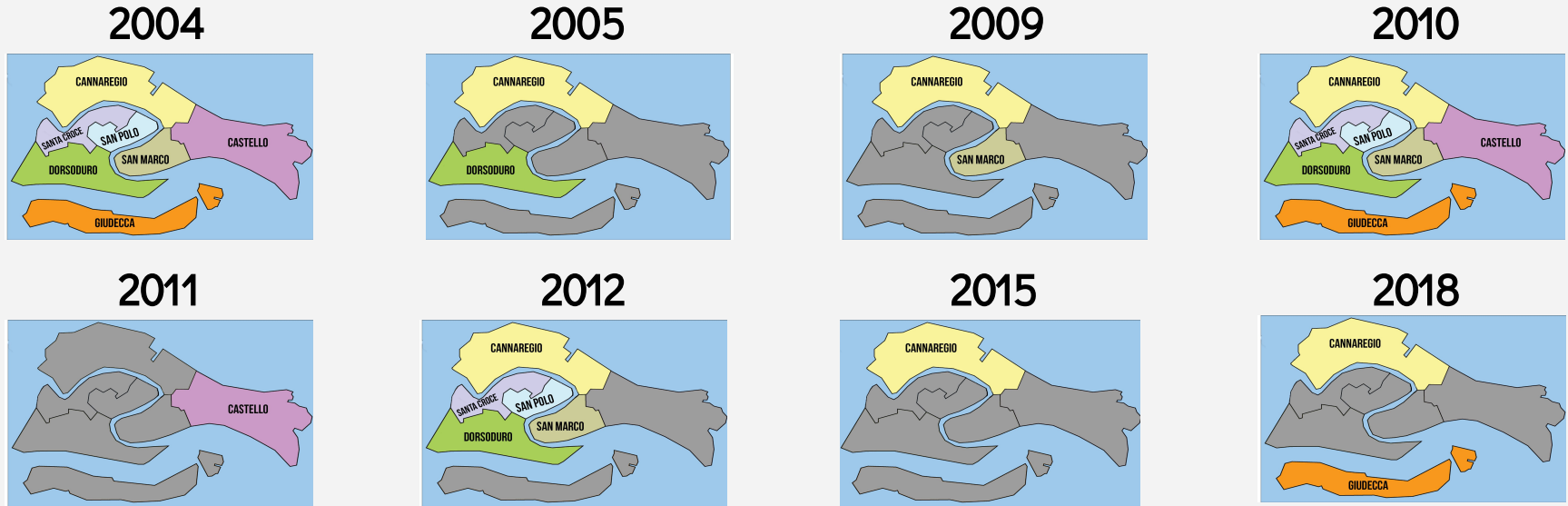


8 Teams  
Over 15 Years

11,312 Shops  
Surveyed

For the past **15 years**, through the Venice Project Center, **8 WPI research teams** have collected shop data in all six *sestieri* of Venice as well as the island of Giudecca! In total, there have been **11,312 shops surveyed**. This statistic includes shops that were surveyed multiple times over consecutive projects. Recording this data allows the history of a specific shop as well as shop locations that have housed different businesses to be tracked in our web application.

# OUR APPLICATION CAPTURES CHANGE OVER TIME



Seen above is a **timeline** of the different *sestiere* from where **shop data has been collected** by the past eight WPI research teams. Any *sestiere* grayed out for a specific year means data was not collected from that location. As it can be seen, **not all sestieri have been surveyed equally**, with Cannaregio standing out since it's been surveyed almost every year data has been collected. For Cannaregio and other similar *sestiere* where shops were surveyed over time, a **timeline of Venetian commerce is able to be drawn** and our web application can visualize this to help make any analyses or see patterns and trends in Venetian shops.

Grocery Stor	Grocery Store	G.52.1.1	Residential	Prix Grocery Stor	Grocery Store	G.52.1.1	Residential
No Name	Grocery Store	G.52.1.1	Residential	No Name	Grocery Store	G.52.1.1	Residential
No Name	Grocery Store	G.52.1.1	Residential	No Name	Grocery Store	G.52.1.1	Residential
Parificio Crosara Bakery		G.52.2.4.1	Mixed	Parificio Crosara Bakery		G.52.2.4.1	Mixed
No Name	Bar	H.55.4.0.1	Mixed	No Name	Bar	H.55.4.0.1	Mixed
No Name	Tobacco	G.52.2.6	Mixed	No Name	Tobacco	G.52.2.6	Mixed
Macaleria	Grocery Store	G.52.1.1	Residential	Macaleria	Grocery Store	G.52.1.1	Residential
No Name	Household Good	G.52.4.4.2	Residential	No Name	Household Good	G.52.4.4.2	Residential
No Name	Art	G.52.4.8.2	Mixed	No Name	Art	G.52.4.8.2	Mixed
No Name	Bar	H.55.4.0.1	Mixed	No Name	Bar	H.55.4.0.1	Mixed
Estetica Mar y Si Spa		O.93.0.2.3	Mixed	Estetica Mar y Si Spa		O.93.0.2.3	Mixed
No Name	Bar	H.55.4.0.1	Mixed	No Name	Bar	H.55.4.0.1	Mixed
No Name	Restaurant	H.55.3.0	Mixed	No Name	Restaurant	H.55.3.0	Mixed
Gelateria San Gic Gelateria		H.55.3.0.2	Mixed	Gelateria San Gic Gelateria		H.55.3.0.2	Mixed
No Name	Grocery Store	G.52.1.1	Residential	No Name	Grocery Store	G.52.1.1	Residential
Bar .collo Modi	Restaurant	H.55.3.0	Mixed	Bar .collo Modi	Restaurant	H.55.3.0	Mixed
Majur	Bakery	G.52.2.4.1	Mixed	Majur	Bakery	G.52.2.4.1	Mixed
Profil	Souvenirs	G.52.4.8.19	Tourist	Profil	Souvenirs	G.52.4.8.19	Tourist
No Name	Clothing	G.52.4.2	Mixed	No Name	Clothing	G.52.4.2	Mixed
No Name	Restaurant	H.55.3.0	Mixed	No Name	Restaurant	H.55.3.0	Mixed
Romina e Sara	Restaurant	H.55.3.0	Mixed	Romina e Sara	Restaurant	H.55.3.0	Mixed
No Name	Toys	G.52.4.8.20	Mixed	No Name	Toys	G.52.4.8.20	Mixed
Lavaggio Tende L Dry Cleaner		O.93.0.1.1	Residential	Lavaggio Tende L Dry Cleaner		O.93.0.1.1	Residential
Prix Grocery Stor Grocery Store		G.52.1.1	Residential	Prix Grocery Stor Grocery Store		G.52.1.1	Residential
No Name	Grocery Store	G.52.1.1	Residential	No Name	Grocery Store	G.52.1.1	Residential
No Name	Grocery Store	G.52.1.1	Residential	No Name	Grocery Store	G.52.1.1	Residential
Parificio Crosara Bakery		G.52.2.4.1	Mixed	Parificio Crosara Bakery		G.52.2.4.1	Mixed
No Name	Bar	H.55.4.0.1	Mixed	No Name	Bar	H.55.4.0.1	Mixed
No Name	Tobacco	G.52.2.6	Mixed	No Name	Tobacco	G.52.2.6	Mixed
Macaleria	Grocery Store	G.52.1.1	Residential	Macaleria	Grocery Store	G.52.1.1	Residential
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No Name	Bar	H.55.4.0.1	Mixed	No Name	Bar	H.55.4.0.1	Mixed
Estetica Mar y Si Spa		O.93.0.2.3	Mixed	Estetica Mar y Si Spa		O.93.0.2.3	Mixed
No Name	Bar	H.55.4.0.1	Mixed	No Name	Bar	H.55.4.0.1	Mixed
No Name	Restaurant	H.55.3.0	Mixed	No Name	Restaurant	H.55.3.0	Mixed
Gelateria San Gic Gelateria		H.55.3.0.2	Mixed	Gelateria San Gic Gelateria		H.55.3.0.2	Mixed
No Name	Grocery Store	G.52.1.1	Residential	No Name	Grocery Store	G.52.1.1	Residential
Bar .collo Modi	Restaurant	H.55.3.0	Mixed	Bar .collo Modi	Restaurant	H.55.3.0	Mixed
Majur	Bakery	G.52.2.4.1	Mixed	Majur	Bakery	G.52.2.4.1	Mixed
Profil	Souvenirs	G.52.4.8.19	Tourist	Profil	Souvenirs	G.52.4.8.19	Tourist
No Name	Clothing	G.52.4.2	Mixed	No Name	Clothing	G.52.4.2	Mixed
No Name	Restaurant	H.55.3.0	Mixed	No Name	Restaurant	H.55.3.0	Mixed
Romina e Sara	Restaurant	H.55.3.0	Mixed	Romina e Sara	Restaurant	H.55.3.0	Mixed
No Name	Toys	G.52.4.8.20	Mixed	No Name	Toys	G.52.4.8.20	Mixed
Lavaggio Tende L Dry Cleaner		O.93.0.1.1	Residential	Lavaggio Tende L Dry Cleaner		O.93.0.1.1	Residential
Prix Grocery Stor Grocery Store		G.52.1.1	Residential	Prix Grocery Stor Grocery Store		G.52.1.1	Residential
No Name	Grocery Store	G.52.1.1	Residential	No Name	Grocery Store	G.52.1.1	Residential
No Name	Grocery Store	G.52.1.1	Residential	No Name	Grocery Store	G.52.1.1	Residential
Parificio Crosara Bakery		G.52.2.4.1	Mixed	Parificio Crosara Bakery		G.52.2.4.1	Mixed
No Name	Bar	H.55.4.0.1	Mixed	No Name	Bar	H.55.4.0.1	Mixed
No Name	Tobacco	G.52.2.6	Mixed	No Name	Tobacco	G.52.2.6	Mixed
Macaleria	Grocery Store	G.52.1.1	Residential	Macaleria	Grocery Store	G.52.1.1	Residential
No Name	Household Good	G.52.4.4.2	Residential	No Name	Household Good	G.52.4.4.2	Residential
No Name	Art	G.52.4.8.2	Mixed	No Name	Art	G.52.4.8.2	Mixed
No Name	Bar	H.55.4.0.1	Mixed	No Name	Bar	H.55.4.0.1	Mixed
Estetica Mar y Si Spa		O.93.0.2.3	Mixed	Estetica Mar y Si Spa		O.93.0.2.3	Mixed
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Bar .collo Modi	Restaurant	H.55.3.0	Mixed	Bar .collo Modi	Restaurant	H.55.3.0	Mixed
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Profil	Souvenirs	G.52.4.8.19	Tourist	Profil	Souvenirs	G.52.4.8.19	Tourist
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No Name	Restaurant	H.55.3.0	Mixed	No Name	Restaurant	H.55.3.0	Mixed
Romina e Sara	Restaurant	H.55.3.0	Mixed	Romina e Sara	Restaurant	H.55.3.0	Mixed
No Name	Toys	G.52.4.8.20	Mixed	No Name	Toys	G.52.4.8.20	Mixed

# CONSOLIDATING PAST DATA

With teams gathering data as early as 2004, information was stored differently and many attributes were labeled different. This created the need to consolidate it all into one dataset so that all of the past data could be comparable to each other. This section highlights how all previously collected data was captured and the work done to build our comprehensive dataset.



# COLLECTING CONSISTENT STORE ATTRIBUTES OVER TIME

Past WPI teams travelled around the *sestieri* of Venice surveying each shop in person, but **each team collected slightly different attributes** from the shops that they surveyed. Some teams took detailed notes while others just collected the bare minimum needed to identify the shop. Despite this, **every team did collect some general information** like the name, address, and type of service provided.



(Bruso, B., et al., 2012)

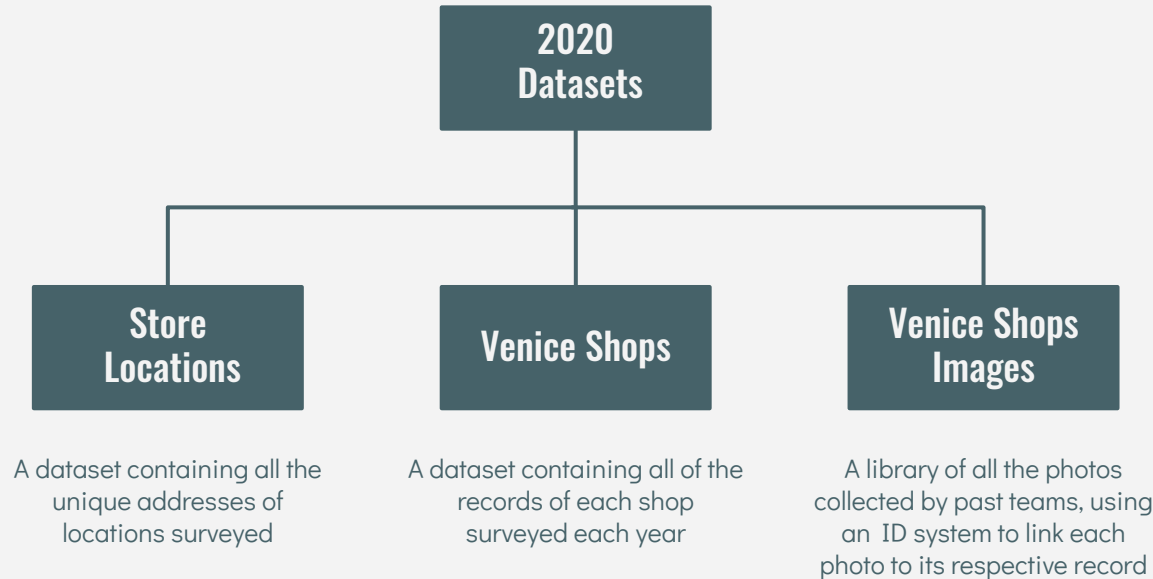
# STANDARDIZED ATTRIBUTES

We found a **set of 13 attributes** that were consistently collected throughout all of the past years, which can be seen on in the figure on the right. Our data cleaning methodologies used to generate our sets using these attributes are **further detailed in the team's technical document addendum.**

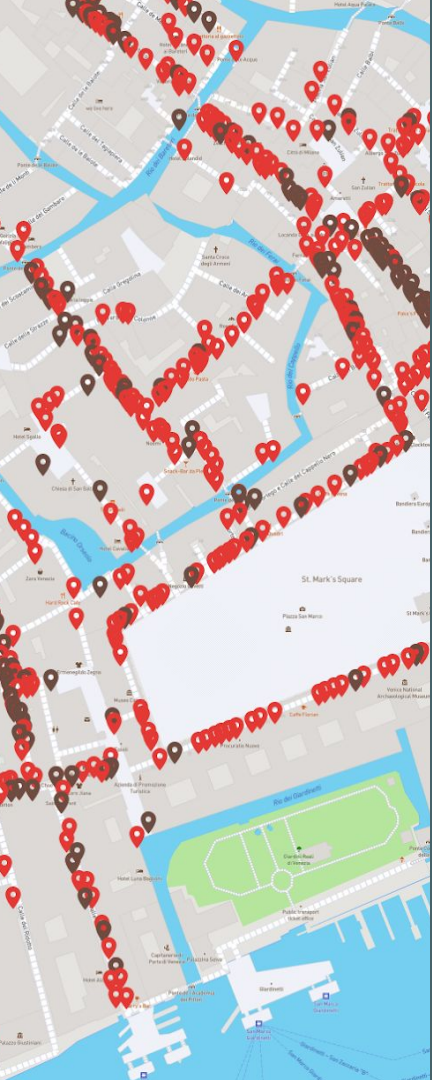
- **Group type** refers to whether the shop caters towards tourists, residents, or both (mixed)
- **NACE code** refers to the system we use to identify the type of shop.
  - it is the **statistical classification of economic activities in the European Union**
  - The NACE code system we are using has helped **identify over 100 unique types of shops** found in our dataset

Attributes	Example Entry
Store Name	Trattoria Alla Palazzina
Address	Calle Michelangelo 1509
Sestiere	Giudecca
Address Number	1509
Latitude	45.1234
Longitude	12.1234
Shop Type	Trattoria
NACE Code	H.55.3.0.2
Group Type	Mixed
Year Open	-
Year Closed	-
Year Collected	2010
Image	2010_GD_1509

# THE FINAL INTEGRATED DATASETS







# FEATURES OF OUR WEB APPLICATION

Our web application can prove to be useful in many **instances**. We now want to highlight the features we've developed which include **filtering specific shop types** and **comparing data from multiple years** to each other.

The screenshot displays a web application for viewing shop locations in Venice. The main map area shows a detailed street view of Venice with numerous pins. A sidebar on the right contains filter controls. Two text boxes provide context: one explains that different pin colors represent different years, and another notes that users can view all 8 years of data at once or select a unique combination. The filter sidebar includes sections for 'Year Collected' (with checkboxes for 2004, 2005, 2009, 2010, 2011, 2012, 2015, 2018), 'Group Type' (a dropdown menu), and 'Shop Type' (checkboxes for Grocery Store, Bar, Restaurant, Cafe).

**VENICE SHOPS**

Users can choose to view all 8 years worth of data at once, or select a unique combination of years

When looking at multiple years, different colors indicate the different years

**Filters**

**Year Collected**

☒ 2004 ☐ 2005  
☐ 2009 ☒ 2010  
☐ 2011 ☐ 2012  
☐ 2015 ☐ 2018

**Group Type**

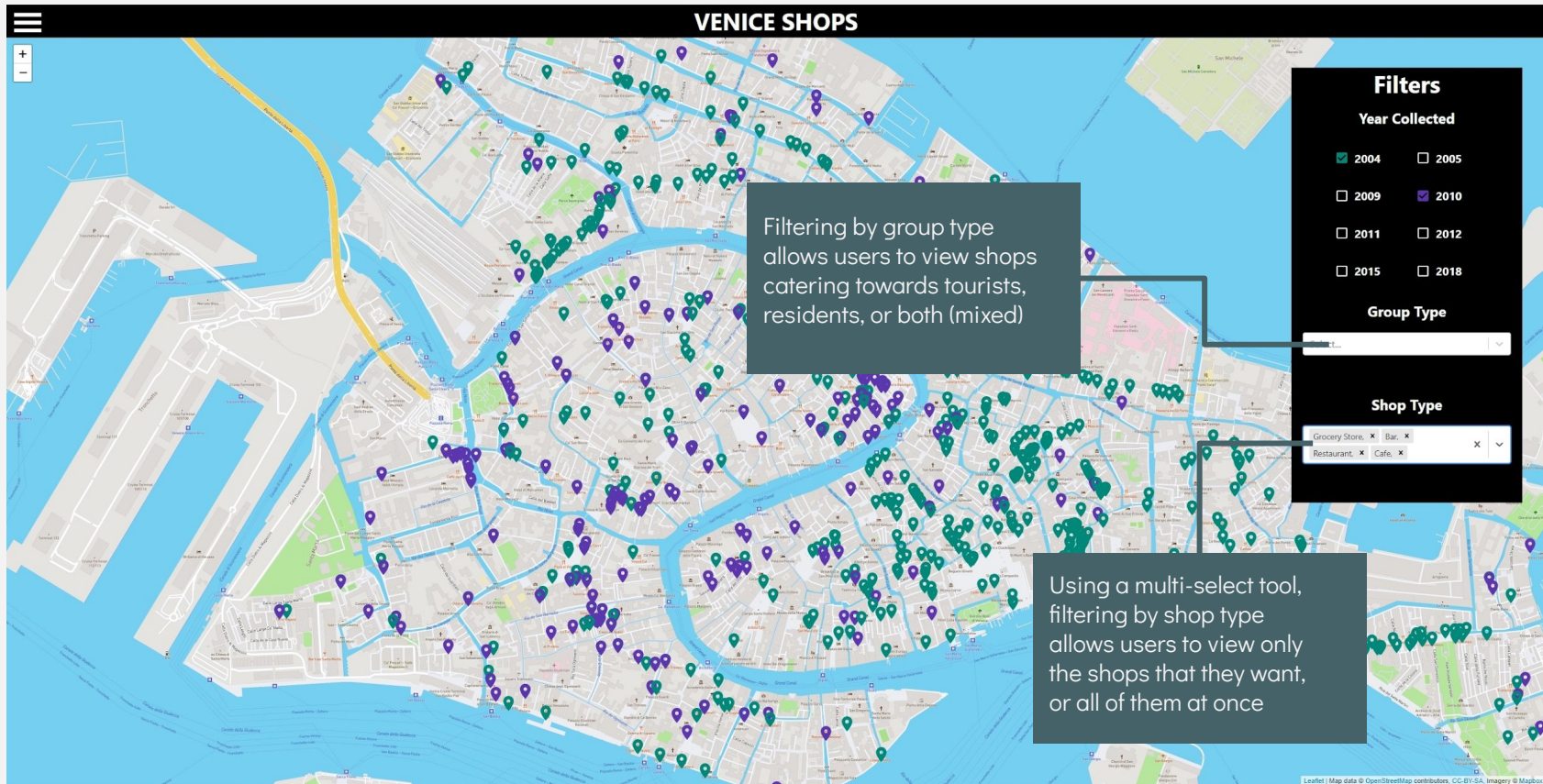
Select...

**Shop Type**

Grocery Store, Bar, Restaurant, Cafe

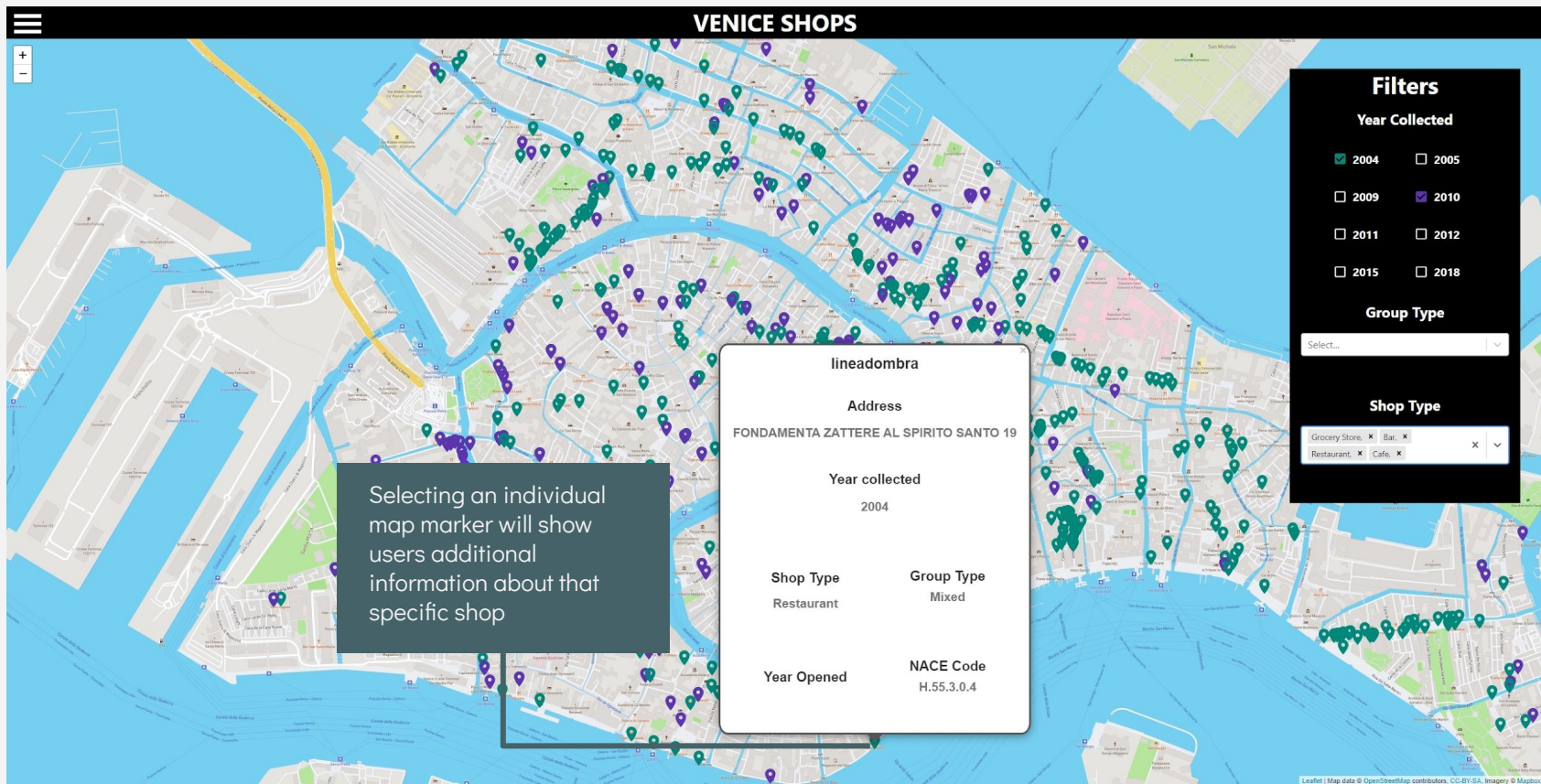
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

# SHOP TYPES CAN BE ISOLATED AND COMBINED





# INDIVIDUAL SHOPS CAN BE EXPLORED





# SAMPLE ANALYSIS

The features highlighted can be used to conduct a number of analyses. With over 100 shop types categorized and data from eight years of research, there are numerous possibilities. This section **highlights three examples:**

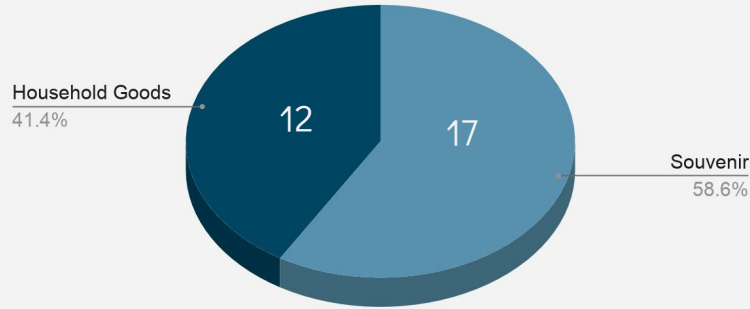
*Comparing Specific Shop Types In Cannaregio from 2004 and 2015*

*Target Consumers of Different Sestieri in 2005*

*Investigating Closed Shops Over Time*

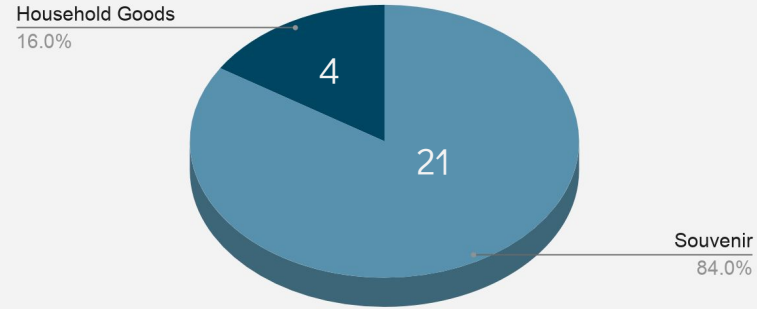
# CANNAREGIO SOUVENIR SHOPS ON THE RISE

Souvenir and Household Good Shops Surveyed 2004



Total: 29

Souvenir and Household Good Shops Surveyed 2015

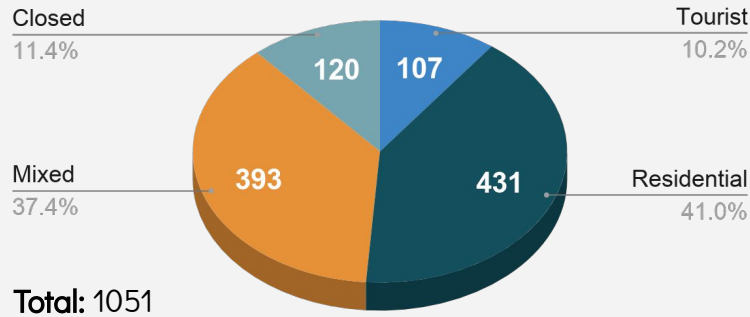


Total: 25

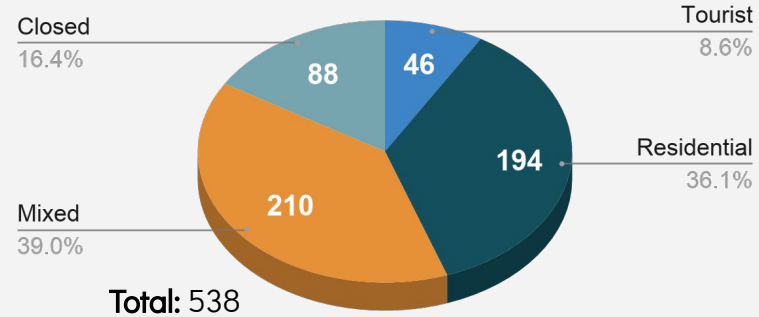
When looking at the data of souvenir and household good shops surveyed in 2004 and 2015 in Cannaregio, two things should be noted. Firstly, **the total number of souvenir and household good shops surveyed each year differed, although very slightly**. In 2004, the total number of souvenir and household good shops surveyed was 29, while in 2015 it was 25. Knowing this and looking at the pie charts above, which represent the relative percentages of each dataset, it becomes evident that the **number of souvenir shops has risen when comparing 2004 and 2015 in Cannaregio**. In 2004, both souvenir and household good shops seemed to be approximately equal, with household good shops making up approximately 41% of both shop types, and souvenir shops making up the latter half. When looking at the 2015 data however, it can be seen that the number of **souvenir shops increased by almost 25%, while household good shops decreased by 25%**. (Chandonnet, et al., 2004; Gandomi, et al., 2015)

# WHAT IS THE TARGET AUDIENCE OF DIFFERENT SESTIERI

2005 Cannaregio Group Types



2005 Dorsoduro Group Types

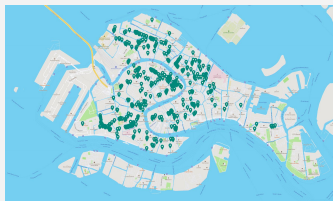


Along with being able to compare years in Venice, our site can also be used to **view trends in the target consumers of shops**. Shown here is an example analysis comparing the group type of shops between two separate *sestieri* within a single year of data collection. Based on the graphs above, in 2005 the largest percentage of shops in Cannaregio target residents, while the largest percent of shops in Dorsoduro target a mix of both residents and tourists (Greene, et al., 2005).



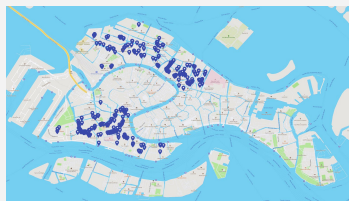
# INVESTIGATING CLOSED SHOPS OVER TIME

2004



12%

2005



17%

2009



8%

2010



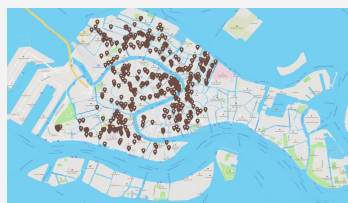
18%

2011



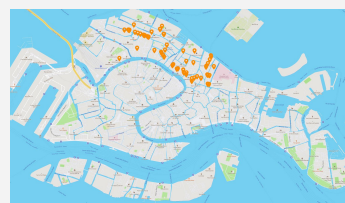
26%

2012



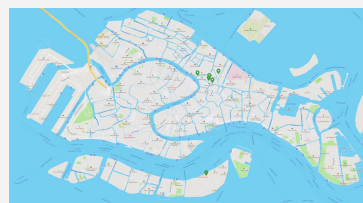
27%

2015



9%

2018



3%

The graphs above show only the **closed shops recorded for each year**. The percent of closed shops varies significantly from year to year, likely due to the different teams surveying different areas of Venice and having varying sizes in their datasets. Considering these conditions, we highly encourage future teams to improve data collection methods in order to increase the consistency between datasets.

# CLOSED SHOPS ARE SOCIO-ECONOMIC INDICATORS



(Chandonnet, G., et al., 2004)

Continuing to track **closed shop data** is an **economic indicator** in of itself. Having the geographical and descriptive information of these shops **can tell a lot about the inhabitants of the surrounding area.**

As we do not yet have access to data from after the COVID-19 pandemic, the number of shops currently closed in Venice is unknown, but likely higher than it was in even the most recent datasets. **Analyzing the shops that closed due to the pandemic will be crucial in the city's fight to recover from it.** Although we don't yet know what the closed shops of Venice will look like post pandemic, **our application is ready for that data and will make it easy for future teams to analyze it.**



# Planning for the Future

The work our team has accomplished is only the **beginning**. There's still room to innovate. The following pages will be outlining the recommendations our team has for features moving forward. These features are **further detailed in the team's technical document addendum.**

# NEXT STEPS FOR OUR WEB APPLICATION

## Data Validation



## Data Collection



## Data Analysis

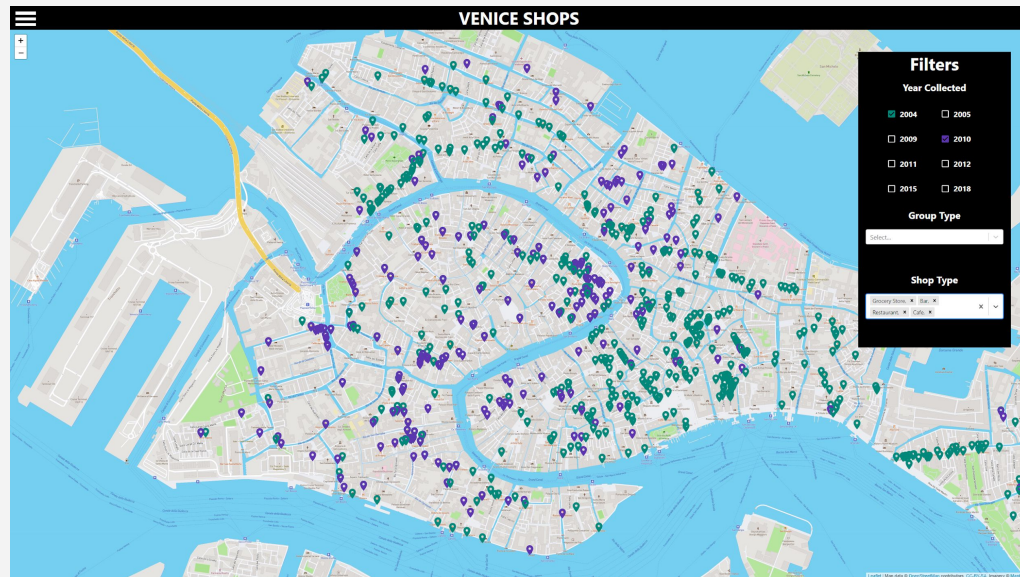
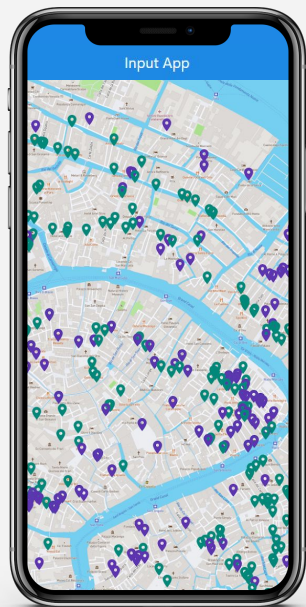
Optimize the **existing dataset** and **include features** that help **modify the dataset** within the application in order to **assess the existing archival data** as well as **connect newly uploaded data**.

Improving the data collection process is paramount to the future success of the project. Teams should **prioritize collecting as much of a full picture of the city** as they can during their surveys.

Look beyond the Venice Project Center (VPC) and **investigate meaningful data sets that can be compared to VPC data**. We encourage teams to **contact the Venice Chamber of Commerce** as well as **research census tract and Airbnb data** on Venice in order to further understand the tourist and residential populations.



# USING INPUT APP TO UPDATE “VENICE SHOPS”



It's now more important than ever to have a **strong** and **efficient method** for **data collection** so that we can capture the state of the **whole city** again. 2010 was the last year that all *sestieri* were surveyed by the project team. We strongly **recommend** that the following teams **focus on developing the Input App**, which is located inside of the same host application that houses our dataset. By simultaneously redesigning the Input App as well as our application to be more **accessible on mobile devices**, in person data collection will be incredibly more **efficient** and will be **accessible** to a wider audience of people.

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