



# **Interactive Venice:** **Using Art and Games to Bring Awareness to Venetian Social Concerns**

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*An Interactive Qualifying Project Report  
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Degree of Bachelor of Science*

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## AUTHORSHIP

This project was completed with the participation of each team member. Without combined cooperation and effort, this project would not have been successfully completed and brought to its current form. Each team member contributed his or her skills in the different pieces of this project, and aided in its overall success.

The “Interacting” hardware installations were created and tested by Rinaldo Izzo and Roni Rostom.

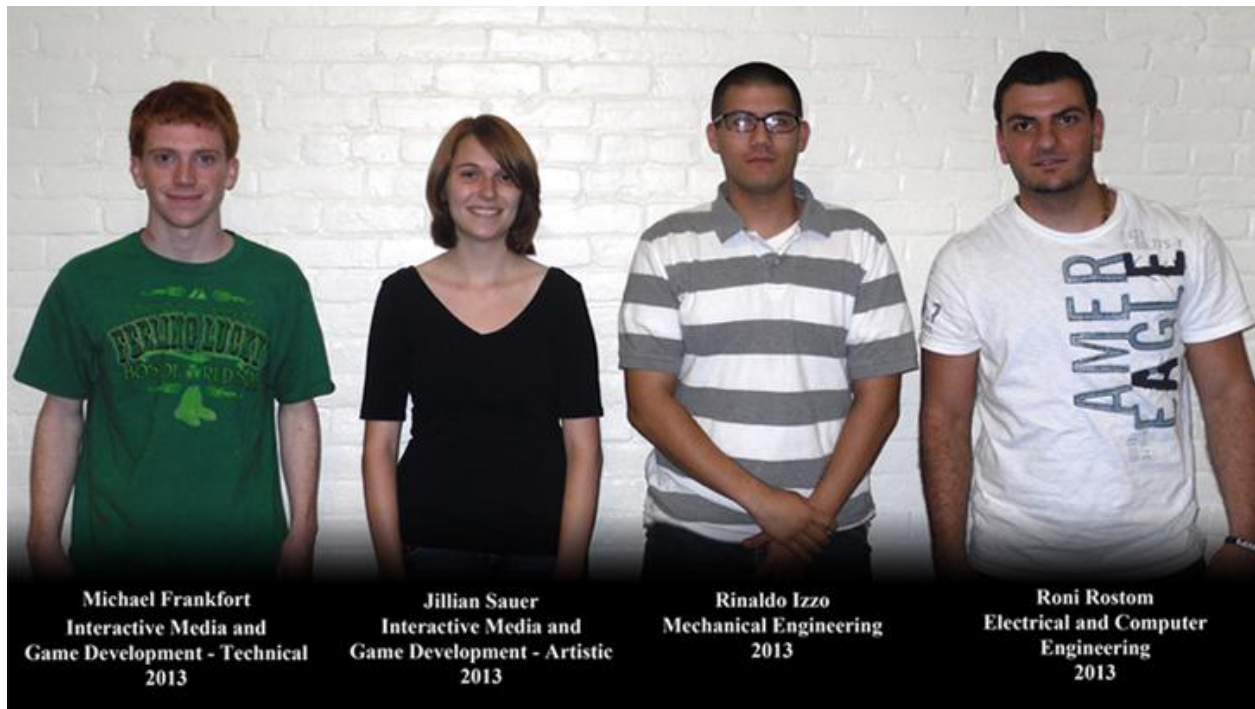
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The “Contributing” mobile application was created and tested by Michael Frankfort.

The “Interactive Venice” exhibit room design was created through the effort of the entire group.

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## **ABSTRACT**

This project explores three approaches to raising awareness about the social concerns in Venice through fun and interactivity. The first approach, entitled "Interacting," consists of hardware installations designed to stimulate the senses of a user. The second approach, called "Exploring," consists of a geocaching route, an outdoor treasure hunting game. The third approach, entitled "Contributing," is a mobile application which allows users to tag and locate Venetian social concerns. These three approaches are woven together by an art exhibit that acts as a central terminal to display all of the individual elements. The exhibit uses multiple types of interaction and media in order to share knowledge of social problems in Venice, as a foundation to be featured in a major art exhibition.

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## EXECUTIVE SUMMARY

Students from Worcester Polytechnic Institute have completed projects in Venice for close to 25 years, studying a wide variety of subjects involving issues of Venetian social concern. These reports have generated significant results through rigorous research and development, aiding multiple agencies in Venice in further improving their city. However, our team took a less conventional approach to these issues, by designing fun, exciting, interactive art installations to impart knowledge and inspire awareness in both native Venetians and tourists who are only in Venice for only a short a time.

Employing art as a means of creating awareness is not a new concept in the art world. There have been countless examples throughout history of artists sending messages through a work of art or an exhibit about a social concern present in society. For example, Pablo Picasso's 1937 painting "Guernica" was created in response to the bombing of Guernica, Spain, drawing attention to the social injustice of the destruction and civilian casualties of the Spanish Civil War. As technology has advanced and art has evolved, artists have also been experimenting with creating awareness through interactive art installations. An example of this approach using interactivity in art to achieve social goals, the exhibit "InterANTARCTICA" created by the University of Sydney successfully educated participants about the issue of climate change in Antarctica.

In our project, we developed three approaches to promote awareness through art, which we termed "Interacting," "Exploring," and "Contributing." Each approach was deployed and tested in order to measure its effectiveness in highlight Venetian social concerns.

As part of our "Interacting" approach, we created three separate hardware installations which highlighted Venetian social concerns by engaging different senses in a hands-on way through experiential interactions with physical objects. The first installation, "Scents and Sensibilities," took advantage of the user's sense of smell to raise awareness towards the Venetian issue of illegal garbage dumping; when the users interacted with a pressure pad in this electronic installation, an air freshener was triggered to deliver a spray that would cover up the smell trash at that location. The second installation, "Brodo di Pesce," used the participants' senses of taste and sight to emphasize the delicate relationship between Venice and its surrounding waters. As the users eat the soup in the bowl, the level of liquid would gradually reveal the three-dimensional shape of the city, thus reminding them of the tides that flood in and out of the city. The third installation was a modular device designed to act as a platform for further customization in creating a variety of different electronic interactive installation. Built from computer components, sensors, and sound devices, this



"Scents and Sensibilities" installation design

installation was prototyped to raise awareness about graffiti and vandalism in Venice. When users interact with the installation by setting off the motion sensor, the device emits the sound of a graffiti spray can in action, drawing attention to vandalism that mars the beauty of Venice.

The second approach which we called “Exploring,” consists of a treasure hunting game of puzzles and riddles spread throughout the city of Venice, to allow participants to witness the social concerns of the city for themselves while learning about them in an unconventional, interactive way. Based off the pre-existing game of Geocaching, where people around the world hide



“Brodo di Pesce” installation

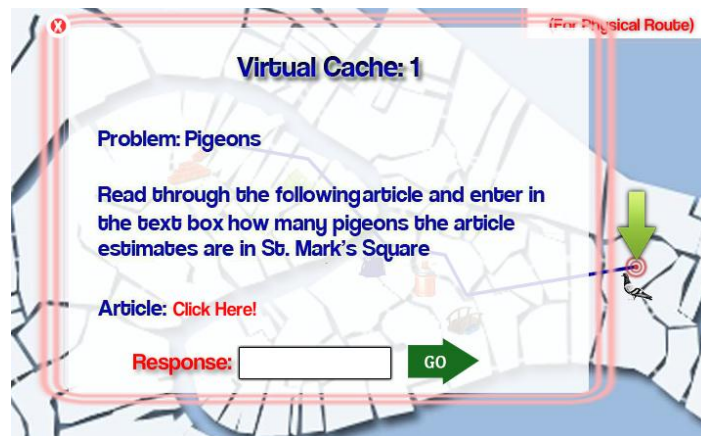


Modular interactive installation

containers for others to find with the use of Global Positioning System devices, our experimental interactive puzzle route featured six hidden containers that led players on a tour of Venice. Participation in this type of tour would allow the users to experience different aspects of Venice that they would not otherwise see as a typical tourist. The route encouraged the participants to be aware of their surroundings by counting specific social concerns and searching for the hidden containers. As a whole, the route prompted the participants to see the distinction between Venice as a tourist attraction and Venice as a residential city with social concerns.

Our geocaching route provided explanations of the social concerns in Venice in addition to allowing participants to witness them in person. Each container included information about a social concern that is present in the part of Venice where the cache was hidden to further highlight them. Additionally, the users were instructed to count a specific prevalent issue from one container to the next. This would encourage the participants to see just how the problems affect everyday life for tourists and native Venetians.

To include participants that would not be physically in Venice, we created an interactive online puzzle game to mirror the geocaching route, which allowed the players to gain the same insight and information as



Screenshot of the interactive online puzzle game



“ButOne” application

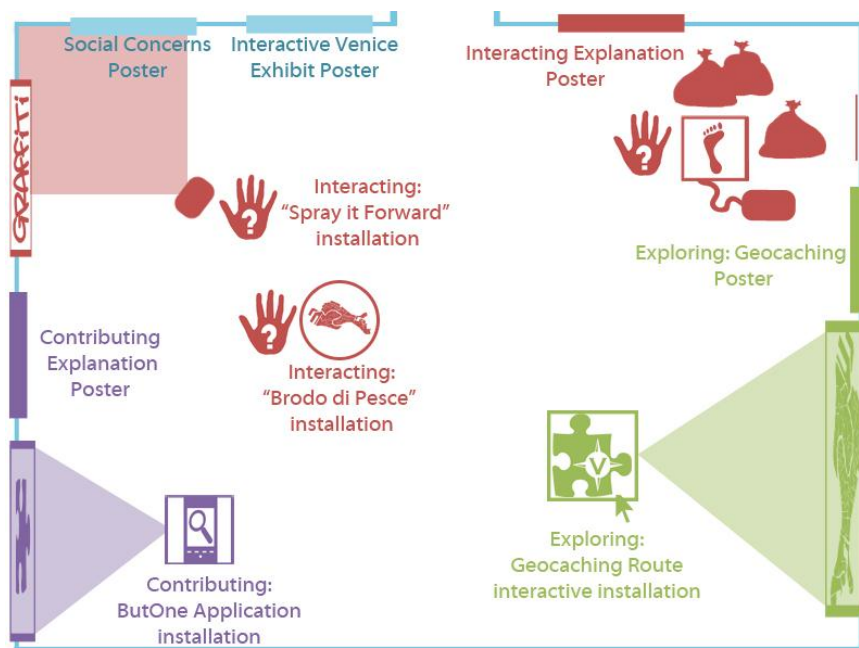
someone who was walking the actual route in Venice. There were six puzzles in the game that each highlighted a different social concern, as the physical containers of the geocaching route in Venice did.

The final approach, which we termed “Contributing,” consisted of a mobile phone application that would allow users to participate in the collection of data about Venice’s social concerns. The “ButOne foto” Android phone application would enable users to tag and upload a picture of a specific Venetian social problem along with the GPS coordinates of the location. The data collected from the application would then be available on an external website, where a map displaying the tagged locations of social concerns in Venice could be viewed.

In order to bring all three approaches of Interacting, Exploring, and Contributing together as one campaign, our team designed an art exhibit. This exhibit focused on learning and education through fun and engaging content. The Interacting hardware

installations were included for participants to physically play with, the ButOne application was set up to introduce users to data collection, and the online puzzle route was set up with information about the physical geocaching route in Venice.

The final goal of this exhibition room is to be featured in an organized art festival or another venue where our exhibit would reach a larger audience to create awareness about social concerns present in Venice, such as the Venice Biennale. Together, the exhibit room, deployed geocaching route, and data collection form a multifaceted artistic campaign.



Prototype exhibit floor plan

# 1. INTRODUCTION

Cultural heritage and historic artifacts are being destroyed in cities all around the world. In China, economic growth in the past two decades has resulted in a massive transfer of population from the countryside to the cities, resulting in the shrinking usage of traditional Chinese dialects.<sup>1</sup> The debt crisis in Greece has depleted government funds for the preservation of historic sites, so archeological sites in Athens such as the Parthenon and the Acropolis cannot be further renovated and restored.<sup>2</sup> The destruction and looting of cultural property is widespread in Iraq, one of the world's most significant places for archaeology; the Iraq Museum, National Library, National Archives and Religious Library in Baghdad have all been casualties of the recent Iraq wars.<sup>3</sup> Though every city is different and many factors come into play, many face a lack of awareness as to the importance of maintaining and preserving cultural heritage. Social problems that affect a community appear in different forms in different parts of the world, but solutions are not found for these issues unless the lack of public awareness is first addressed. The main objective of this project was to raise awareness about the social concerns present in Venice, Italy, both in visitors and local Venetians.

Venice, considered one of the most beautiful cities in the world, is in danger of losing important aspects of its cultural heritage as a result of social problems. As an ancient city rich in history, art and architecture, preserving Venice for generations to come is a task of great cultural importance. Local Venetians and visitors alike have been ignorant and apathetic of issues of social concern, failing to set their sights upon problems that affect Venice's culture and community. Raising awareness about these social problems is the key to preventing the loss of cultural heritage that threatens Venice if nothing is done.

One way of raising awareness about social problems is by means of art. Because it is visually appealing and often emotionally compelling, art has been used as a medium in raising awareness for centuries. Pablo Picasso created his famous 1937 painting *Guernica* in response to the bombing of Guernica, Spain during the Spanish Civil War, an outcry at the widespread destruction and the suffering inflicted upon innocent civilians in the attack.<sup>4</sup> The mural was displayed at the 1937 World's Fair in Paris and then went on a brief world tour, quickly gaining notoriety as an anti-war symbol and helping to bring the Spanish Civil War to the world's attention. Even today, *Guernica's* provocative visualization of the tragedies of war is representative of peace and anti-war sentiment, sending a very real, emotional message even though Picasso's style is distinctly abstract. In recent years, the British graffiti artist Banksy has created a multitude of street art installations that reflect and satirize issues in current politics and culture. The high exposure of graffiti art has allowed Banksy

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<sup>1</sup> Yu 2010

<sup>2</sup> Smith 2011

<sup>3</sup> Suter 2008

<sup>4</sup> Koppelman 2009

to create artwork that is a commentary and critique on the issues that society faces.<sup>5</sup> Banksy's art, like that of many artists before him, is a medium of social commentary that is effective in raising awareness about important issues present around the world.

Students from Worcester Polytechnic Institute recently completed an Interactive Qualifying Project at the Venice Project Center entitled "Postmodern Postmortem."<sup>67</sup> The project planned and prototyped 11 interactive public art installations that aimed to engage the six senses of the audience and present issues of social concern in Venice in a comprehensive, interactive way.<sup>8</sup> The Postmodern Postmortem project was successful in designing and developing prototypes for the interactive installations. However, the project only included short-term functionality testing of the electronic components as the "proof of concept" for these installations. The Postmodern Postmortem project did not address testing the longevity of the installations, realistically deploying the installations for a period of time in Venice, or evaluating the effectiveness of the installations in raising awareness about social problems among local Venetians and tourists. Without testing the interactive installations, it is unclear if the prototypes would survive in Venice's weather conditions, and if they are successful in creating awareness to inspire locals and tourists to consider the threat social concerns pose to Venice's cultural heritage.

This project aims to raise awareness among local Venetians and visitors about the issues affecting Venice's cultural heritage by creating interactive installations that highlight the social problems in Venice. The ultimate goal is for the installations to be showcased as one exhibit in a major art exhibition. In order to do this, we first identified the key issues of social concern present in Venice, Italy. Once we found relevant social problems and selected the ones that were the most prominent in Venice, we designed and prototyped interactive installations that intended to raise awareness about these problems. We performed strict, controlled tests on these prototypes as a means to evaluate their usefulness in creating awareness within the Venice community. Finally, we created a plan for successfully deploying the installations in Venice as one cohesive exhibit to be included in a major art exhibition.

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<sup>5</sup> Chaundy 2006

<sup>6</sup> "Worcester Polytechnic Institute" 2011

<sup>7</sup> "Venice Project Center" 2011

<sup>8</sup> Rinaldi et al. 2009

## 2. BACKGROUND

In order to understand the importance of creating awareness in Venice, it was necessary to study the current problems affecting the city that threatened Venetian cultural heritage. This report divides the social problems present in Venice into two main categories: issues stemming from the people and the community, and issues stemming from physical deterioration in this centuries-old city. While there are a wide variety of social concerns in Venice, these sections outline the ones chosen in this project through extensive research as some of the most prominent social problems in Venice. Section 2.1 described the social problems in Venice that concern its population: the commercialization of Venice's culture, the shrinking and aging of the local population, and the defacing of property or graffiti. Section 2.2 presented information on the structural concerns of Venice: Venice's deteriorating infrastructure, illegal garbage dumping, sewage problems, flooding, damaging of canal walls, and degenerating public art. Finally, Section 2.3 addressed the ways of raising awareness in Venice: creating awareness through art, interactive installations, geocaching, and the Venice Biennale.<sup>9 10</sup>

### 2.1 Community Concerns

Venice has a long history of tourism, dating back to religious pilgrims that came in the 15<sup>th</sup> century on their way to Jerusalem.<sup>11</sup> The modern increase in tourism in the last century, while beneficial for Venice's economy, also led to an increase of tourist-driven social problems. Local Venetians are not blameless, though they are often the victims of these problems; they have accepted Venice for what it is, and do not contribute to actively finding solutions to these social concerns.

#### 2.1.1 Commercializing Venice's Culture

Venice's economy has been tailored to the tourist for centuries. Venice once had specialty shops that would sell a specific kind of good, such as dairy or meat, scattered throughout the city. However, in recent years, large supermarkets are replacing many of these specialty stores, as it has become more convenient for local population to shop at one location for their needs. Tourists have less of an interest in specialty stores that



Figure 1: A busy street in Venice's retail sector

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<sup>9</sup> "Geocaching" 2011

<sup>10</sup> "La Biennale di Venezia" 2011

<sup>11</sup> Davis and Marvin 2004

typically cater to local Venetians.<sup>12</sup> The 60,000 tourists who visit Venice every day have also caused many souvenir shops to pop up where old family-owned shops once stood, as seen in Figure 1.<sup>13</sup>

Retail and souvenir stores also contribute to the lack of supermarkets in Venice, and domestic goods are becoming more expensive and harder to find among the hundreds of souvenir shops. The changing retail sectors of Venice results in many of the locally-owned stores to go out of business. These shops are then replaced by luxury retail stores which hold no cultural significance to Venice and cater mainly to tourists; over time, small, locally-owned business could disappear from Venice completely.

Beyond the issue associated with the advent of larger scale supermarkets, Venice has also seen a significant shift in the cost of living. Prices of goods are nearly always higher in central tourist destinations, creating an ever-rising cost for the primary goods in Venice. In addition, the shift of currency in Italy from the lira to the euro a decade ago has resulted in a price increase of goods in Venice. The price rise has affected transport, telephone, motorway, cigarette, and lottery charges, which impacts the local Venetian population greatly.

### 2.1.2 Shrinking and Aging of Venice's Local Population

Due to the commercialization of Venice, the cost of living has sky rocketed in recent decades, making it increasingly difficult for locals to stay in the city. Every year, the number of local inhabitants of Venice slowly declines, and in 2009 the number of inhabitants fell below 60 thousand whereas the annual tourist population

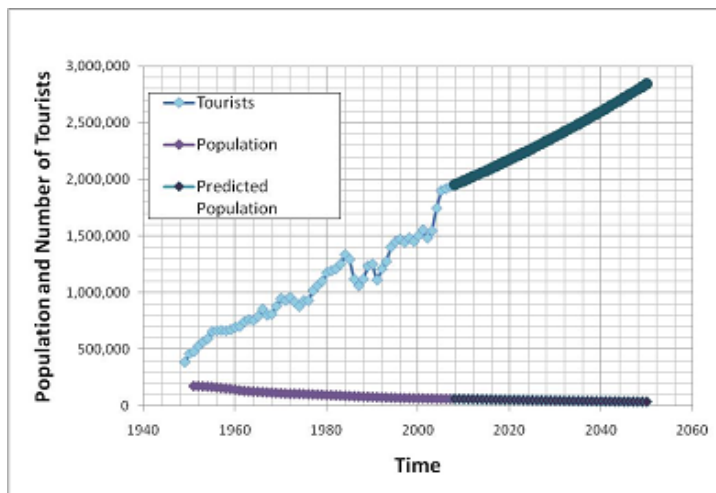


Figure 2: Population of Tourists and Locals in Venice over Time

reached 21 million. This effect is visually presented in the line graph of Figure 2. The annual 350- to-1 ratio of tourist to inhabitants in Venice is one of the highest differences in all of Europe.<sup>10</sup> On any given day in Venice, the tourist population matches or exceeds that of the local population, a demographic that has only increased in the most recent decades as Venice continues to be a popular tourist destination.<sup>14</sup> Figure 3 visualizes the daily amount of tourists and local

<sup>12</sup> Bureau of Labor Statistics, U.S. Department of Labor 2009

<sup>13</sup> Carbone 2011

<sup>14</sup> Newman 2009



Venetians in Venice, with the tourists in blue and the local population in black; this demonstrates how the tourist population in Venice is gradually overwhelming the local population on a daily basis, with an increase in tourists and decrease in Venetians between 1996 and 2009. The gap between the local population and tourist population is creating high food and necessities prices for the locals, which is making it harder for locals to afford living in Venice. The continuing commercialization of Venice plays an integral role in the decline of the local population of Venice, and if nothing is done to curtail the issue, Venice will be nothing but a tourist destination in the years to come.<sup>15</sup>

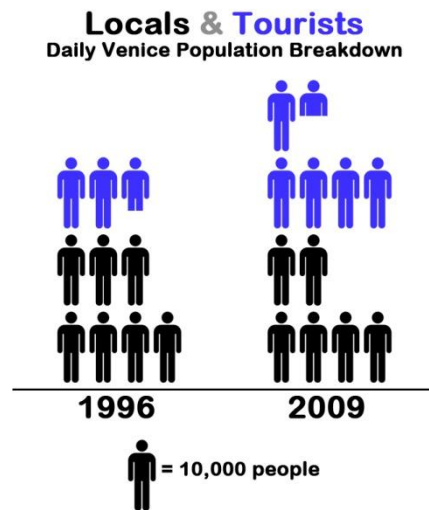


Figure 3: The daily breakdown of tourists and locals in Venice, in 1996 and 2009

Since commercialization has propelled the cost of living in Venice to extremely high levels, the local population consists primarily of those who have lived in Venice for many decades. This is why we see that a significant portion of the local Venetian population is over the age of 65, as demonstrated in Table 1 below. In 2008, approximately 24% of residents on the main island of Venice were over the age of 65, and this is expected to grow to over 25% by 2015.<sup>16</sup> Younger people and families are forced to move to the mainland, where it is less expensive to live and domestic goods and necessities are cheaper. This shift in Venice’s demographics is a threat to the city, as Venice is continually overrun with tourists and the local population declines.

Year	# over 65	Total Population	% over 65
2006	43,109	176,708	24.39561
2008	43,951	176,981	24.83374
2015	44,707	175,789	25.43219

Table 1: Number and percent of citizens over 65 in mainland Venice

<sup>15</sup> Newman 2009

<sup>16</sup> Citta di Venezia 2010

### 2.1.3 Defacing Property and Vandalism

Graffiti is a problem in countless urban areas, and while it is often associated with modern cities, it has been around for centuries. Described as markings, scratchings, or paintings made on public surfaces, graffiti has existed since ancient times, with surviving examples of ancient graffiti in the Catacombs of Rome and on the walls of the buildings unearthed at Pompeii.<sup>17</sup>



Figure 4: Graffiti on a building wall in Venice

While modern graffiti is often created as a means of expression, graffiti is considered a crime of vandalism. Venice, like many other urban cities, faces the problem of graffiti. Many of Venice's famous and historic buildings have been marked with graffiti, as seen in Figure 4. Found on any available surface – from bridges and overpasses to buildings and closed store fronts – graffiti in Venice disrupts its historical beauty. The city of Venice has asked people to show respect and stop spraying the buildings, as the graffiti is unattractive to locals and tourists alike, and is costly to remove. Venice can no longer afford the costs of cleaning up this vandalism.<sup>18</sup> Small neighborhood groups have volunteered to help clean the graffiti that decorates Venice's buildings, but these groups can only do so much; graffiti in Venice has become an increasingly difficult problem for the city to face.

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<sup>17</sup> Ohlson 2010

<sup>18</sup> "Venice asks for graffiti stop" 2008

## 2.2 Structural Concerns

Venice is world-renowned for not only its history and art, but also for its architecture and unique physical attributes as “The City of Water.” However, Venice’s age and extensive history are resulting in structural problems in the modern day. Venice was not built with many of the modern conveniences of the last century, and a myriad of problems have arisen as a result of technological changes in Venice paired with the historic city’s aging physical structures.

### 2.2.1 Deteriorating Infrastructure

Venice’s infrastructure is largely unseen by the public, but requires constant maintenance like that of any city. New utilities have been installed in Venice to replace outdated systems. However, Venice is unique in that a large percentage of the city is protected by federal and local laws as a historic region, and urban



Figure 5: An Insula maintenance project of the utilities under a walkway

maintenance must make efforts to leave the buildings, bridges and canals looking exactly like they did before construction and repair work began. Insula SpA is an urban maintenance company for the City of Venice that coordinates and executes projects of urban infrastructure maintenance, and prides itself in performing maintenance and minimizing the inconvenience of these construction projects in Venice.<sup>19</sup> The difficulty in

maintaining Venice’s infrastructure lies with the need to preserve this historic city as it stands in addition to functionally repairing and maintaining the infrastructure; Insula has done so with its many maintenance projects. Venice’s infrastructure consists of many parts, from the canals, walkways, and bridges to the unseen utility grid of gas, electricity, and sewage disposal, as seen in Figure 5. Maintaining the city of Venice is a difficult task, and the infrastructure of Venice deteriorates over time even with Insula’s work.

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<sup>19</sup> “Who is Insula” 2010

### 2.2.2 Illegal Garbage Dumping

Garbage is found everywhere in Venice: in the canals, lagoon water, and streets of this historic city. The wind, tide, and birds disperse the garbage after it had been disposed, polluting the city's waters. The garbage collecting in Venice is done by boat and foot by Veritas, the municipal garbage collector in Venice, seen in Figure 6. In the older parts of the city there are no spaces for garbage containers near the canal. As a result, the residents of Venice place the plastic bags with their domestic garbage on their doorstep in the evening, and Veritas employees collect the garbage in the morning.<sup>20</sup> The seagulls and other pests recognize the garbage and tear the plastic bags apart before the garbage collector removes the bags in the morning. This leaves the garbage strewn all over the streets and the canals, defacing the beauty of Venice and dirtying the city for locals and visitors.



Figure 6: Garbage collecting by boat in Venice

### 2.2.3 Sewage Problems

Venice, as a city with thousands of years of history, was not built with the modern conveniences of the 21<sup>st</sup> century. In medieval times, Venice was one of Europe's cleanest cities; like most medieval people, 15<sup>th</sup> century Venetians would throw their waste into the streets. The streets of Venice, however, are canals connected to the ocean, so the tide would sweep Venice's waste out to sea twice a day.<sup>21</sup>

The canals still function as the main sewer systems in Venice, but can no longer fully support the waste disposal needs of the people. Health standards in Venice have increased but the traditional methods of waste removal have stayed the same with little widespread reform. Continuing to deposit sewage directly into the canals is a health risk, as the sewer system contaminates the water with bacteria and materials that are hazardous to humans. Recent laws have required businesses such as hotels and restaurant to collect and treat their sewage, leading to the installment of small-scale sewage treatment facilities throughout the city. In 1997, a student Interactive Qualifying Project researched and proposed a plan for installing a HIFLO vacuum sewage system in Venice, identifying three methods that would suit the sewage disposal needs of Venice.<sup>22</sup>

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<sup>20</sup> "Garbage" 2011

<sup>21</sup> Davis and Marvin 2004

<sup>22</sup> Felices et al. 1997

Despite the need for reform and modern technology, a large number of residential sewage system still lead directly into Venice's canals.

Sedimentation is the long-term buildup of sediments and solids in the canals of Venice. Venice's sewage, along with building debris and material brought in naturally from the lagoon by the tide, contributes to the solid deposits that form in the canals. In 1997, a study of the sedimentation in Venice determined that 12 percent of all sediments in the canals come from sewage discharge, and 6 percent from masonry debris. If left unchecked, sedimentation can cause the canals to become so shallow at low tides that they become impassable. Additionally, if the sedimentation blocks the sewer outlets of buildings adjacent to the canals, the outlets can burst and cause severe infrastructure damage, as seen in Figure 7.<sup>23</sup>



Figure 7: A sboccho, or sewer outlet, revealed in a drained canal for maintenance

#### 2.2.4 Flooding

Acqua alta, literally meaning “high water,” refers to the periodic tide peaks in the Northern Adriatic Sea that often flood Venice and Chioggia. This condition of flooding primarily occurs between autumn and spring when the tides are reinforced by seasonal winds. Flooding in Venice can reach extreme levels, as visualized by the picture of Saint Mark's Square in Figure 8.

A city-commissioned study shows that a tide up to 90 centimeters above sea level leaves Venice



Figure 8: Acqua alta in Piazza San Marco

virtually unaffected, however with the addition of 30 more centimeters, water will affect nearly one third of the city.<sup>24</sup> The full study results of the area of Venice affected by tide depth, which acts as a guide for the locals, can be found in Table 2. Floods above 130 are historically rare, but have become increasingly frequent in recent years. The highest tide level recorded during a flood in Venice is 194 centimeters on November

<sup>23</sup> Borrelli and Horstick 1999

<sup>24</sup> Citta di Venezia 2011

4, 1966.<sup>25</sup> This extreme flood in Venice brought increased attention to the issue of flooding and the threat it poses to the city.

The MOSE project, which stands for *Modulo Sperimentale Elettromeccanico* or Experimental Electromechanical Module, has been developed as a countermeasure for the acqua alta. The project is an integrated defense system consisting of rows of mobile gates which isolate the Venetian lagoon from the Adriatic Sea. The system would complement coastal reinforcement by raising barriers that would protect the city of Venice from flooding.<sup>26</sup> The MOSE project has been in progress for years and years, but has not taken effect due to budget constraints.

**Sea Level Area of Venice submerged (percent)**

+90 cm	1.84%
+100 cm	5.17%
+110 cm	14.04%
+120 cm	28.75%
+130 cm	43.15%
+140 cm	54.39%
+150 cm	62.98%
+160 cm	69.43%
+170 cm	74.20%
+180 cm	78.11%
+190 cm	82.39%
+200 cm	86.4%
>+200 cm	100%

Table 2: Sea level Area of Venice submerged

**2.2.5 Damaging Canal Walls**

Several factors contribute to the damage of the historic canal walls in Venice. Rising sea level is causing the land on which Venice sits to sink slowly into the lagoon over time. Surrounding waters have risen approximately 23 centimeters since 1897, exposing brick and mortar to the corrosive salt water of the canals.<sup>27</sup> Additional damage to the canals also stems from the presence of sewer pipes that enter the canals



Figure 9: Canal Wall Damage in Venice

underwater. Occasionally, silt will deposit in the system of pipes causing clogging in the sewage system. Sewage material seeps into the surrounding mortar and takes away from the integrity of the canal walls, as seen in

Figure 9: **Canal Wall Damage in Venice.**

Finally, the damage that motorboats cause to the canal walls contributes to structural problems. Boat wakes may cause weakening in the mortar that holds the canal wall's brick together. Vibration caused by turbulence only serves to amplify any damage that

<sup>25</sup> Imboden 2011

<sup>26</sup> Poggioli 2008

<sup>27</sup> Sever 2011

already exists in the walls. Damage to the canal walls exponentially grows with little repair being done over time.

### 2.2.6 Degrading Venetian Public Art

Venice welcomes millions of tourists every year for a plethora of reasons, but among the top is the art that Venice has to offer. Public art covers Venice, contributing to the reasons why Venice is considered one of the most beautiful cities in the world. It is important that the collection of public art be protected from many threats it faces including theft, degradation, negligence, and vandalism.

Degradation is an effect of both the natural decay of the material of Venice's public art and the environment in which it is found. The unusual atmosphere of Venice, where it is hot and humid during the summer and below freezing in the winter, is not very forgiving to the city's outdoor public art. The waters that surround Venice present saltwater and bacteria to the art that further degrade material.

Additionally, pigeons, which infest certain parts of the city like St. Mark's Square, deposit chemically harmful droppings on the public art and architecture. Figure 10 shows a stone relief of an angel deteriorating over time; the most recent picture, taken in 2007, is barely recognizable.



Figure 10: Angel sculpture in 1939, 1978, and 2000, seen deteriorating over time

Negligence and misuse of public art in Venice is common since the city is crowded with locals and tourists alike. People use the art to hang their laundry, sit on it as a bench, and run electrical wires over it. Also, vandalism is common, especially among the younger citizens of the local population. Graffiti marks many pieces of art, marring the historical and cultural beauty of Venice's public art.

## 2.3 Tools to Raise Awareness

One of the key aspects of this project is raising awareness about the issues of social concern in Venice. To effectively develop approaches to highlight Venetian social problems, it is necessary to first study the ways in which social problems have been illuminated in the past. Art has been a medium for social critique for centuries, and modern technology has added to the multitude of ways in which awareness can be created through art. Individual works and larger exhibitions, like the Venice Biennale, are pushing artistic boundaries in creating art installations that highlight issues of social concern around the world.

### 2.3.1 Creating Awareness through Art

Art has a long history as a medium of raising awareness and commenting on the issues present in society. In 1814, Francisco Goya created one of the first paintings that realistically depicted the horrors of war and social injustice. *The Third of May, 1808* displays a bloody encounter between French soldiers and the Spanish resistance during Napoleon's 1808 occupation, seen in Figure 11. This piece has no precedent; it was groundbreaking in subject matter, presentation, and emotional impact.<sup>28</sup> It has become an archetypal, iconic image of the tragedies of war and anti-war sentiment, inspiring many artists to create similar pieces in outcry of social injustice.



Figure 11: French troops killing Spanish civilians in Francisco Goya's *The Third of May, 1808*

*The Third of May, 1808* inspired many later artists in addressing social injustices through art. Pablo Picasso's *Guernica* similarly illuminates the tragedies of war, focusing on the wanton destruction and killing of innocent civilians in the 1937 bombing of Guernica, Spain during the Spanish Civil War. *Guernica*'s brief world tour in 1937 brought the world's attention to the Spanish Civil War, and became widely acclaimed as symbolic of anti-war sentiment.<sup>29</sup> Picasso later painted *Massacre in Korea* in 1951, a protest against the United States' intervention in Korea that visually as well as thematically reflects the influence of *The Third of May, 1808*.

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<sup>28</sup> Clark 1960

<sup>29</sup> Koppelman 2009



Artists around the world are still addressing issues of social concern and social injustices through art. The British graffiti artist Banksy has a prominent presence in the urban art community as a voice of social



Figure 12: Banksy's visual critique: society does not accurately address the "social problem elephant" in the room

criticism and political commentary. His works often satirize the current social or political issues in the global community, drawing attention to social problems that need to be addressed. The centerpiece of his Los Angeles exhibit in 2006 was a live elephant painted to match the wallpaper of the room in which it stood, a satire on society's failure to address big issues, as seen in Figure 12.<sup>30</sup> While often controversial, Banksy is successful in creating awareness through his art and is

at the forefront of artists addressing social problems through art in the present day.

### 2.3.2 Interactive Installations

As new technology has become more readily available, artists have taken creating awareness through art to the next level with interactive installations. Installation art is a branch of three-dimensional art that aims to change the audience's perception of the physical space or site where it is placed. An interactive installation is therefore a piece of public art that aims to change the users' perception, impart knowledge, or create awareness through user interaction and participation. This type of public art is becoming more and more prevalent around the world as a means of illuminating issues of social concern.

*InterANTARCTICA* was an interactive public art installation created at the University of Sydney



Figure 13: Users interact with tangible interface objects in *InterANTARCTICA*

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<sup>30</sup> Chaundy 2006

in 2009 to create awareness about the issues of climate change in Antarctica and inspire behavior change in the audience that benefits the environment. The installation used a wide variety of different technologies to bring interactivity to the subject of climate change, as seen in Figure 13. Video footage, tangible interface objects, interactive maps and interactive sounds brought life to the issues of climate change and aided in raising awareness.<sup>31</sup> During its exhibition, *InterANTARCTICA* was tested to measure whether it was effective in imparting knowledge about climate change and creating awareness about environmental issues. On both counts *InterANTARCTICA* was a success, making it a great example of art taken to new levels to create awareness about global concerns.

### 2.3.3 Geocaching

Geocaching is an outdoor treasure hunting game in which participants use a Global Positioning System (GPS) receiving device to hide and seek containers hidden around the world. The name “geocaching” is a portmanteau of the prefix “geo-” meaning relating to the earth, and “caching,” which describes using a hidden place to temporarily store items. The geocaching game began in 2000, when Selective Availability was removed from the Global Positioning System to increase the accuracy of civilian GPS devices, allowing for more exact coordinates of specific locations. The first documented geocache was placed on May 3, 2000 in Beaver Creek, Oregon by Dave Ulmer. Geocaching has evolved into a popular outdoor activity, with over 1 million placed cache containers and 4 million participants in locations around the world.



Figure 14: A typical geocache and its contents

In geocaching, participants go online to one of a variety of geocaching websites to find the GPS coordinates of a location where a geocache container is hidden. Using these coordinates, the participants then go outside to find the location and hidden container. A typical geocache is a waterproof container with a paper log book, an explanation as to the game of geocaching, and some kind of “treasure,” which can be anything from plastic toys to collectible coins and homemade key chains, as seen in Figure 14. Participants

follow the rule that one can only take something from a geocache if they have something of equal or greater value to leave in it. The geocache containers come in a variety of sizes, from half-gallon ammo cans to Tupperware, film canisters, and tiny “micro” caches which only contain the paper log book.

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<sup>31</sup> de Bérigny Wall 2010

As geocaching has grown, participants have become more creative with the containers hidden and the manner in which the other participants must find them. Puzzle geocaches require participants to solve some kind of puzzle in order to figure out the GPS coordinates of the hidden physical container. From riddles to mathematical equations to research on local history, puzzle caches provide another level of interactivity in geocaching and a unique experience, as no two puzzles are the same. In Venice, along with the traditional one-part physical geocaches, there are several geocaches that take participants on a tour through the city to learn about local history and culture, and solving the individual pieces ultimately leads to the final location of the hidden container. The diversity, creativity, and interactivity present in the puzzle element of geocaching makes it a popular pastime around the world.

### 2.3.4 The Venice Biennale

The Venice Biennale is a prestigious contemporary art exhibition that takes place every two years in Venice, Italy. Established in 1895 by the Venetian City Council as an Italian art exhibition, the Biennale has grown to include music, cinema, and theatre with the addition of the Venice Film Festival, the Venice Biennale of Architecture, and the International Festival of Contemporary Dance. The event became international in the 20<sup>th</sup> century as the council set up a system to invite foreign artists, and in 1907 countries began installing their own national pavilions to showcase the artists chosen. The art in the Biennale each year expresses new artistic trends and reflects the prominent issues or problems present in the world.<sup>32</sup>



Figure 15: US Venice Biennale Entry

The Venice Biennale is a chance for a nation to not only showcase its creative minds, but to send a message about social concerns in the world at present. Numerous national exhibits in past years have served to demonstrate the social concerns of our time. For example, as seen in Figure 15, the US recently featured an exhibit with a runner striding upon a treadmill atop an overturned 60-ton military tank. It is often the pinnacle of an artists' career to be featured at the prestigious Venice Biennale, which has over 300,000 visitors in the 7 months of the art exhibition. The Biennale is the artistic centerpiece of Venice, one of the city's major highlights during the odd years when it is present in Venice.

In addition to the main Biennale Gardens and Arsenale section, where the national pavilions for many of the participating countries sit, there are peripheral exhibits that are also included in the Biennale. Many of these are for countries that now participate in the Biennale, but do not have specific pavilions built

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<sup>32</sup> "History of the Venice Biennale" 2011

for them in the Biennale Gardens or Arsenale on the eastern end of Venice. These exhibits are often featured in palazzos as stand-alone exhibits scattered throughout the city, tied to the Biennale through their presence on the brochures and maps available through the Biennale. Having these external venues allows for more countries and artists to participate in the Biennale, and immerses Venice in even more art during the Biennale's 7-month presence.

## **2.4 Summary**

The social concerns of Venice are highly diverse, with many different causes and effects. The community problems in Venice and the structural problems of the physical nature of the city threaten the quality of life in Venice for tourists and residents alike. Art has proven to be an effective medium in conveying messages about social concerns, but it has not yet been used to illuminate concerns in the city of Venice. To preserve and protect Venice, it is necessary to address these important Venetian social concerns through art. We do this with the hopes that we will raise awareness in Venice and inspire others to tackle and overcome these problems.

### **3. METHODOLOGY**

The goal of our project is to raise awareness about social problems in Venice by creating interactive installations that highlight Venetian social concerns, with the goal of being included in a major art exhibition.

To accomplish this goal, we will have defined four objectives in our project:

- To identify key issues of social concern in Venice, Italy
- To design and prototype interactive installations that relate to Venetian issues of social concern
- To perform strict, controlled tests on any and all prototypes as a means to evaluate their usefulness in raising awareness
- To create a plan for successfully deploying the installations in Venice as one cohesive exhibit with the goal of being included in a major art exhibition

### **3.1 Identifying key issues of social concern in Venice, Italy**

In order for our project to be successful, we needed to identify the issues of social concern that are present and prevalent in Venice. This was a key first step, as the issues we identified were the basis for our project work, and we needed to ensure that the issues we illuminated through our project work are relevant in Venice.

First, we defined what we consider to be “issues of social concern” in Venice. Defining “issues of social concern” helped us identify Venetian problems that were relevant to our project work, and kept us focused on what kind of content we were looking for in our research efforts. We decided to define the term “issue of social concern” as follows: an issue which directly or indirectly affects members of a society, and is considered a problem that ultimately relates to the moral values of the members of said society.

After we defined “issues of social concern” for the context of our project, we performed preliminary research to identify the issues currently present and prevalent in Venice. Through our library research and studies of past projects, we identified a wide variety of social problems that Venice faces. We then narrowed our focus to a number of specific social concerns, which we documented in the field. This ensured that the social concerns we chose to address were relevant to Venice and its community.

#### **3.1.1 Performing Preliminary Research**

To begin identifying the key social problems in Venice, we needed to do extensive research. We focused our research on what social problems are prevalent in Venice, what issues the city has been facing historically that have continued into the present day, and problems that are currently emerging. It was absolutely necessary to be thorough and careful in our research to identify not only the social concerns of Venice, but also what sources were the most reliable for information about Venice’s social problems.

We looked at the past 20 years of WPI student project work in Venice to take note of which issues have been studied in the past. While many of the projects have contributed to our research, the “Postmodern Postmortem” project completed in 2009 was particularly helpful to us, as that project was the predecessor to ours and included a list of Venetian social concerns. We have used the Postmodern Postmortem list, in conjunction with other WPI Venice projects and our outside research, to create a list of the social concerns in Venice that are relevant today.

Lastly, one of the most reliable resources for issues of social concern in Venice was the local texts. Venice’s local newspaper is La Gazzettino; though the newspaper is written entirely in Italian, we were able to translate articles and learn from the newspaper about the issues that the city of Venice was currently facing.

The results of our preliminary research about Venetian social concerns have been summarized in Table 3 below. While the list we have created is not a full list of all of Venice’s social problems, we chose these issues as ones we would be able to easily identify in our documentation efforts in addition to being important to the Venetian community.

<b>Issue of Concern in Venice</b>	<b>Description</b>
Aging Population & Demographic Shifts	Venice’s local population is getting older and is dominated by the large number of tourists.
Boat Wakes & Turbulence	The continuous boat wakes and turbulence, called “moto ondosso,” damages the historic canal walls.
Commercialization of Venice’s Culture	Traditional shops in Venice are being replaced by franchise companies with no historical or cultural value.
Damage to Canal Walls	Venice’s canal walls are damaged as a result of pollution, subsidence, “moto ondosso” and sedimentation.
Deteriorating Infrastructure	Venice’s infrastructure cannot support the high numbers of people in Venice and gets damaged and deteriorated as a result.
Flooding	Seasonal high water and tides cause flooding in Venice, resulting in damage to buildings and canals.
Graffiti & Defacing Property	Graffiti and urban art disrupts Venice’s historical beauty and are costly for the city to clean up.
Illegal Garbage Dumping	Venetians put garbage outside for collection when they are not supposed to, and birds spread the trash into the streets and canals.
Loss of Public Art	Venice’s famous public art is being lost for a wide variety of reasons, including weather conditions, theft, and vandalism.
Mobility Issues	Venice’s walkways, canals, and bridges are congested with traffic from the high volume of tourists that visit the city.
Noise	The excessive number of tourists and cruise ships in Venice everyday produces a higher level of noise in this historically quiet city.

Table 3: A table recording social concerns found through preliminary research

### 3.1.2 Documenting In the Field

As soon as we arrived in Venice, we started to document Venetian social concerns by walking around the city and taking pictures of the social problems that we came across. In our travels in and around Venice during our project work, we documented the structural and community problems that Venice faces, and to what extent the problems span. We chose eight of Venice’s social problems to focus on because of the logistical restraints on our project. However, our methods in research could be expanded to include any other prominent social issue present in Venice.

1. **Acqua alta** is the name for the phenomenon that occurs in the city of Venice most commonly during the autumn and spring high tides, when the most low-lying areas of the city become flooded. Flooding was one of the most prevalent social concerns we found through our research, as well as one of the most visible. During our stay in the city, Venice flooded more than 3 times in less than 3 weeks, and the city put up the raised walkways, called *passarelle*, so that tourists and locals could get around the city despite the deep water. St. Mark's Square, as seen in Figure 16, is one of the lowest points in the city, and often floods the most and for the longest periods of time. Flooding in Venice not only damages this historic city, but also causes major mobility problems, with tourists crowding the *passarelle* and rendering St. Mark's Square and other flooded locations almost impassable.



Figure 16: Avoiding the flooding in Saint Mark's square on the *passarelle*

2. **Graffiti** is another major social concern we identified in Venice. We knew that Venice would have graffiti, as most cities do, but we were surprised to see exactly how prevalent it is in Venice. We saw graffiti



Figure 17: Graffiti on a store front in Venice

everywhere we went, from bridges and closed storefronts as seen in Figure 17. Much of the graffiti we saw were “tags,” slogans sprayed throughout the city, or tourist graffiti, such as names and initials written on walls or carved into exposed wood. In some places the graffiti has been painted over, but it is still somewhat visible. Graffiti mars the historical beauty of Venice, and is found indiscriminately throughout the city.



3. **Tourism** is another major social concern we found in Venice. The streets to and from Venice's main tourist spots – notably St. Mark's Square and the Rialto bridge – are always packed with tourists from around the world, as seen in Figure 18. While tourists are beneficial to Venice and drive much of the city's economy, they are also the source of a wide variety of problems. The high volume of tourists present in the city each day causes human traffic jams with Venice's narrow streets and bridges. We witnessed dozens of tour groups walking through the streets, stopping at inconvenient places and disrupting the flow of traffic as locals had to find their way around them. Tourists are an ever-constant presence in the city of Venice, for better and for worse.



Figure 18: Human traffic in Saint Mark's square

4. **Illegal garbage dumping** is another main social concern spread throughout Venice. In front of many restaurants and houses, we saw piles of trash left out during the day to be taken away the next morning. This is explicitly forbidden in Venice, and not only are there laws in place regulating the times when trash can be placed outside, but we saw that many residents put homemade signs outside their homes that warn against dumping garbage illegally. Seagulls, pigeons, and other pests open the garbage bags and spread the trash through the streets, as we saw throughout Venice as seen in Figure 19. We also saw trash spread throughout St. Mark's Square on days of flooding, when the garbage was not picked up at the usual time because of the acqua alta, allowing birds to spread the trash throughout the square from the overflowing trash cans. The amount of trash we saw in the streets depended on the time of day as well as the location, but illegally dumping garbage is a widespread problem that we found to be prevalent throughout Venice.



Figure 19: Trash in the street torn up by birds

5. **Pigeons** are a very prominent problem we saw in Venice. The pigeon population in Venice is very large; the birds themselves are everywhere, especially in high-traffic tourist areas like St. Mark's Square. The pigeons are no longer afraid of humans and are used to getting fed, so much so that they will actually land on tourists' hands and are constantly waiting on the ground near outdoor cafés. The most pigeons we saw were in St. Mark's Square, where tourists could even pay to get a picture feeding them, as seen in Figure 20. Pigeons and their droppings are found everywhere in Venice.



Figure 20: Pigeons in Saint Mark's square

6. **Moto Ondoso** is an important, though not always as visible, problem that occurs throughout Venice. We observed many, though not all, of Venice's canals and canal segments during our time in Venice. Boat wakes from barges, water taxis, and other watercraft damage canal walls in Venice, as do the blockage of sewer



Figure 21: Damage to canal walls

outlets present in many of the canal walls. The damage and deterioration of canal walls was not always easily visible in Venice's canals because of the changing water levels with the tides. Additionally, there were no drained canals as part of maintenance projects occurring while we were in Venice, so we were not able to witness the kind of damage canals can have underneath the surface of the water. However, most canal walls are covered in algae and moss, and black from the water and exhaust from boats, as seen

in Figure 21. The bricks in the walls themselves are also often damaged or falling apart, the mortar between the stones eaten away by the water and wakes over time. Canal wall damage from moto ondoso is prevalent throughout the city of Venice, and was visible to some degree in every canal we passed.

7. **Commercialization** is another main social concern in Venice. Famous brand-name stores such as Gucci, Ferrari, Dolce & Gabbana and Cartier have taken up residence in Venice, forcing out locally-owned shops. Venice is plagued with luxury stores that line the most tourist-traveled streets, in the sestiere of San Marco



Figure 22: High-end retail shops that have opened in Venice

from Saint Mark's Square up to the Rialto Bridge. Along with the famous brand stores, such as the ones seen in Figure 22, souvenir stores make up the bulk of the shops in the commercialized tourist center of Venice. These kinds of stores force out locally-owned shops; additionally, chain supermarkets have caused specialty stores to go out of business in Venice. While walking around, we found there to be an overabundance of luxury stores and souvenir shops in comparison with shops that actually suit the needs of local Venetians. Similarly, we found

supermarkets to be much more prevalent than specialty stores such as bakeries, butcheries, and cheese shops. Commercialization in Venice is widespread in the historic center of the city, which has become dominated by tourists and stores that cater to them, rather than local Venetians.

8. **Deterioration of public art** is a prevalent problem in Venice. Public art in Venice is found everywhere, from the sculpted crests on the side of buildings to the keystones in the archways over doorways and bridges. While some of the public art we observed is intact, much of it is damaged in different ways. Erosion from the environment, including rain and air pollution from the mainland factories, has damaged many of the sculpted pieces of public art on buildings, as seen in Figure 23. Additionally, the air pollution also stains the white marble in Venice dark grey and black, further making the pieces of art unrecognizable. Public art is also deteriorated and lost when ownership of the buildings changes hands; pieces of art get lost in the construction or restoration processes, or the new



Figure 23: Public art in Venice damaged beyond recognition

owners have the historic art damaged so that the old family crest is not on their home. The most visited parts of the city, including St. Mark's Square, were under renovations while we were in Venice; the maintenance of public art is often only for these popular sites, however, and much of the public art found in the streets of Venice where locals live is deteriorating over time.

## 3.2 “Interacting” Approach

The first type of installation we created was “Interacting,” hardware installations that address different social concerns by engaging the five senses of the users. We re-created installations designed by the “Postmodern Postmortem” project, and we built our own modular electronic installation that allows for adaptation into different designs. These installations include “Scents and Sensibilities,” which highlights illegal garbage dumping, “Brodo di Pesce” which emphasizes the relationship between Venice and its waters, and “Spray it Forward,” which exposes the concern of graffiti in Venice.

### 3.2.1 Creating “Interacting” Installations

The 2009 “Postmodern Postmortem” project presented a number of designs for interactive installation prototypes, which we were able to improve upon and build ourselves. Based on the previous designs and prototypes, we chose two “Postmodern Postmortem” designs to re-create: “Scents and Sensibilities,” which underscores illegal garbage dumping, and “Brodo di Pesce,” which highlights the relationship between Venice and the lagoon.

1. **“Scents and Sensibilities”** highlights the recurring problem of illegal garbage dumping present in Venice. This installation engages the participants’ sense of smell; not only is illegal garbage dumping causing residents to pay more in taxes for garbage collection, but on an immediate level the garbage also causes the streets to smell unpleasant. Incorporating a pressure pad and an air freshener, “Scents and Sensibilities” delivers a spray of air-freshening scents when the pressure pad is activated. This installation required two primary electronic components: an actuator and a sensor.



Figure 25: "Scents and Sensibilities" final installation design



Figure 24: AIR WICK FreshMatic used in the “Scents and Sensibilities” installation

The actuator, or mechanism that acts upon the environment, is an AIR WICK FreshMatic air freshener, as seen in Figure 24. The air freshener is designed such that it delivered a spray once every 9, 18, or 36 minutes, up to a total of approximately 2,400 sprays. In order to override the timer’s normal functionality, we ran a wire to connect the positive to negative ends of the timer. This allows

the air freshener to deliver a spray every time the sensor is activated, as we wanted in our design.

The sensor in this installation is a pressure pad that we designed, seen in Figure 26. We started with a normal-sized cereal box that we then flattened. We cut a 5-inch square hole out of the center of cereal box; then, we taped square pieces of aluminum foil over the two holes. We left a space between the top and bottom of the box such that the aluminum foil pieces are separated to facilitate the design's functionality.



Figure 26: Pressure sensor setup for the "Scents and Sensibilities" installation

In our design, the air freshener delivers a spray whenever the pressure pad is activated. To accomplish this, we ran wires from each of the air freshener battery terminals to different sides of the pressure pad. The circuit is completed when pressure is placed on the pad because the aluminum foil pieces, which are excellent conductors, join together.

For aesthetic purposes, we cut a black dance pad to act as a sleeve, which we then put the functioning pressure pad into. Three sides were sewn and one last side was affixed with Velcro to allow for removal of the pressure pad in the case of maintenance. Lastly, we placed a very obvious target graphic on the pressure pad to indicate that a user should apply pressure to the pad when interacting with the installation. The final design of the completed installation can be seen in Figure 25.

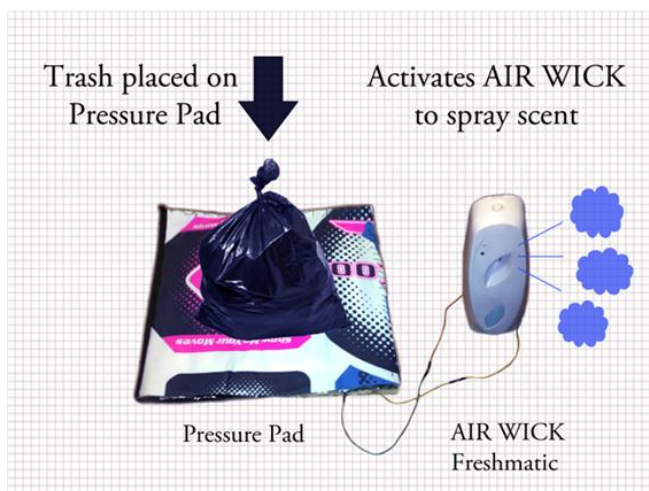


Figure 27: Final design of "Scents and Sensibilities"

The functionality of the final working installation is shown in Figure 27. While the conceptual design remained similar to the design from the "Postmodern Postmortem" project, the updated physical version is more robust and durable; this is ideal because it allowed us to fully test the installation objectively and subjectively in the environment where the installation would be physically deployed.

2. **“Brodo di Pesce”** emphasizes the Venetian concern of “acqua alta,” the seasonal flooding that affects Venice, as well as how closely the city of Venice is tied to its surrounding waters. This installation addressed the participants’ senses of taste and sight to bring awareness about these issues.

The original design of “Brodo di Pesce” as created by the Postmodern Postmortem project was a soup bowl with a topographical map of Venice in the bottom, as seen in Figure 28. “Brodo di Pesce” means “fish broth” in Italian, and would have been what the soup bowl contained.

The updated design of the installation still includes a three-dimensional model of Venice on the bottom of a bowl, but we chose to instead use a much larger fruit punch bowl in place of the individual soup bowl as proposed by the Postmodern Postmortem project. This allows for a larger version of a topographical map in the bowl, which emphasizes the relationship between Venice and the water level even more.

We used small ceramic tiles were to construct the actual three-dimensional model. When necessary, the ceramic tiles were broken up into smaller pieces to allow for the creation of more minute details. The



Figure 29: Final design of the “Brodo di Pesce” installation



Figure 28: The Postmodern Postmortem design of “Brodo di Pesce”

topography of Venice is illustrated in the model as closely as possible, with bell towers and churches at a higher elevation than the lower points in the city, such as Saint Mark’s Square. Larger canals are also included in the model design, including the Grand Canal that winds through the center of the island. The final design of the installation can be seen in Figure 29.

In addition to revising the designs of previous Postmodern Postmortem project, we designed and prototyped a modular device which serves as a base unit for creating a wide variety of

different interactive installations. The base device can be modified with different functional parts to accomplish the desired goals of building additional interactive installation with ease. In our prototype modular device, we used a microprocessor, multiple different kinds of sensors, an audio device as an actuator, a solar power source, and a weatherproof container to encapsulate the fully built prototype.

An Arduino microprocessor forms the primary platform for the modular device. Arduino is an open-source electronics prototyping platform based on flexible hardware and software. The Arduino processor is ideal for the basis of the modular installation prototype because it can receive input from a variety of different sensors and can control various actuators, allowing for a wide range of customization in design.

Because the Arduino processor is compatible with many different kinds of sensors, we explored several different options for sensor input devices which are useful in terms of building a modular interactive installation. The table below illustrates some of these sensors and what uses they bring to the design of interactive electronic devices.

Sensor	Use/How it Works	User Experience (Sense)
Motion Sensor	Triggers an event when a substantial object blocks the Infrared beam sent out by the sensor.	Motion, Hearing
Accelerometer	Send outs the current G forces being exerted on the object.	Touch, Motion, Hearing
Microphone	Records and outputs volume and sound information which can trigger an event	Speaking, Hearing

Table 4: Arduino functional components

To power the modular device we used an XTG solar portable battery and charger, as seen in Figure 30. The XTG solar charger includes a built-in lithium ion battery that charges using either the USB cable provided, connected to a computer or other electronic device, or by any form of light. This functionality allows the installation to be deployed in many different locations, as the charger does not require a specific kind of light to charge itself and power the installation. Additionally, the XTG charger is about the size of a typical smart phone, which makes it an ideal choice for the modular device.



Figure 30: XTG solar portable battery and charger



We included an Arduino audio shield as the sound actuator for the modular installation base. The audio shield is connected to the main Arduino processor, and comprises of a sound board and a small-scale speaker. The shield plays up to 22 Kilohertz, and uses 12-bit uncompressed audio files of any length. The audio shield we chose is low-budget and performed well, which makes it ideal as the default sound actuator for the modular device.

Finally, in order to weatherproof our installation, we encapsulated our hardware so that it is safe and dry in Venice's climate and weather conditions. We used an OtterBox waterproof case to contain our modular installation device, as seen in Figure 31. This container is able to withstand large amounts of water pressure and is rugged enough to be out in the elements for days or weeks at a time. The OtterBox container is also light enough so that it is easy to mount and deploy, with no risk of the installation falling and breaking.



Figure 31: Installation inside OtterBox

Because Venice is an urban environment, it is also crucial that the hardware container is as theft-proof as possible.

We added holes strategically in the box to facilitate for the hardware components that require mounting outside of the box. These holes are taped around the edges to maintain the watertight interior necessary for the protection of the modular device.

The modular device described above is the basis for several prototypes that we designed. We

created an installation built off of this device which takes advantage of the modular, customizable nature of the modular installation base. The modular base is meant to be used in this way, and a wide variety of other prototype installations can be created using this base.

1. **“Spray it Forward”** is based off the modular device and underscores the ever-present graffiti in Venice

through the use of a motion sensor and speaker. The PIR motion sensor, as seen in Figure 32, acts as the sensor to bring interactivity to the device. When the motion sensor is activated, the speaker plays a pre-determined sound file, which draws the user's attention to the social problem of graffiti.



Figure 32: Arduino PIR motion sensor component

The sound file we chose is the sound of a graffiti spray paint can. There are two primary sounds that create

the effect of someone using spray paint can: the shaking of the can, followed by the actual sound of spraying paint. To create the sound file, we combined these two sounds by creating different layers. The resulting sound file plays alternating bits of the two sounds. We decided to add a 5 second interval after the sound file to allow for a delay period between the activation of the sensor and the repeat of the sound file. When the users walk by and activate the motion sensor, the graffiti sound file plays, highlighting the negative effects of graffiti in Venice as well as the prevalence of this social problem.

### **3.2.2 Testing the “Interacting” Approach**

The objective portion of testing for the hardware installations evaluated the performance of the installations when they were deployed in the field. To accomplish our goals of objective analysis, we created a list of parameters that we determined to be necessary for the installations to be successful. The list contained specific performance expectations that were measured in a numerical manner. If an installation met all of our prescribed criteria, we deployed the installation and continued on to emotional response testing. If the installation did not meet all specifications, we went back and revised those areas of the design that were lacking. This method of iteration allowed us to refine our designs and ensure that the installations met our goals.

The subjective portion of testing for the hardware installations examined how users interacted with the installation. We decided to take video clips of users as they interacted with the installation as observational results. It was absolutely necessary to come up with a way that we could obtain these video results without providing a distraction to the user, as this could change the results. We accomplished this by implementing a mobile phone camera while pretending to use the mobile phone for some purpose other than video recording. This method allowed for up-close videos while we did not distract the users as they interacted with the installations. After a sufficient amount of video results had been obtained, we examined the video and determined the results.

## **3.3 “Exploring” Approach**

The second approach we developed was “Exploring,” an interactive geocaching puzzle route that leads participants around the city in a scavenger-hunt like game and highlights Venetian social concerns through the use of puzzles. We also created an interactive online puzzle game that mirrors the geocaching route, so players around the world can have the same experience and learn about Venice’s social problems even if they are not able to physically visit Venice.

### 3.3.1 Creating “Exploring” route

To create the interactive puzzle route in Venice, we first mapped out the physical walking route that participants take as they solve the puzzles and move from one location to the next. From our documentation of Venice’s social concerns, we knew which parts of the city we wanted to feature in our route as a location of a specific Venetian social problem. We created the route to be a reasonable length, so that the whole puzzle game can be completed in the course of several hours or an afternoon, as a large majority of Venice’s visitors are only in the city for the course of one day. The finished geocaching route, with small red circles representing each physical container location, can be seen in Figure 33 below.

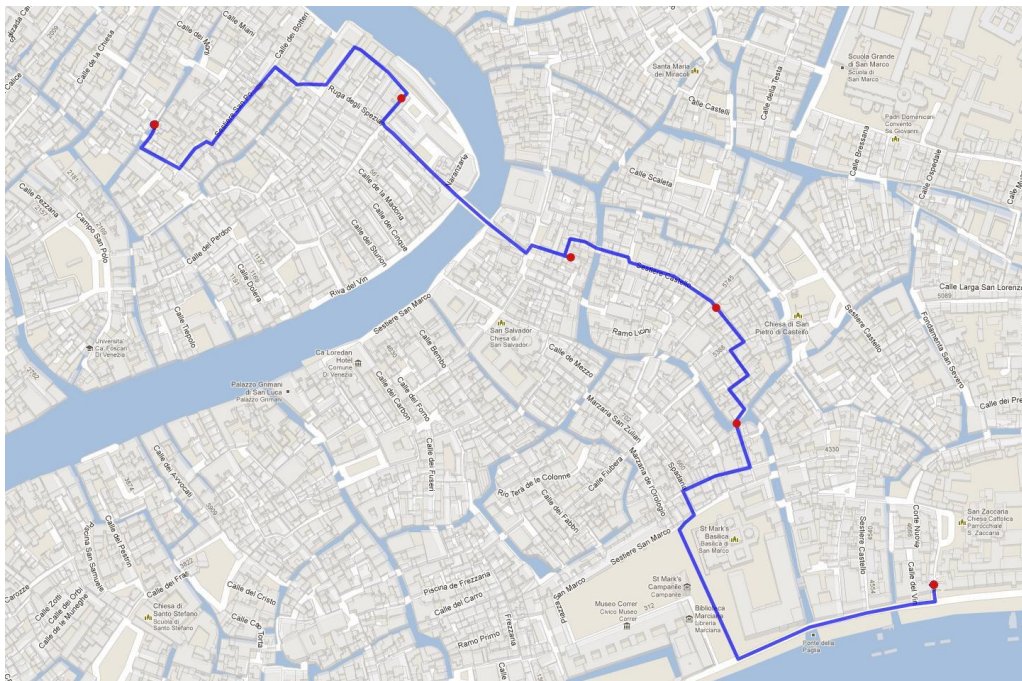


Figure 33: Geocaching puzzle route, starting in the bottom right corner and in upper left corner

The route goes through both heavy-traffic and quieter parts of the city, contrasting the hustle and bustle of Venice as a tourist city with the quiet residential areas of Venetian locals. From start to finish, it is a little over 1 mile long, with the physical containers hidden along the way and at the start and end of the route, six in total.

After we determined the walking route and the locations to hide the geocache containers, we created the geocache containers themselves. We used a variety of different containers with different sizes, shapes, and materials to hide around Venice. All of the containers are about 30-50 milliliters, or slightly larger or smaller than the size of a 35mm film canister. The containers are waterproof, and camouflaged with black duct tape so that they are harder to find unless participants are specifically looking for them. The locations of the

Container Number	Location Name	Latitude	Longitude
1 (Start)	Sortoportego S. Zaccharia	N 45° 26.041	E 12° 20.573
2	Ponte de L'Anzolo	N 45° 26.148	E 12° 20.394
3	Sortoportego S. Antonio	N 45° 26.225	E 12° 20.376
4	Sortoportego E Corte Zocchi	N 45° 26.255	E 12° 20.238
5	Calle de la Scimia o de le Spade	N 45° 26.356	E 12° 20.093
6 (End)	Ponte	N 45° 26.329	E 12° 19.859

Table 5: The GPS locations of the six geocache containers

containers in Venice are marked with red dots on the above map, and the GPS locations of each container can be found in Table 5.

Once the walking route and physical containers were determined, we designed the puzzles that are placed in each container which, when solved, lead the participants from one container to the next. Each puzzle is different, and the solutions to the puzzles are the key to the location of the subsequent container. This way, the puzzle route leads participants around the city, from container to container, allowing them to witness and experience many of Venice's social problems.

The starting location of the puzzle route is the Sortoportego San Zaccharia on the south edge of Venice, along the Riva degli Schiavoni. This location of the first container is given by default, with no puzzle to be solved to determine its location. The container is a small jar covered in black duct tape, hidden in a crevasse five feet off the ground in the Sortoportego, on the right when looking out towards the waterfront, as seen in Figure 34. The container is hidden



Figure 34: The first container in the geocaching route, at the Sortoportego S. Zaccharia

behind a brick in the shadows of the wall, so that it is difficult to see unless you are looking for it, which keeps the container safe from theft or accidental discovery.

The contents of the first geocaching container are a brief description of the game aspects of the puzzle route, the puzzle that led to the second container and information on accessing the puzzle web site. These printed materials are rolled tightly so that they fit inside the container safely, and can be removed and replaced with ease. The brief game description placed in the starting container introduces the puzzle game, and can be found in Figure 35.

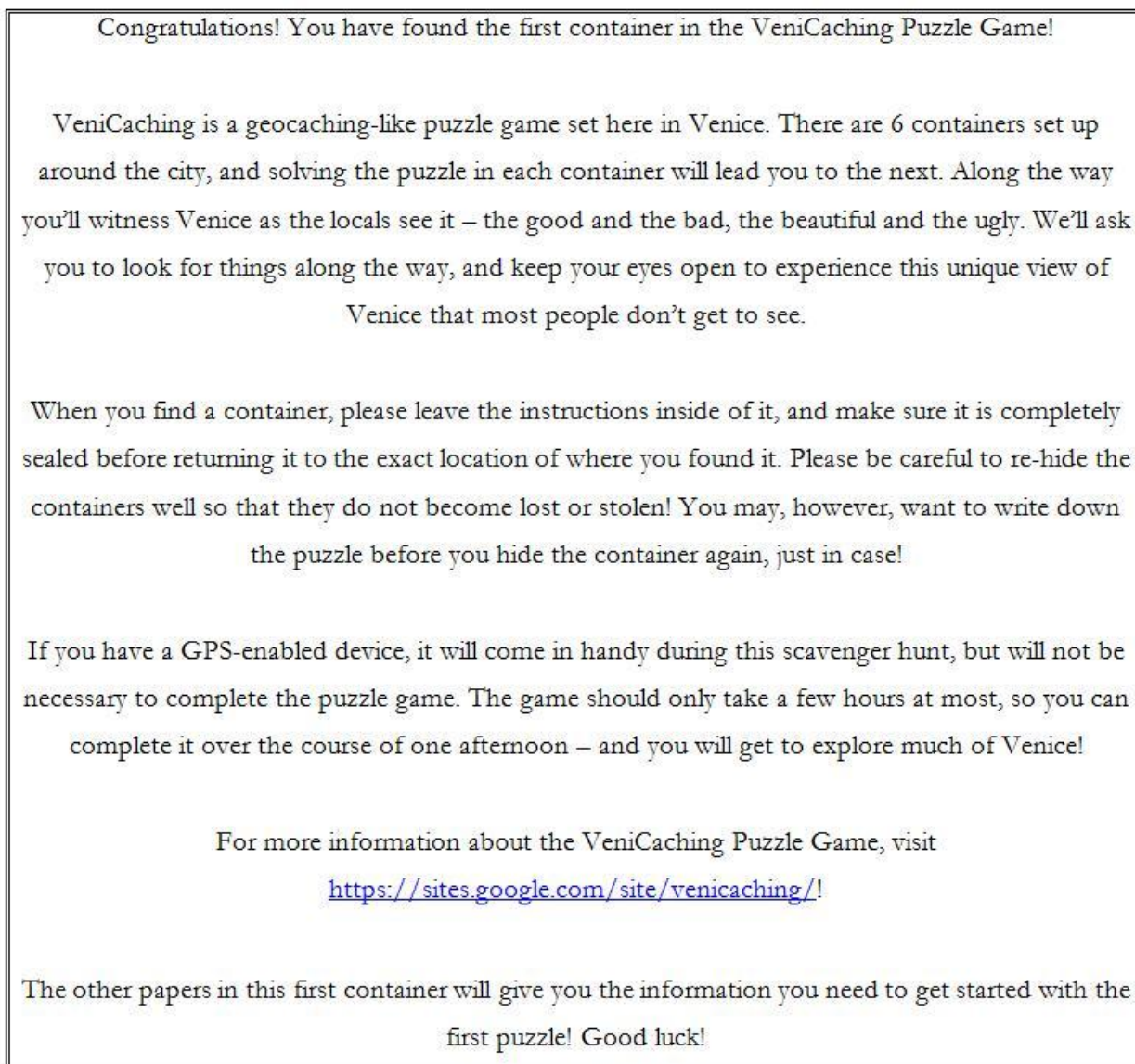


Figure 35: Game description and directions found in the starting cache container

The puzzle directions between the first container and the second container are split into two parts. This makes it easier for the participants to navigate their way through the city of Venice, which is maze-like and confusing to visitors who have never been in the city before. The first puzzle requires participants to find

Puzzle Part	Puzzle walking directions	Walking directions when decoded
1, from the Sortoportego S. Zaccharia to St. Mark's Square	<p>Walk west along the waterfront, towards the tallest tower; the pillars strong, the arched walkways, the seat of Venice power. Counting these specific things should now be your vocation; carefully, count them right, to reveal the next location.</p> <p>A: Number of gold lions on the Basilica            B: Number of bronze horses            C: Number of vertical windows on the north side of the bell tower            X: Number of flag poles in front of the Basilica            Y: Number of mosaic archways on the front of the Basilica plus 4            Z: Number of statues on poles on the south side of the square facing the sea x 2</p>	<p>Walk 250 meters west along the waterfront, and turn right into Venice's biggest tourist attraction. Count the following or find the following information.</p> <p>The correct numbers for the counting part of this puzzle are:</p> <p>A: 1            B: 4            C: 8            X: 3            Y: 9            Z: 4</p>
2, from St. Mark's Square to the Ponte de l'Anzolo	<p>Use the numbers from the great square to finish up this code in a flash, sooner than you'll know it you will find the next puzzle cache!</p> <p>N 45° 26.ABC, E 12° 20.XYZ</p> <p>Pass underneath the clock so blue, heading north straight and true; but the first right comes quickly, and then the last left slowly, pay attention to this clue:</p> <p>The second container lives at the bridge that spans over canals coming together, it's tucked away and should be safe no matter what the weather!</p>	<p>Walk underneath the archway with the clock on the North side of the square and take the immediate right. Take the last left before the bridge. Continue straight north until you reach the next bridge where the second container is hidden.</p> <p>The GPS coordinates of the second container are:            (N 45° 26.148, E 12° 20.394).</p>

Table 6: Puzzle directions and decoded directions between Containers 1-2

information at St. Mark’s Square, so the directions are broken down from the Sortoportego S. Zaccharia to



Figure 36: The second container hidden on the Ponte de L’Anzolo

St. Mark’s Square as the first part, and St. Mark’s Square to the second container location as the second part. The written directions of the first puzzle, parts 1 and 2, can be found in Table 6.

The second container in the puzzle route is hidden on the bridge Ponte de L’Anzolo. Using the puzzle in the first cache and the GPS coordinates created from the counting puzzle, participants find this cache not far from St. Mark’s Square. It is tucked into an eroded section of a railing post on the bridge, with the black duct tape on the container partially exposed, as seen in Figure 36. The Ponte de L’Anzolo crosses a section of canal, and from the bridge an intersection of three canals can be clearly

seen. The social concern of moto ondosio is visible from here, with much canal wall damage exposed at this busy canal intersection.

The puzzle in the second container comprises of only one part, as do all of the containers after the two-part container that starts off the puzzle route. Like in the first container, the second container holds rolled-up paper puzzle directions to the next container. The puzzle from the second container to the third container can be found in Table 7.

Puzzle walking directions	Walking directions when decoded
<p>Cross the bridge and follow the snaking streets of this old city; don’t fret about getting lost, though you won’t if you’re witty. Remember the firsts: right – left – right – left, onto San Lio and straight ahead; keep an eye to your right, and soon in your sight, you’ll see twin boxes of red. You seek what is underneath!</p>	<p>Follow the path after the bridge and take alternating turns: right, then left, then right, then left, onto Salizada San Lio. Look for a right turn – a sortoportego with twin red mail boxes. The next container is underneath one of the mailboxes.</p>

Table 7: Puzzle directions and decoded directions from Containers 2-3

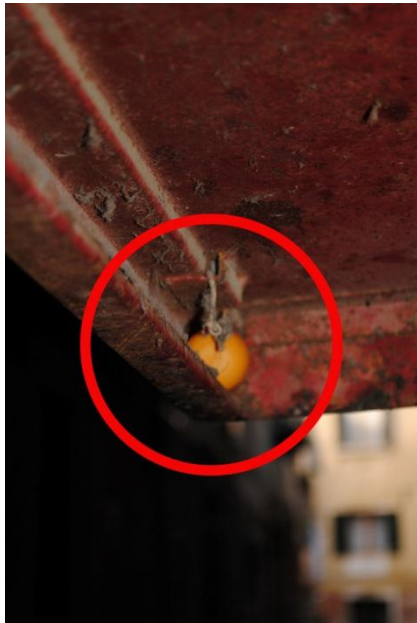


Figure 37: The third container in its hidden location under the mail service box

The third container in the geocaching route is hidden under a red postal service box in a sortoportego along the street Salizada San Lio. The red service box is magnetic and has a lip along the bottom, where the container is securely hidden, as seen in Figure 37.

The puzzle directions placed in the third container to find the fourth container are a descriptive map of the area. This map outlines the route between two points that leads the player to the general location of cache number four, visible in Figure 39.

There are many smaller checkpoints along the map that correlate to specific locations along the San Lio region. These checkpoints make it easier for the participants to find their way so getting lost is less likely. The third container also holds a riddle that describes the correct walking directions from the third cache to the fourth, found in Table 8. The riddle, in tandem with the descriptive

map, allows the players to have a general sense of the location of the fourth cache, without giving direct walking directions or GPS coordinates.

The fourth geocache on the puzzle route is placed at the Sortoportego e Corte Zocchi, hidden behind some pipes as seen in Figure 38. The map in the previous container leads the players to the general location of the container, and the geocache is located on the left from where the players come into the street from the sortoportego.

Original walking directions	New puzzle walking directions
Continue straight on Salizada San Lio over a bridge, turn left where the path snakes around pillars, and take the first left under a sortoportego into a dead-end alley.	Go along the Salizada of San Lio up and across the bend; cross it with might, don't give freight, until it comes to an end. Spin to your west and give it your best until you see the first path; Take that left, make sure you're deft, and arrive at the cache.

Table 8: Caches 3-4 directions, in puzzle form and decoded



The puzzle direction in the fourth geocache container is an alpha-numeric code puzzle which, when solved, directly leads the player to the location of the next cache. The phrases in the directions are mostly complete, with specific words strategically omitted. These words are replaced by the numerical representation of each letter in each omitted word; for example, the letter “A” corresponded with the number “1” and so on through the alphabet. When the player converts the numbers that correspond to each letter, the coded words become the necessary information to follow the directions

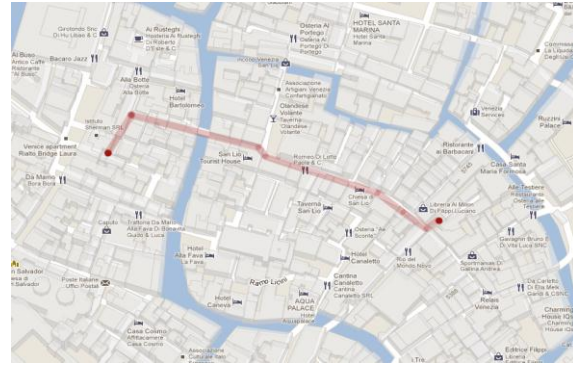


Figure 39: Descriptive map placed in the third container, plotting the route from Container 3 to Container 4



Figure 38: The hidden location of the fourth geocache

correctly to the location of the next container.

In order to facilitate the process of decoding the puzzle, small one-line directions are left in the fourth physical cache which simply read “K = 11.” This non-obvious hint allows the players to gain some insight on how to decode the puzzle without explicitly stating the solution. The full puzzle directions and the decoded solution are shown in Table 9.

Puzzle walking directions	Walking directions when decoded
Cross the most (06 01 13 15 21 19) bridge over the (07 18 01 14 04) (03 01 14 01 12), past the square with the old (03 08 21 18 03 08), and take the (19 05 03 15 14 04) right at the five-way intersection of roads. Follow the (19 20 18 05 05 20) almost to the end.	Cross the most famous bridge over the Grand Canal, past the square with the old church, and take the second right at the five-way intersection of roads. Follow the street almost to the end.

Table 9: Caches 4-5 directions, in puzzle form and decoded

The fifth container is hidden at the end of the street Calle de la Scimia o de la Spade, near the open-air vegetable and fish markets along the Grand Canal. The container is hidden on the right side as the participants walk towards the markets, hidden in a section of brick wall that is slightly deteriorated as seen in Figure 40.

Hidden in the fifth container are the directions to the location to the sixth and final geocache in the route. The directions are broken down into three distinct parts to give the player a final challenge. Each part has separate instructions to arrive at specific points along the full route between the two containers. There are no GPS coordinates or specific walking directions from the fifth container to the



Figure 40: The hidden location of the fifth geocache container

Part Number	Puzzle Text	Solution
1	The smell of fish is all throughout the air, and the calm marketplace is right near the square. Venture to this spot, and you will be one step closer to discovering the end of the plot.	Cache location 5 is located right outside the fish market which sits just on the other side of the Rialto Bridge. The clue states to continue until you hit the square which the player will arrive into after a left into the fish market.
2	These two ingredients are the centerpiece of every Venetian meal; one goes well with oil and butter, where the other comes from the manipulation of a certain round fruit. Find the restaurant which specializes in these two staples of Italian cuisine and you will be one step closer to the goal.	The two ingredients are bread and wine. There is a restaurant by the name Pane e Vino which can be found by either looking on Google Maps, or by crossing the square diagonally onto a bridge. Then continuing straight until reaching the next large street. Take an immediate left and following the street will take you to the restaurant.
3	ThE end is near, don'T quiver in fear; just solve the lasT cluE it's all up to you!	The third and final clue capitalizes each important letter in the riddle's sentence. TETTE are capitalized which corresponds to a street name where the location of the final cache is stored.

Table 10: Caches 5-6 Puzzle Solutions

sixth, as outlined in Table 10.

The sixth and final geocache container is hidden at the Ponte de le Tette, in a crack at the side of the bridge. The final container holds a “Thank you for playing” note with a description of how to access more information through the web site we set up for the geocaching route. The web site for the geocaching route, which we titled “VeniCaching,” holds information not only about the puzzle route but also the social concerns participants witness along the way.

### **3.3.2 Social Problems Addressed through the “Exploring” Geocaching Route**

Each section of the geocaching problem route focuses on a different social concern that is prevalent in Venice. The locations for each container were chosen so that at least one issue is visible for the participants to witness along the way, or at the physical location of the cache container. This way, the puzzle route raises awareness in the participants about the social problems that Venice faces, especially the ones that visitors and tourists may not encounter by staying in the tourist center of the city.

On the way from the first container at the Sortoportego S. Zaccharia to the second container at the Ponte de L’Anzolo, participants need to walk through St. Mark’s Square to obtain the required information to solve the puzzle. Walking through St. Mark’s Square encourages the participants to witness the tourist congestion and mobility issues that plague the area during the daylight hours. Additionally, pigeons are a hard-to-miss social concern that participants see by walking through this section of Venice. Flooding is another social concern present in the St. Mark’s Square area, although participants would not always witness this event as it is dependent on the tides and weather conditions in the city.

On the walk from the second geocache container to the third geocache container, the prominent social concerns are moto ondosso and canal wall damage at the Ponte de L’Anzolo, where the second cache is hidden. The bridge over the busy canal intersection allows participants to see the typical boat traffic in Venice and the effects it has on the city’s structural integrity, as the boat wakes are ever-present in this section of the canals. Additionally, from the second container to the third container are the issue of commercialization and graffiti, especially at the site of the third container, where the postal service box is covered with graffiti.

From the third container to the fourth container at the Sortoportego E Corte Zocchi, there are many souvenir shops which display the issue of commercialization, and at the fourth cache location itself the social concern of trash is prominent. The cache location is off a side-street very near a large square by the Rialto Bridge, but even just that far off the beaten path, illegal garbage dumping is an obvious issue.

On the way from the fourth container to the fifth, participants walk across the Rialto Bridge, which displays the Venetian issue of commercialization even more prominently. Also prominent on the Rialto Bridge is graffiti, which mars the beauty of this historic bridge.

From the fifth container to the sixth and final container, in contrast to the other social concerns thus far, participants walk through the traditional vegetable and fish market of Venice. The view of how Venetians



Figure 41: Screen shot of Interactive Online Puzzle Game

typically get their food, as opposed to the tourism-driven economy in other parts of Venice, allows participants to see that Venice is indeed a living city and not just a giant tourist attraction. Along with this local's view of Venice, participants witness the issue of mobility with the very thin, winding streets of Venice, and trash as they

headed away from the tourist center of Venice and more in a direction that only locals travel in. The final container is located at the Ponte de le Tette, where deteriorating infrastructure and canal wall damage are prominent issues.

### 3.3.3 Creating an “Exploring” Interactive Online Puzzle Game

The online interactive puzzle game was created as a way for participants to experience the geocaching route without requiring them to be in Venice. The puzzle game functions just like the physical geocaching route in Venice with a few minor changes. Instead of having specific GPS coordinates or riddles to decode, the players need to read an article and enter the correct answer to a question in order to progress from one virtual cache to the next.

If the participant answers the question correctly, a new point appears on the map that corresponds to a physical container in the deployed geocaching route. Each point on the online puzzle game highlights the same social problem that is also brought to the attention of participants in the deployed route.

We created a Flash application as the base of the online geocaching route. Once the Flash document was created, we imported graphics from Adobe Photoshop into Flash, so that the graphics could be animated and given the correct code to function properly. In total, there are over 35 specific movie clips, or animated graphics, that we implemented in order to complete the online puzzle map. Each movie clip has its own

functionality code which allows the users to interact with the game. Once the online puzzle game was completed, the document was exported into a browser-friendly format known as a .swf file so that internet browsers such as Internet Explorer and Firefox could display the puzzle game appropriately. Finally, once exported, we used a few lines of html code to embed the .swf file containing the puzzle game into our webpage. One of the puzzles in the online puzzle game can be seen in Figure 41.

### 3.3.4 Testing “Exploring” Geocaching Route

To successfully test our geocaching route, we broke down the testing into several different parts. Though the design of this interactive installation is complex, breaking the testing into different segments allowed us to test and evaluate the success of every step, and see exactly what worked well and what didn't.

First, we tested the walking route that the participants take through Venice. We ensured that the route is a reasonable distance to walk, and that it is relatively easy to follow, with clearly marked street names at the major turns and intersections. This way, even though the participants may not be familiar with Venice and how to get around, the route is still reasonable to navigate within the time frame that we planned.

Next, we ensured that the locations of physical containers were hidden and secure enough to be used for the geocaching route by deploying the physical containers. We put the geocache containers out in the intended locations for four weeks, checking on them each day to make sure that they were still secure and in place and had not been thrown away, destroyed, vandalized, or gotten wet. This four week test allowed us to ensure that the cache containers would remain in place for participants to find, as one missing container disrupts the route and prevents the participants from solving the sequence of puzzles and finding the subsequent containers.

After the route and containers pieces were individually tested, we tested the puzzle geocaching route as a whole through play testing. To play test the geocaching route, we had groups of volunteers walk through the route, solving the puzzles and riddles to get from container to container. One team member accompanied each group to observe their progress, and we asked the participants to “think aloud” so that we could follow their thought processes as they tried to figure out the puzzles. In addition to the observational recordings, we also noted the time during the play tests to accurately see how long each section was taking, and where the difficult parts of the route were for later review and revision. When each group finished the route, we asked them for feedback on what they liked, didn't like, found difficult, and what improvements they would like to see to make the geocaching route even better.

When we finished the first round of play testing, we created a second iteration of the puzzles based on the observations and feedback we got from our volunteer play testers. The observation and feedback

allowed us to update and revise the puzzles so that they are more in line with our goals and vision. The second iteration of the puzzles were then placed in the deployed containers for a second round of play testing by volunteers, in which we used the same methods as the first round of testing. We continued to observe the participants and took note of the successes, failures, and challenges that occurred through the testing to gather more information on the performance of the geocaching route.

### **3.3.5 Testing “Exploring” Interactive Online Puzzle Game**

Our interactive online puzzle game was tested in a similar manner as the geocaching route. We had users play through the game while we observed their actions and reactions. We took quantitative data from the amount of time that users spent on each piece of the puzzle route, and on the functionality of the interactive online puzzle. Observing the users while they were playing enabled us to gather the data that we needed to determine whether or not the interactive puzzle game was a functional success.

In order to obtain qualitative data, our team asked the participants to think out loud so that we could understand their thought processes, what they found difficult, what they found easy, and what they enjoyed. After each stage, the participants were asked two questions: “Do you think the article you read was informative?” and “Did you have any confusion or difficulty in finding the correct response?” The participants answered these questions for each of the 6 different puzzles until they had completed the game. Upon completion, the players were asked to give their overall impression of the puzzle game. This data enabled us to evaluate the overall success of the online puzzle game.

## **3.4 “Contributing” Approach**

In our project, we created a “Contributing” mobile application as another form of raising awareness about social concerns in Venice. This Android mobile application facilitates the collection of data about social problems and serves as another way participants can learn about the social concerns of Venice.

### **3.4.1 Creating Contributing Approach**

Our mobile application features a simple interface that allows users to collect data about social concerns in Venice by tagging a physical location where a social concern is present, taking a picture, and uploading the data to a web site, as seen in Figure 42. The application uses the built-in GPS of a mobile device to pinpoint, on a Google map, the exact location of the tag as well as the accompanying picture if provided. The data is transmitted wirelessly to an external website where all the information is presented and easily accessible. The original ButOne application, created by Benjamin Lichtner, was used as base for the application we created; we added the functionality of picture capturing.

For our version of the ButOne application, our team kept the initial platform which runs exclusively on Android-powered devices. In order to create software for Android devices, we downloaded the necessary development kit that allowed us to access the open-source libraries that make up the Android platform. After the development kit was correctly downloaded and installed, the actual programming of the mobile application began.



Figure 42: ButOne application on an Android phone

The existing code base of the ButOne application allowed us to easily employ additional functionality to the application. We added a “Take Picture” option to the list of commands to give users the option of taking a picture to add to their tag. Once the default camera is finished taking a picture, saving the picture is as simple as using a pre-existing function created by Lichtner to save the picture data into the mobile phone’s memory.

Since the pictures are saved in the mobile device memory, it was necessary to allow the pictures to be viewed by anyone who would want to access the data. To save the picture globally, we ensured that the data was saved in an accessible location. The easiest solution to this problem was to employ an external application programming interface given by a popular image hosting website. Imgur.com allows picture uploads from a variety of different devices, at a rate of 50 uploads per IP address per hour. Due to Imgur’s generous

allowance of upload space and easy-to-use API, we used their services to host the images saved by the mobile application.

To access Imgur’s API and decipher the messages passed back by the service, we implemented a new class inside the mobile application that handled the process of sending picture data to Imgur’s servers. Once the upload is complete, the class has to retrieve the “upload” and “delete” links for the uploaded image so that the users have access to these functions within the application. The class implements an iterator to capture all the messages and look for the key words “upload” and “delete” to find the links associated with the two responses. In order to implement this functionality, external java .jar files were downloaded and installed into the project’s build path.

The final step in completing the ButOne extension was to upload all the data obtained from the use of the application to an external website, so that participants can view the results of their data collection efforts.

Lichtner’s code base had a preexisting class dedicated to posting the information to an external website, [geotageeverything.appspot.com](http://geotageeverything.appspot.com). To add the picture data to the website, additional tables were needed to add a location on the website to display the uploaded picture’s hyperlink. We used the Python programming language to create a column on the geotageeverything website that prominently displayed the associated picture link for the tagged element. This way, when a user tags a GPS location and adds a picture, the uploaded information includes the link to the picture.

### 3.4.2 “Contributing” through the Geocaching Route

Another facet of our geocaching route is data collection via crowdsourcing. Crowdsourcing is opening up a task for completion through public participation; within our project, we created a method for participants to gather data and submit what they collect to get more information about the social concerns present in Venice. Each physical geocache container includes piece of paper indicating an event or situation that the participants are asked to keep track of numerically while participating in the geocaching route. Each counted item corresponds to the social problem present in that area of Venice. Table 11 details which events are counted at each of the physical geocache location along the route. Additionally, if the participants have a mobile phone, they can keep track of the social concerns they witness along the route with the ButOne application we developed.

Cache Number	Event Counted
1-2	Tour groups
2-3	Noticeable graffiti
3-4	Shops that sell masks
4-5	Mobility issues
5-6	Trash bags

Table 11: Counted event at each cache

Once the participants count the events as described by each cache, they are instructed to log into our geocaching route web site at: <https://sites.google.com/site/venicaching/data-collection>. The interactive map for data collection allows users to enter the information they collected in a text box. When the users click the green “Go” button, they are prompted with a screen which adds a digital signature of the data, as well as a log of the number of the specific event they found. A screenshot of the data collection page can be seen in Figure 43.





Figure 43: Interactive data collection map

Under the interactive map, a digital high scores table keeps an up-to-date total of all of the collected data submitted by participants, as seen in Figure 44. The data is sorted by highest number first and can be sorted into data from the past day, week, month, or year for an in-depth look of what social concerns are present over time.

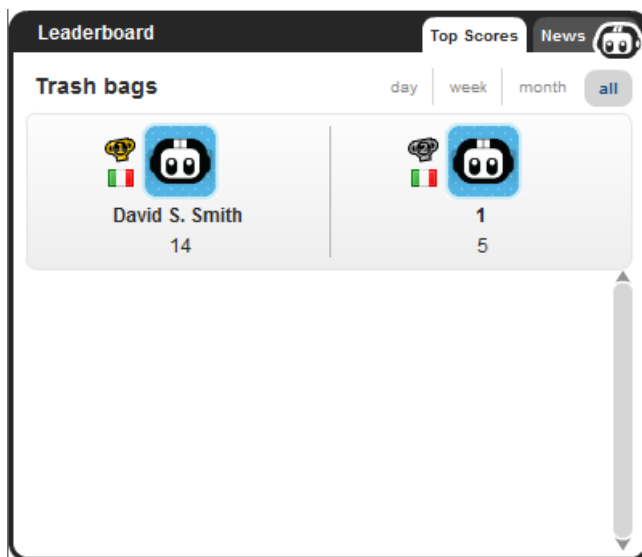


Figure 44: Leaderboard for collected data

The collection of data in our geocaching route provides not only a way for the users to be more aware of their surroundings while participating in the activity, but also provides a running tally of what specific problems are present and prevalent in Venice.

The software employed to create the interactive data collection was made in the same fashion as the interactive online puzzle game. However, we needed to make a few changes for the leaderboard function more like a database than a high scores table. The leaderboard service is provided by Mochimedia.com, and in order to take advantage of its full functionality, we created an

account. Once the account was created, the leaderboard fields were created by filling out forms which automatically generated database tables for the scores. A few lines of code were included in the .swf file of the interactive data collection map in order to connect it with the Mochimedia server. We optimized the data collection settings so that the service recorded the time and date of data submission as well as sorted the table by highest number, lowest number, and by submission time. Finally, we added a code that allowed the leaderboard to automatically update when a new piece of data was submitted by participants, and the functioning data collection was in place.

### **3.4.3 Testing “Contributing” Mobile Application**

The objective testing for our mobile application was accomplished mainly through observational user testing methods. For thorough testing, we gave the application to many different users and had them complete the process of tagging an object, taking a picture of said object, and posting it to the external website. The objective testing only concerned whether or not the user was able to successfully navigate the menus of the application, and whether the application functioned as intended. It is important that the application responds in timely manner at fewer than 500 milliseconds for all activities. Additionally, the application needs to take pictures successfully and save the picture to the phone memory. It is also important that the picture as well as the tag associated with it is successfully uploaded to Imgur’s API and the upload links are received. Finally, the application has to successfully upload all the saved information up to the external website where all the information can be viewed publicly.

The subjective portion of the mobile application was based around how the user interacted with the software. We considered many factors in testing, including ease of use, navigation time or responsiveness, recognition of explicit directions given by the application, and overall impression of the application. The users were given a short form after interacting with the application that asked for their overall impressions on a 1 to 5 scale, with 1 being the lowest and 5 being the highest.

### 3.5 Creating a plan for one exhibit to be entered in a major art exhibition

We created a plan to bring these individual installations, “Interacting,” “Exploring,” and “Contributing” together as one campaign which can be featured in a major art exhibition to raise awareness in Venice. This way, the installations are tied together and create a greater effect in increasing public awareness about social problems in Venice; the whole is greater than the sum of the parts. We titled the campaign “Interactive Venice” to highlight the interactive, fun nature of the different approaches to creating awareness.

#### 3.5.1 Creating an Exhibit Room

To have our “Interactive Venice” campaign featured in an art exhibition, we designed an exhibit room that is be the central hub for the main elements of the campaign, in addition to the pieces that are intangible or placed around Venice. The individual elements of our art exhibit are our “Interacting,” “Exploring,” and “Contributing” installations.



Figure 45: Interactive Venice logo



Figure 46: "Interacting" logo

The “Interacting” section includes the three hardware installations that we created. The “Scents and Sensibilities” installation, “Brodo di Pesce” installation, and “Spray it Forward” modular installation are all included for the users to physically interact with while they visit the exhibit, to gain understanding about Venice’s different social concerns. The “Interacting” installations are accompanied by a poster that explains the different hardware installations and how they function to create awareness.

The “Exploring” section includes an introduction to the idea of geocaching and a computer terminal where participants can play through the online puzzle game that mirrors the geocaching route. The screen of the computer terminal is projected on one wall of the exhibit to give other attendants the chance to watch and learn about the puzzle route. Additionally, there is information available on a poster about how to start playing through the geocaching route, so interested participants can go outside and begin exploring the city for themselves.



Figure 47: "Exploring" logo

The “Contributing” section of the exhibit room includes a terminal where participants can learn how to use the ButOne application to start collecting data themselves, with a projection of a current map of Venice that displays the tagged locations of social concerns. A poster also explains how to use the ButOne

application, and includes instructions on how to access the web site and how to download the application on an Android mobile phone.

The floor plan we created is only a prototype, and can be expanded upon and modified in the future to better fit the chosen exhibit space and to include additional interactive installations. In Figure 49, the “Interacting” installations are labeled in red, the “Exploring” section is labeled in green, and the “Contributing” section is labeled in purple. The exhibit room is the central hub of the “Interactive Venice” campaign, and serves as a gateway to the other interactive pieces of the campaign. Tying all of the different approaches together in the exhibit room provides a way for participants to be exposed to all of the pieces in one place.



Figure 48: "Contributing" logo

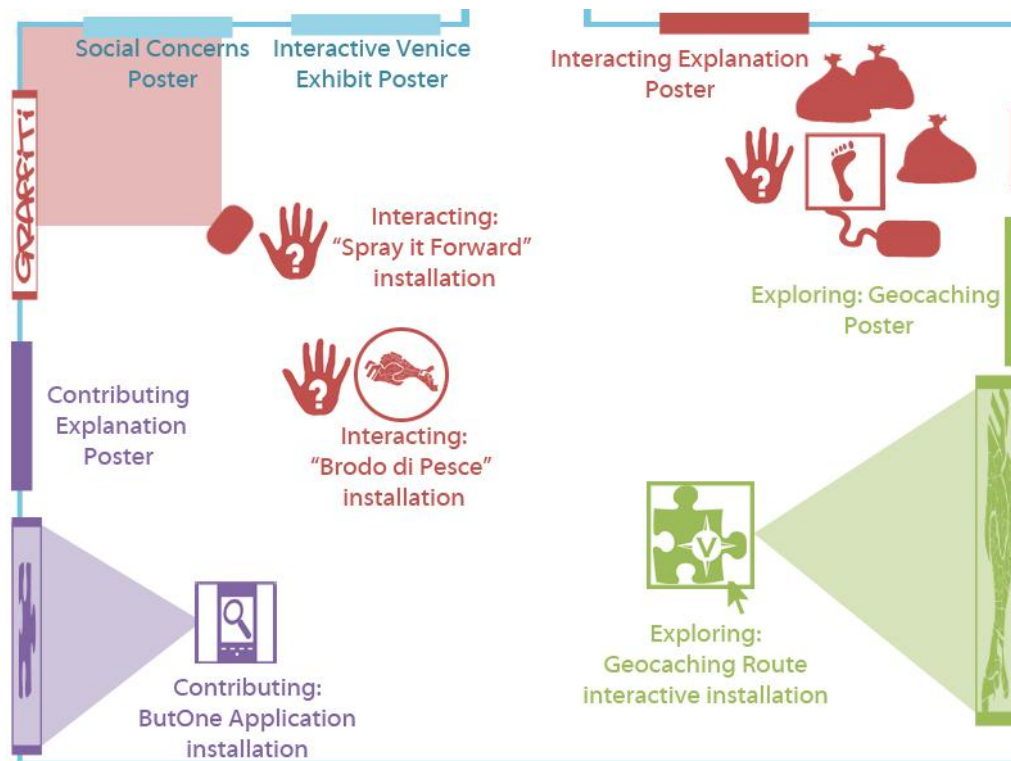


Figure 49 - Floor plan of our prototype interactive art exhibit.

## **4. RESULTS AND RECOMMENDATIONS**

A big part of our project was deciding the direction it would take, and what we would develop as approaches to raising awareness. It was a challenge to figure out what exactly we should do to accomplish the goals of our project, and much of our preparatory work was dedicated to defining our project work. Through the process of defining our project, we have many recommendations about the ways of going about tackling difficult issues such as raising awareness in unconventional ways.

We also have results and recommendations from the testing we completed once we had finished creating the different approaches themselves. Because we tested the three approaches objective and subjectively, we have results and recommendations about not only the functionality of the different approaches, but also about their effectiveness in raising awareness about social concerns in Venice.

### **4.1 Creating the Three Approaches**

A large amount of our project was dedicated to defining the course of the project in terms of what we wanted to create as different approaches to raising awareness about social problems in Venice. As such, we have recommendations about the process we took in deciding what installations to create and test, as well as recommendation about the physical creation of the three different approaches.

#### **4.1.1 “Interacting” Hardware Installations**

The hardware installations that we created were a combination of revised designs from a past project, “Postmodern Postmortem,” and installations that we designed and created ourselves. Overall, updating the installations from past project work was a success, as the previous group had already laid out the designs and functionality of the installations. It was more difficult to design and create our own installations, as we did with the modular installation, but with the resources available from the past project work, our creation process was still successful.

##### **1. “Scents and Sensibilities”**

Our pressure pad design was taken from the “Postmodern Postmortem” project, which we updated and improved. In the end, the design involved a cereal box with foil on each side to complete the circuit. The success of the pressure pad depended upon sufficient recoil between uses. Because of the materials used under the constraints on the project, the pressure pad was not durable for prolonged use, though it was functional for the duration of our project work. Future project work can continue to revise these designs and create hardware installations with increased durability and functionality from our work.

## 2. “Brodo di Pesce”

The original design of “Brodo di Pesce” called for using a three-dimensional printing service to create the topographical Venice map bowl professionally. We did not have this available to us because of our limited time and budget; our research into 3-D printing also revealed that there were no options for printing in food-safe plastics, so we decided to redesign the installation in such a way that would serve as a proof of concept. We used ceramic tiles to create a topographical map of Venice in a large fruit punch bowl. The model worked as a proof of concept for the installation, but was not polished and professional enough to include in the overarching exhibit as we had planned. In the future, creating a topographical map of Venice by hand can be further researched, concentrating on what materials are safe to use with food and drink to ensure that the “Brodo di Pesce” bowl not only looks good, but is also functional.

## 3. “Spray it Forward”

The desired functionality for the modular device “Spray it Forward” was achieved in our project work. However, there was one small issue that we did not anticipate in our original design. The installation was no longer completely waterproof once holes were put in the OtterBox housing. Holes were necessary to allow for certain components to be exposed to the environment, such as the motion sensor and speaker. The modular device would be more deployable if the installation could be successfully watertight. Future researching into different kinds of watertight containers as well as methods of wiring that maintain the integrity of a sealed container would aid in refining this installation design.

### 4.1.2 “Exploring” Geocaching Route

The geocaching route created as our “Exploring” approach to raising awareness was created successfully as per our designs. The most difficult and time-consuming portion of creating the geocaching route was determining where to place the physical containers in Venice so that the route would be a reasonable distance, the containers would not be stolen, and the participants would witness a wide variety of different social concerns. We originally wanted to place a container in St. Mark’s Square, but as it is a very high-traffic area that is maintained frequently, we could not find a safe location for a container that was well hidden and quiet. The locations of the six containers were found by wandering the city itself, which was not very efficient, and the route went under revision several times.

Additionally, the containers themselves initially posed a problem, as it was difficult to find small, waterproof containers in Venice that were relatively inexpensive. In the end, we used a wide variety of different containers disguised with black tape so that they could be successfully hidden around the city. Finding magnets for the containers that needed to be hidden underneath metal objects was also a challenge. Having the correct supplies and more time would have refined the design of the geocaching route, though it was successfully prototyped in our project work.

#### **4.1.3 “Contributing” Mobile Application**

The mobile application created as the “Contributing” approach was built in the Java programming language and was adapted from Benjamin Lichtner’s original source code. Although the existing code base was well written, major issues arose when smaller changes were made in the process of adapting the original application to our design.

In order to further use and extend the ButOne application, our team recommends that multiple changes are made to enhance the quality of the application. To streamline the application to WPI’s existing resources, our team suggests that, once available, the ButOne application should upload the user’s images to Venice2point0’s gallery. The gallery also does not currently have an API which would allow for integration into android applications. Another further change that can be made to the ButOne application is the reorganization of the existing code base. The most recent version contains all of the code that handles picture-taking and uploading in the “settingsActivity” class. On further review, it would be more organizationally sound if the picture handling and uploading was placed its own separate class to improve functionality.

## **4.2 Objective and Subjective Analysis**

The objective and subjective analysis of the three approaches allowed us to evaluate the installations’ overall success, as well as make recommendations on how the installations could be improved upon.

### **4.2.1 “Interacting” Hardware Installations**

The objective and subjective testing of the “Interacting” installations was centered on physically deploying the installations in Venice, and iterating upon the results of the testing. Deploying the containers in Venice allowed us to analyze how the “Interacting” installations performed not only in an open environment for functionality purposes, but also to observe the reactions and responses of the users.

## 1. “Scents and Sensibilities”

To objectively test the functionality of the “Scents and Sensibilities,” we performed several different tests to ensure that the installation was performing in the way that we expected from our designs. We tested the different pieces of the installation as we were building it to ensure that it was functioning correctly along the different stages of the design and creation process, as well as at the end to measure how well the installation performed as a whole.

Since the circuit in this installation was completed by aluminum foil in the pressure pad, it was necessary to ensure that the product we were using would sufficiently conduct electricity. This was tested by creating a circuit including the aluminum foil, a battery source, and an LED. When we connected the circuit, we found that the LED lit without issue; therefore, the aluminum foil product would suffice in the design of the installation.

Since the design depended upon the recoil of the inner box upon use, this recoil had to be durable and survive for the period of time in which the installation was deployed. This was tested by applying pressure to the pad continuously, with the goal of 30 successful uses. Through our testing we found that, in some instances, the two pieces of foil that complete the circuit became stuck together, resulting in a continuous spray. To combat this issue, a pliable cardboard frame was inserted inside the dance pad housing the functioning pressure pad. This allowed for sufficient recoil during continuous use of the pressure pad.

When completed, the “Scents and Sensibilities” installation was fully functional and performed to our expectations. When the pressure pad is activated, the air freshener releases a spray of fragrance as designed; the operational testing of this installation proved that its design and creation were a success.

To subjectively test “Scents and Sensibilities,” the installation was deployed on Calle Carampane in San Polo, Venice, for user response testing. The installation was placed under a horizontal rock frame in a corner, as seen in Figure 50. We took videos with a mobile phone whenever an individual walked by the installation location to record their subjective responses. “Scents and “Sensibilities” was tested for four hours, and 41 people passed by the installation in that time. Of the 41 people who walked by the installation, the installation gained the attention of nearly every one; only 7 individuals made an effort to completely look away. Of the 34 individuals who took attention, 18 stood and examined the installation for more than 5 seconds. 27 individuals actually activated the pressure pad; the pressure pad was successful in delivering a spray every time. 19 of those individuals who interacted with the installation tended to show general interest in the



Figure 50: “Scents and Sensibility” testing with target



installation; the rest shared a sense of confusion.

Overall, 44% of the participants who interacted with “Scents and Sensibilities” had a significant reaction, meaning that they reacted or interacted with the installation for more than five seconds, whether it was observing or interacting with the pressure pad. 39% of participants had a minimal reaction, meaning that they reacted to the installation for between 1 and 5 seconds; finally, 17% of participants had no reaction, meaning they ignored the installation completely, as seen in Figure 51. In total, the amount of participants that had some kind of reaction to the installation was over 75%, so “Scents and Sensibilities” was successful in attracting the attention of participants and creating a reaction.

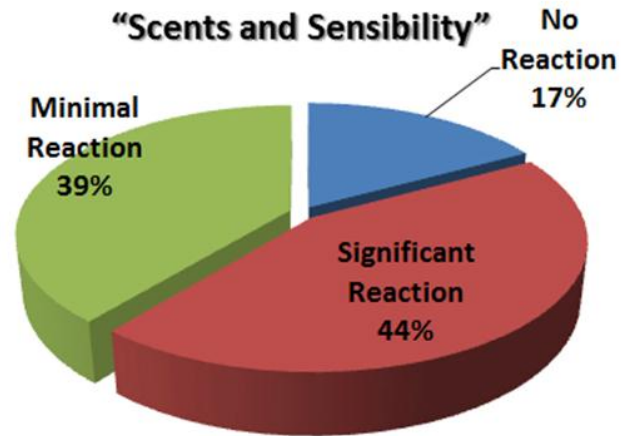


Figure 51: Subjective results from "Scents and Sensibilities" installation

## 2. “Spray it Forward” modular device

The modular device was tested with motion sensor and speaker components. The “Spray it Forward” design of the modular device was tested objectively to validate that the installation performed as we expected, and subjectively tested to ensure that the installation created a reaction in its users.

The first thing we tested once was that the sound file played correctly and could be heard from a distance of at least 3 meters. The Arduino sound shield has a volume control for manual adjustment, but it was also necessary to properly set the decibel level in the code. At first, the decibel level was set at 55 decibels; we were not satisfied with the result, as the sound was muffled and not clear at 3 meters away. Therefore, the decibel level in the code was increased to 75 decibels. At this level, the sound file could be heard more than 3 meters away.

After ensuring that the decibel level was correctly set, it was then necessary to test the frequency of the sound file when activated by the motion sensor. When there was no delay in the frequency between plays, the sound file played continuously while the motion sensor was activated. We desired for the sound file to play only once when the motion sensor was activated, instead of having a constant repetition of the sound file. A 5-second delay was implemented so that there was a pause between repetitions of the sound file. This ensured that the sound file played only after the motion sensor had been inactive for at least 5 seconds.

From our tests, the “Spray it Forward” version of the modular device was proven to be functionally successful. The technical tweaks we made through the testing allowed us to ensure that the installation performed as we expected so that we could test the installation subjectively.

For subjective testing, the modular device was deployed for a total of five hours on Calle Carampane; three hours on one day and two hours on another day. The installation was placed under a horizontal rock frame in a corner, the same testing location as the “Scents and Sensibilities” installation. We took video recordings with a mobile phone whenever an individual walked by the installation location to observe the reactions and subjective performance of the installation.

On the first day of testing, the modular device was deployed with fake bags of garbage placed around it as camouflage. Of the 38 participants that walked by the installation, the installation gained the attention of nearly every one; only 4 individuals made an effort to completely look away from the installation. Of the 34 individuals that gave their attention to the installation, 5 stood at and examined the installation for more than

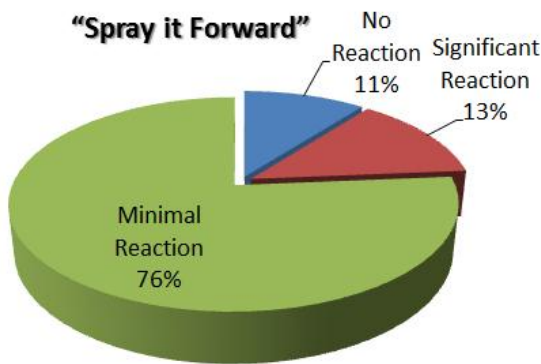


Figure 53: Results from the first day of "Spray it Forward" testing

5 seconds. Those individuals who interacted with the installation tended to demonstrate curiosity, but did not really understand what the installation’s purpose was. Overall, 76% of participants had a minimal reaction to the installation, reacting or interacting for between 1 and 5 seconds in time. 13% of participants had a significant reaction, and 11% had no reaction, as seen in Figure 53.

From the first day of testing, our results showed that the “Spray it Forward” modular device was gaining recognition, but the users did not understand the purpose of the installation, and did

not interact with the installation for very long. Therefore, we revised the design of the installation and added a stimulus to the testing location to bring more attention to the installation and what it was trying to do. A poster that read “Graffiti macchie di Venezia,” or “Graffiti stains Venice,” was placed right above the installation location, as seen in Figure 52.

On the second day of testing the modular device, with the addition of the poster, there were a greater number of reactions to the installation. Of 33 participants who walked by the installation, it gained the attention of nearly every one; only 3 individuals made an effort to completely look away and ignore the installation. Of the 30 individuals who took attention, 14 had a significant reaction and stood and examined the installation for more than 5 seconds. Those individuals



Figure 52: Modular device testing with stimulus

who halted to examine the installation read the poster placed near the installation, showing that the addition of the poster to the installation location helped to draw more attention to the installation and increased the reactions of the participants. 42% of participants had a significant reaction to “Spray it Forward” on the second day, as opposed to 13% that had a significant reaction on the first day. Additionally, 49% of participants still had a significant reaction, with only 9% of participants completely ignoring the installation. The added stimulus of the poster resulted in a significant change in the reactions of the participants, increasing the success of the installation in the context of having a greater number of significant reactions, and a greater number of reactions as a whole.

#### 4.2.2 “Exploring” Geocaching Route

To objectively test the functional success of the geocaching route, we first tested the physical route itself to ensure that it met our design goals. The route is about a mile long, provided that the participants do not get sidetracked or lost, which is a reasonable distance to walk through Venice in the course of an afternoon. Next, we tested the physical geocache containers themselves. The six geocache containers were placed in their specific location around Venice for 4 weeks in order to test if the locations were well-hidden and safe from theft, and that the containers themselves were viable for long-term deployment. In the 4 weeks the containers were deployed, none of the containers were lost or stolen, and only one had minor water damage on the inside because of recent rains. Overall, the physical containers themselves proved to be viable and functional for the purposes of our geocaching route.

To further test the geocaching route, we had volunteers play through the puzzles and observed their progress to see how they performed when deployed. Three groups tested the geocaching route across two iterations, which allowed us to gather the results from the first round of testing and make the necessary changes to make the route more successful before testing a second time.

On average, it took the participants groups about one hour to complete the geocaching route. This is in line with our goals, as we

<b>Leg of Route</b>	<b>Average Time Completed</b>
Cache 1-2	17 minutes
Cache 2-3	13 minutes
Cache 3-4	10 minutes
Cache 4-5	14 minutes
Cache 5-6	16 minutes

Table 12: Average times between cache container locations

wanted people who were both familiar with the city of Venice and first-time visitors to be able to complete the mile-long route in the course of the afternoon. The volunteers that completed our route were familiar with Venice and its maze-like nature, so the average time of one hour was within the range we were expecting for how long it would take to complete the route. The average times between cache containers can be found in Table 12.

From our observations and from feedback given by the participants, the geocaching route was a success in raising awareness about specific social concerns present in Venice. The participants expressed that they enjoyed reading about the different social problems presented by each different container, and liked counting the social problems from one location to the next. Having something specific to count that displayed a social concern in Venice encouraged participants to be more aware of their surroundings. The average number of social concerns found along the geocaching route by the participants can be found in Table 13.



Figure 54: Key words of participant responses to geocaching route

The puzzles that led the participants from one location to the next along the geocaching route were successful, but did undergo slight revision between the first and second rounds of testing. The first round of participants found it difficult to count some of the items in St. Mark’s Square because the information in the container was vague about which exact items to count. Additionally, directions that included “North” and “South” worried the participants, because while they were familiar with Venice and knew which way was North, they acknowledged that someone unfamiliar with the city who did not have a GPS unit or compass would not know what they were looking for. These parts of the first puzzle were revised for clarity in the second iteration of the puzzle route.

Additionally, while we deployed the containers for 4 weeks to test their viability, several containers went missing through the course of the puzzle testing. The 4 containers were placed in different locations, and were lost at random intervals. From these occurrences, we can recommend that regular maintenance is a necessity for the viability of a deployed geocaching route; if one container is missing, participants are at a dead end and cannot progress with the route.

Finally, the participants had a strong response to the geocaching route as an interactive puzzle game experience. Throughout the course of the route and at the end, the participants expressed that they were enjoying themselves, and liked the different puzzles that were present in each cache. They enjoyed solving the different puzzles and trying to

Social Problem to Count	Average Found
Tour groups	6
Graffiti	16
Mask Store	5
Mobility issues	6
Trash bags	4

Table 13: Social concerns counter by geocaching participants

figure out where they were supposed to go to find the next container. The participants felt that overall, using a puzzle game that had them walking through the city of Venice was a great way to inspire awareness and to create a unique experience for participants. Figure 54: **Key words of participant responses to geocaching route** shows the words used by participants to describe their experience with the geocaching route, with the larger words appearing more frequently in the participants' reactions. Overall, the geocaching route was a functional success as well as successful in raising awareness and being a fun, interesting way to get participants to witness the social problems of Venice for themselves.

To further develop the geocaching route, we recommend that standardized containers are used that are made specifically for geocaching, so that it can be ensured that the containers will be waterproof and viable for the duration of their deployment. Additionally, the route can be expanded with more containers that highlight additional social concerns, to allow participants to witness more of the social problems present in Venice. The VeniCaching route that we have created can also be linked to the official Geocaching network, through a single container or several, so that participants of the Geocaching world actively seek out the containers we have placed in Venice, and follow the route we have created.

#### 4.2.3 “Contributing” Mobile Application

To objectively test the functionality of the mobile application, we had users test the device to ensure that it performed as expected. The device was tested with three test subjects, and each subject was instructed to simply go through the process of setting an object to tag, taking a picture of the tag, and uploading the image. Objective analysis of the application was measured in two parts: responsiveness of windows and menus, and total time completion of tagging and uploading a picture. The responsiveness of the menus in the application on all tested devices was exactly up to par with our expectations, at 300-500 milliseconds between menus. All of the navigation buttons and menus responded quickly, usually in range of 100-300 milliseconds depending on the device. The hit boxes of all of the menu buttons behaved as expected and all test subjects did not encounter a time when an unintended button was pressed. The overall time between the setting of an object and the uploading of the picture usually took between 55 seconds and 80 seconds. The area which took the most time out of the whole process was the uploading of the image. Due to the phone's slow upload speed and the large file size of the image, almost 60% of the overall time was consumed in retrieving the image link from Imgur's service. These upload times were problematic because not only did the process that handled the upload of the image lock-up and deny any more input, the rest of the phone was still active to interact with. This occurrence created the appearance that the image had already been uploaded.

The main problem in the quantitative results of the ButOne application was the overall uploading time of the image. Due to the actual internet speeds varying from device to device and network to network, it would

be very difficult to alter any aspect of the internet speed to reduce the upload time. However, the one variant that can be changed is the file size of the image. The code of the application was set up in a way that the Imgur API took the file path of the image and uploaded the image directly from the string that the function was given. This blocked any attempt at altering the image's resolution to dramatically reduce the file size of the image. Our team recommends using a different uploading service in the future which allows users to manually set the resolution size of an image. Another option would be reducing the image quality of the camera. This can be done rather easily; however, if the image quality is reduced too much, it may have a negative effect on the user base who would want a higher quality picture, even if it takes longer to upload.

The qualitative data fields for the ButOne application comprised of many factors; the most notable of these factors were ease of use, recognition of explicit directions given by the application and overall general impression of the application. Gathering all of the results collected from the user of the application, it was clear that the ease of use category was the weakest out of the three. All of the users understood the instructions dictated by the applications, and on overall impression, the average was 3.75 out of 5, with the largest complaint being the lack of ease. The issue stemmed from the absence of directions given to the user on how to take a picture and navigate menus. Unfortunately, due to the code structure, the "Take Picture" button had to be placed into the same menu as the "Delete Tag" option, whereas a picture icon next to the menu option would have been preferable. Another smaller complaint was the notion of setting a username. In many android applications, one can view options by pressing a specific button; however, the button is slightly different on every device. When a participant is using a phone that they are not familiar with, this creates a bit of confusion because they are not used to the user interface. This problem is only an issue if the user was interacting with a foreign device and was not familiar with other android applications.

In order to address the ease of use problem that is in the current version of the ButOne application, a few solutions can be considered. The first solution is to add a smaller "Take Picture" button next to each tag in the main list. This icon would be a button that opens the camera and allows the user to take a picture. The only drawback is that this button would have to be small and difficulty may arise in trying to select the camera icon and not an item in the tag list.

### **4.3 Planning for participation in a major art exhibition**

#### **4.3.1 Central Exhibit Room**

Although the exhibit room outlined in the methodology contains all of the approaches explored in this project, the exhibition can be expanded to include more elements. Exhibition participants could be allowed to create accounts and link them to social networking sites such as Facebook and Twitter in order to

track their progress in discovering all of Venice’s social problems. Each element in the exhibition room could be placed in a computer terminal where the players can log in and earn points by completing activities such as interactive with hardware installations, tagging social problems with the ButOne application, or completing the online interactive puzzle games. These points could be organized into a leaderboard or high scores table, which would be viewable both online and in the main exhibition room to inspire participants to get involved. Players could post their scores to the social network sites to attract more attention to the exhibition and the social problems as a whole. Moreover, additional people could explore our online interactive puzzle game as players share their accounts on social media networks. This integration would help attract global interest about Venetian social concerns, with the goal of inspiring and encouraging participants to not only become more aware of the social problems present in Venice, but to also seek out solutions to these problems.

#### 4.3.2 Gaining Recognition by the Biennale Institution

The ultimate goal for project groups who build upon this concept should be to gain recognition and entry into some section a major art exhibition, such as the Venice Biennale. We have done a lot of work to try to identify the most realistic ways to accomplish this goal within the context of the Biennale, researching it as a possible venue for our Interactive Venice campaign.

To be recognized by the Venice Art Biennale, the artist or institution gaining entry must pay a 20,000-Euro fee. This would buy the artist a collateral space that is advertised by the Biennale institution. If a project group was to raise the necessary funds to be recognized by the Biennale, the current curator must approve the exhibit before it has the Biennale name attached to it. The curator has full autonomy over what he or she wishes to display in the art Biennale, and can reject an exhibit if it does not meet their standards.

After further talking with Andrea del Mercato, the current general director of the Biennale institution, we found a far more realistic method of having our exhibit included in an art exhibition under the Biennale institution. The “Carnevale dei Ragazzi,” or Kids’ Carnival, is sponsored by the Biennale Institution each spring during the Carnevale season. Held in the Central Pavilion in the Biennale Giardini, the exhibition



Figure 55: Logo for 2nd annual Kids' Carnival

showcases the creative work being done by today’s young generation of artists. It is designed to challenge, encourage, and inspire change and creativity in the young generation. The Kid’s Carnival was recently opened to international participation by the Biennale institution, and last year’s exhibits welcomed over 11,000 visitors.

The Biennale institution sends invitations to the ambassadors of those countries that own a pavilion in the Biennale gardens, inviting them to send a representative that

follows the theme of creativity to exhibit in the Kid's Carnival. For the scope of the Interactive Venice project, this would mean getting into contact with the organizers of the United States pavilion and proposing the entrance of a project into the Kid's Carnival under the United States pavilion.

It is the opinion of this year's project group that the most realistic and effective way of gaining recognition by the Biennale institution is to seek out an exhibit space in the annual Kids' Carnival. The Carnival lasts 11 days, as compared to 7 months like the art or architecture sections, which makes maintenance of an exhibit far more manageable. The Carnival's mission weaves well with this project's goals and approaches towards raising awareness. This project's participation in such a venue could truly inspire today's generation to bring change in Venice.

Participation in the Kids' Carnival would bring a positive light upon all student project groups who have worked on this concept, the Venice Project Center, and Worcester Polytechnic Institute. It is our hope that in the future this ultimate goal of recognition by a major art exhibition can be accomplished, and the Interactive Venice campaign can be deployed in Venice to start raising awareness.

#### **4.3.3 Venetian Sponsorship**

Another possibility in getting the Interactive Venice campaign successfully deployed would be to reach out to organizations in Venice who are also invested in raising awareness about Venetian social concerns. UNESCO, the United Nations Educational, Scientific, and Cultural Organization, is present in Venice and the entirety of the city is a UNESCO World Heritage site<sup>33</sup>. Part of UNESCO's mission is to promote lifelong learning and address social and ethical challenges, which fits very well with the overarching goals of this project. Employing art to create awareness among all people, especially younger generations, is an attractive way to address Venice's social concerns and inspire changes to address them. Deploying the Interactive Venice campaign in a large venue or with the help of Venetian organization would be the first step in generating greater awareness in Venice, for the benefit of all.

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<sup>33</sup> "Venice and its Lagoon" 2011



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## APPENDIX A: TABLE OF VENETIAN SOCIAL CONCERNS

Issue of Concern in Venice	Description	Current Project Work
Aging Population & Demographic Shifts	Venice's local population is getting older and is dominated by the large number of tourists.	n/a
Boat Wakes & Turbulence	The continuous boat wakes and turbulence, called "moto ondosso," damages the historic canal walls.	Venice Maintained
Commercialization of Venice's Culture	Traditional shops in Venice are being replaced by franchise companies with no historical or cultural value.	Changing Venetian Retail Sectors
Cruise Ships	Cruise ships bring large numbers of tourists into the city and make a lot of harmful noise with their engines always running.	Noise in Venice
Deteriorating Infrastructure	Venice's infrastructure cannot support the high numbers of people in Venice and gets damaged and deteriorated as a result.	Venice Maintained
Flooding	Seasonal high water and tides cause flooding in Venice, resulting in damage to buildings and canals.	Canal Hydrodynamics
Graffiti & Defacing Property	Graffiti and urban art disrupts Venice's historical beauty and are costly for the city to clean up.	n/a
High Cost of Living	The increasing cost of living makes it difficult for locals to continue to live in Venice as a result of many factors.	
Illegal Garbage Dumping	Venetians put garbage outside for collection when they are not supposed to, and birds spread the trash into the streets and canals.	n/a
Lack of Housing	Owning a house in Venice has become increasingly expensive, and locals leave for the mainland to start their own homes.	n/a

Lack of Jobs	The tourism trade driving the economy makes it hard to live in the city without having a job centered in tourism, and it is hard to make a living in Venice.	n/a
Lack of Sanitation & Sewage Problems	Venice does not have a sewer system; waste goes into the canals, which causes canal wall damage and poor water quality.	n/a
Loss of Public Art	Venice's famous public art is being lost for a wide variety of reasons, including weather conditions, theft, and vandalism.	Preserving Material Culture in Venice
Mobility Issues	Venice's walkways, canals, and bridges are congested with traffic from the high volume of tourists that visit the city.	Mobility
Moto Ondoso	Venice's canal walls are damaged as a result of pollution, subsidence, "moto ondosos" and sedimentation.	Venice Maintained
Noise	The massive number of tourists and cruise ships in Venice everyday produces high level of noise in this historically quiet city.	Noise in Venice

## APPENDIX B: MATERIAL BUDGET

Budget table		
Description	Quantity	Cost
Arduino Board	2	\$60
Motion Sensor	1	\$25
Solar Power Supply	3	\$90
Sound Kit	1	\$30
Clear plastic OtterBox	1	\$20
Ceramic Tiles	140	\$10
Punch Bowl	1	\$10
Geocache Containers	10	\$20
Neodymium Magnets	100	\$15
Exhibition Posters	5	\$30
Geocache Camouflage Adhesive	2	\$5
<b>Total</b>		<b>\$315</b>

## APPENDIX C: PARTS LIST

Description	Quantity
Arduino Board	2
IR Motion Sensor	1
Solar Power Supply	3
Sound Kit	1
Ammo Case	1
Clear OtterBox	1
Breadboard	1
Wire and Resistor Package	1
Geocache containers	6
Punch Bowl	1
Neodymium Magnets	100