Preserving the Floating City:
A Survey of Architecture Preservation in Venice

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Abstract:

This thesis works to provide a broad survey of the preservation of Venice, Italy. The paper begins by justifying conservation due to the city's unique architectural history from the foundation of the city to the fall of the Venetian Republic. Next, the preservation history of Venice is summarized. Preservation projects must build off and learn from previous successes and failures. Some of the early projects were ill guided and had unintended consequences. In some cases, preservationists are still trying to fix the effects of some of these projects and have learned from them. Modern conservation efforts are discussed and cutting-edge science that could be applied to Venetian materials is summarized. Preservation efforts in Venice will only become more difficult with the projected sea level rise over the next century. The paper concludes by making suggestions to solve the unsustainable tourism problem in Venice and revive the living and intangible culture in Venice. Preservationists must prioritize Venetian residents when planning their projects before thinking of tourists.

Contents

Introduction:

Any conservation project must consider three important questions. What is being conserved? This considers both the materials and the historical aspect of an object or site. How should the piece be conserved? This takes the materials defined and applies innovative science to best preserve a piece. Preservationists must consider what the best techniques to use are and what is ethical when it comes to heritage objects. Most importantly, why is an object being conserved? You can conserve any object, but an impactful project has a historical or cultural impact. The "why" can be justified in many ways. A project can conserve something unique; a heritage object can hold art historical importance, or it can be culturally important to modern people. These are not mutually exclusive, and often the most meaningful conservation projects deal with objects or sites that are both unique and culturally important.

Venice poses unique challenges for preservationists. The city is essentially a conglomeration of important heritage objects and sites that are in constant need of preservation. The buildings were built with their own unique characteristics over hundreds of years, but modern environmental and manmade changes pose constant threats to the city. Due to its size and scope, very few writings on Venice are able to describe the what, why, and how of preserving the city as a whole. However, there are analyses of specific buildings that can do this. Plenty of scientists have written about their studies of the state of Venetian materials and how to conserve them. The effects of mass tourism and climate change are popular topics for news articles, but very few sources are able to capture the true importance of Venice and why it deserves the immense amount of focus the preservation world gives it.

This thesis attempts to answer these questions and give a broad survey of the preservation work completed in Venice while also providing suggestions about what comes next for the city's

preservation. The architectural history of the site and the buildings' engineering features will give context to what must be conserved in Venice. The city's unique architecture also provides one reason why it is important to save. The preservation history in Venice is a valuable tool for understanding how its monuments must be conserved. Previous projects provide valuable lessons and inspiration for contemporary conservationists to use, and an in-depth discussion of common materials outlines possibilities for how Venice's individual buildings can be preserved. Most importantly, the current cultural state of Venice will be discussed. This addresses a fourth emerging question that conservationists have, which is "for whom?" Who is being benefitted by a project? In Venice, this means reevaluating the level of tourism in the historic center. Venice must be preserved for its residents first and for the rest of the world next.

For much of history, preservation has been focused on the aesthetics of a building. It then expanded to considering science in a much more thorough way. Today, preservation is becoming an increasingly complex field. This thesis works to evaluate the preservation of Venice in a more well-rounded way by not only considering the science and engineering but also the economic, social, and political implications that come with the modern conservation of a living city. Embracing all these fields will ensure that the city's preservation plan can be carried out with a citizens first mentality. Rarely are all of these pieces considered in tandem, but the preservation of Venice will require tools from all of these fields to ensure the survival of the city with both its tangible and intangible culture intact.

Part 1: Engineering

While large settlements through history have been founded around water, very few chose to create cities on land as unstable as Venice's. It seems nonsensical for people to have settled

practically in the middle of the lagoon. It would pose many challenges for the building, expansion, and survival of the city. The story of how Venice came to be is full of myths and legends. They are no doubt meant to highlight the glory of the city when it was in its prime, but the reality is probably less intriguing than the ties to gods and divinity that Venetians claim.[1] Because of its unconventional location, Venice's architecture was guided by engineering specifications that would make building on unstable soil possible. Its architectural history was then forced to progress differently than the rest of Europe. Venetian architects took this opportunity to gain inspiration from Europe as well as their Eastern trade partners and incorporate these influences into the city. All these factors produced architecture that is completely unique. Not entirely European, Italian, or Eastern, Venice has a distinctive blend of all of them while creating an innovative style to fit the engineering challenges presented. These first two chapters should not be read as a simple chronical of engineering and architectural history, but rather context and justification for the city's conservation.

The legends claim the founding date of Venice to be 421 CE. While there is little evidence of a date as specific as this one, carbon dating has shown evidence of an early settlement in the fifth century.[2] The population would begin to increase substantially when more people preferred living in the mudflats than being controlled by the Lombard tribes on the mainland.[3] By the end of the sixth century, the refugees settling in the Venetian lagoon were wealthier families, leading to the growth of the settlement.[4] The small settlement claimed

1. Ennio Concina, *A History of Venetian Architecture,* trans. Judith Landry (New York: Cambridge Press, 1998), 3.
2. Deborah Howard, *The Architectural History of Venice* (New Haven, CT: Yale Press, 2002), 2.
3. Joanne M. Ferraro, *Venice: History of the Floating City* (New York: Cambridge University Press, 2012), Accessed January 19, 2021. ProQuest Ebook Central, 37.
4. Howard, 3.

independence with the election of the first Doge in 697 CE but would face many challenges from other European forces. The Doge would be the title given to the elected ruler of Venice throughout the span of the Venetian Republic. After invasions by both the Lombardy as well as Charlemagne's son Pepin, the Doge settled in Rivo Alto, which would later become the island Rialto. The islands Rialto and San Marco would become focal points of the city as it grew because they sat on the highest land, making them the easiest to build on.[5]

Venice was one of the few large cities in Italy that did not grow out of a Roman colony. This means that it lacked some of the order that other Italian cities had and instead reflected the tight streets of Islamic cities.[6] Venice was not based on a grid system. It developed from wealthy families building around enclosed courtyards. These would expand into parishes and grew until one parish would reach another. While some of the parishes would grow along linear streets, the meeting points did not always line up. This, and the lack of space, caused Venice to be full of narrow passageways and winding streets, leading to dead ends.[7] Other medieval cities would have had these narrow alleyways, but most did not survive into the modern era due to fires and rebuilding. Modern cities that have roots as far back as Venice (or earlier) were also updated over time to accommodate carriages and cars. It was impossible for Venice to embrace automobiles because of the lack of space, so it still holds some of the early city layout that other surviving metropolitan locations could not preserve.

The soft soil that Venice sits on required innovative engineering techniques, which led to unique architecture types. As the city grew in population, it had to maximize the small amount of land available. Canals were dug out, and land was shifted to create larger islands and deeper

5. Ibid, 48.
6. Ibid., 50.
7. Ibid., 51.

channels.[8] To manage the population, builders would need to find a way to construct multi-story buildings without traditional foundations. Normal foundations at this time would use piles that would reach more solid ground to provide a secure base for a building. The soil in Venice does not become solid enough to hold the weight of building until far past the reach of historical piles.[9] Venetian builders would have to find another way. Piles instead were used to compact the soil rather than holding the weight of the building. By compressing sand with many piles placed close together, the soil becomes much stronger, allowing buildings to securely rest on the previously soft ground.[10] Most building materials in Venice had to be brought in by land or sea, and wood became more and more difficult to come by as European civilizations grew. Wooden piles could only be used beneath weight bearing parts of the building and not as the full foundation. They were only used when strictly necessary. It also meant that many new buildings were built on older foundations to save money. By the Renaissance, the cost of the foundation was a substantial part of every project.[11]

Even with this method to strengthening the land, architects had to make modifications to their buildings to make them stable. One of these strategies was to use brick rather than stone construction. Bricks are much lighter than stone due to their more porous configuration. They also have the added benefit of being cheaper and easier to obtain than stone blocks.[12] Bricks pose one large challenge in Venice. They are susceptible to major degradation when in contact with

8. Ibid., 50.
9. Paolo Foraboschi, "Engineering Failure Analysis: Specific Structural Mechanics that Underpinned the Construction of Venice and Dictated Venetian architecture." Elsevier, no. 78, (2017): 169-195. https://doi.org/10.1016/j.engfailanal.2017.03.004, 172.
10. Foriboschi, 173.
11. Howard, 57.
12. Foriboschi, 178.

water. Because bricks have many large openings, they fill with water easily. When the water level lowers, salt is left behind within the brick's structure. The crystallization of these salts puts pressure on the brick from the within, degrading its stability. This is a common issue with the conservation of all types of stone, but bricks are particularly susceptible because they have larger channels into the interior. The water level in Venice is constantly changing, which means that the bricks would need to be protected from this process. Many buildings in Venice have a layer of stone cladding to protect the brick interior. This is a thin layer of stone over the outside of the building. On some buildings, cladding only reaches above the water level, but for other buildings, it covers the whole façade.[13] Stone cladding adds weight to the buildings but protects the bricks from water and salt damage.

Another strategy for reducing the weight and pressure of walls was to poke as many holes in them as possible. Columns and arches were preferred to solid weight bearing walls. With later Gothic pointed arches, there is vertical forces where the column meets the floor, but some of the weight is also distributed horizontally. This does not happen with a post and lintel building tactic, making this arch style more popular in Venice.[14] The use of many windows, arches, and columns created the iconic style for Venetian buildings, which embraced a very repetitive use of arches across the façades. These repetitive colonnades also allowed for buildings to extend over walkways to gain more living space in the upper stories.

Venetian buildings often have orderly exterior facades with rows of arches on every level for the structural reasons stated above, but these also helped with natural lighting. Light was a commodity in Venice because the abundance of narrow passageways and canals led to buildings

13. Ibid.

14. Ibid., 176.

being built extremely close together. Palaces were often built with large windows on the main floor to light the open living space.[15] This would reduce the use of candles during the day, decreasing the risk of fire. The heavy use of windows would have been impossible without Venice's glass industry. Oiled canvas or parchment were used in other cities in place of glass for windows. With such large openings, cold winters, and rainy seasons, these materials would not have provided sufficient protection from the weather in Venice.[16]

Due to their immense weight, masonry vaults were rarely used in Venetian architecture. Flat timber ceilings were common in Venice because they were required to decrease weight.[17] Flat ceilings were made from timber because it provides a sturdy ceiling that is both lighter and takes up less space than a masonry vault. Flat ceilings in prominent buildings such as the Palazzo Ducale were heavily decorated, but in other structures, different types of faux ceilings were employed to give the appearance of a vault. These included building curved wattle, daub, and plaster structures that could be hung from the ceiling or using wood to build a structure like a vault. The process using wood is a lot like building the hull of a ship that could play a structural role as the ceiling.[18] Roofs on the exterior were built with large timbers and smaller purlins covered with the iconic curved tiles seen across the city. The roofs were usually hipped, or slopped, for the sake a water catchment.[19]

This discussion of Venice's unique engineering issues is meant to preface the chronical of the city's architectural history. Behind all the great architects and craftsmen who designed

15. Howard, 36-37.
16. Howard, 62.
17. Foriboschi, 179.
18. Foriboschi, 183.
19. Howard, 61.

iconic buildings in Venice was a consciousness of the restrictions laid out here. These engineering innovations are what created the unique palace form that echoes through Venice's architecture, and they determined the natural progression of buildings in the city. Venetian nobility would not be building stone towers to show their wealth like they did in other Italian cities, and there would be no race toward the tallest Gothic cathedral as there was in France. Instead, architects had to take inspiration from other locations and tailor them to fit the Venetian environment. Not all attempts to do this would be successful, causing preservation issues later, but it did contribute to the city's distinctive architecture, separating Venice from other parts of Europe.

Part 2: Architectural History

The engineering challenges discussed in part one will always be relevant to architects working in Venice. The earliest structures in the area were only huts on stilts.[20] As the buildings became more permanent, Venice flirted with architectural styles from both mainland Italy and the Eastern Roman empire. While Byzantine style architecture showed up in other places in Italy, it lasted the longest and was particularly influential for the progression of Venetian architecture. The earliest surviving Byzantine buildings date to the seventh century.[21] Exterior building decoration also took influence from the east. Trade and travelers brought art from Asia and the Islamic world, making Venice a unique meeting point for many cultures through its history. The buildings in Venice are entirely unique because of both their engineering challenges as well influences coming from around world.

20. Ibid., 4.
21. Ibid., 6.

It is assumed that many of the domestic buildings built before the 13th century were wood. These would have been prone to fire and later replaced by wealthier Venetians with brick structures.[22] This means that little remains of the architecture of the lower classes prior to the 13th century. Even the examples of wealthy palaces displaying Veneto-Byzantine facades were built after the 12th century. Across the rest of Italy during this time, stone towers were being built to display wealth and status. This practice was impossible in Venice due to the lack of solid ground and the costly process of shipping in stone.[23] Instead, the wealthy would build palaces where they could both live and work. Most of these palaces had the front façade of the building facing out toward larger canals. This allowed Venetians to have direct water access to aid in their trade ventures.[24] It also meant that buildings had large windows facing out towards the canal to let as much light into the buildings as possible.

One potential example of what the Veneto-Byzantine palaces may have looked like is the Fondaco dei Turchi (Figures 1 & 2). The building dates to the 13th century but has gone through numerous changes since then; most importantly, it was reconstructed in the 19th century. This building displays the long colonnades across the first two stories that were common for these palaces. There is much debate over where inspiration came from for the Veneto-Byzantine palaces. Some scholars have suggested that they reflect a late-classical villa form with small towers on either end while others argue that the room layout mirrors that of Armenian or Bulgarian homes. Between the 12th and 13th centuries, the influence of Byzantine architecture from Constantinople only increased.[25]

22. Ibid., 30.
23. Ibid., 31.
24. Ibid., 32-33.
25. Concina, 58-60.

While the Fondaco dei Turchi is only two stories with a horizontal orientation, its neighbor and later counterpart, the Ca'Loredan (Figure 3), is much more vertically oriented. The lower colonnade opens on to the water so goods could be loaded and unloaded from storage rooms on the ground floor. The upper stories would have been living space.[26] Ca'Loredan shows tall and narrow stilted arches, which was a marker of eastern influence.[27] The palace layout seen in Ca'Loredan would be the prevalent form in Venice far past the Veneto-Byzantine period. Transitioning into Gothic architecture, only small changes were made to the palace form. Long arcades were paired down to fewer arches that were restricted to the center of the building. This gives a much more closed off look than the previous porticoes but was likely much cheaper.[28]

Along with these late Veneto-Byzantine style palaces, there is also remaining Byzantine influence in church architecture. One of the most iconic buildings in Venice, the Basilica di San Marco (or St. Marks Basilica), gives hints of Veneto-Byzantine religious architecture. A 9th-century church that was severely damaged by fire in 976 CE was built on this location and is assumed to have the same layout as the later church. From its conception, the church was going to be one of the most important buildings in the growing community. It was originally built to hold the body of Saint Mark with the location being chosen for its proximity to the Doge's housing, showing the interweaving of church and state.[29] The original building likely had the same Greek cross plan that the later church would follow with a dome over the center. The church was quickly rebuilt after the fire but was replaced by the 11th century. This is when the

26. Howard, 34.
27. Concina, 62.
28. Howard, 38.
29. Ian Fenlon, Piazza San Marco (Cambridge, Harvard University Press, 2009), 6.

most distinguishing features, such as the five domes and the vaulting, were built (Figure 4).[30] Over time, the layout was stretched slightly to emphasize the nave and two side chapels rather than having four equal arms of the Greek cross plan. This layout was still vastly different from the elongated naves of Romanesque churches being built in other parts of Europe. The use of such heavily Byzantine features, particularly the central plan, in one of the most important buildings in Venice shows the tendency for Venetians to embrace non-European art and architecture.

Decorating the Basilica di San Marco was a long process that ended up bridging architectural styles. The interior decoration is full of gold mosaics that also reflect Byzantine influence. The opulence of the gold walls is reminiscent of the Hagia Sofia in Istanbul but on a smaller scale. Interior and exterior decoration were added after the fourth crusade, expanding the elements of Eastern influence.[31] The money from these crusades likely funded the finishing of the church's façade as well as collecting some of the art pieces for both the interior and exterior. Most notably, the sculpture *The Moors* was included in the façade. This is a dark porphyry sculpture of Byzantine style. An inscription reveals that the piece was likely taken from Istanbul during the 4th crusade.[32] *The Moors* and other statues taken during the crusades were displayed on the churches water-facing façade. Even the famous Bronze Horses that used to look over the square were brought from Constantinople.[33] Eastern influence in Venice is often visible, but it is a unique blend of reused art pieces as well as the inclusion of eastern elements built by Italian artists.

30. Howard, 19.
31. Howard, 28.
32. Fenlon, 26.
33. Idid., 30.

Byzantine architecture led into Gothic and by the 13th century when the façade of the church was being completed, this style was also prominent. At this time, the faux domes were built around those already there.[34] The crux of Byzantine dome architecture was that the domes, which were very impressive from the inside, were too shallow to be seen from the outside. The Gothic fix was to encase the domes with a more decorative exterior bulb shape. They emphasized the building's height and created the iconic structure for which the church is known. It is a mistake to categorize the Basilica di San Marco as singularly Byzantine, Gothic, Eastern, or European because it is truly a blending of all of these. As Deborah Howard says "to a visitor from the Near East, [San Marco] would seem foreign" because it took influence from the East but was built by Italian craftsmen, which influenced the final form of the church.[35]

While the façade of San Marco has non-European factors, it is also reminiscent of other major cathedrals. While the cathedrals in Venice, Sienna, Florence, and Milan were all built during slightly different times, they all show an opulence associated with city pride. These large cathedrals were meant to be a demonstration of wealth, power, and identity for their cities, and Venice was no exception to this practice. Aside from these large cathedrals, a less flashy Gothic style for churches was popular in Venice and other Italian locations. These churches were products of the increased importance of mendicant orders across Italy. The mendicant orders, particularly the Franciscans and Dominicans, gained popularity in Venice in the 13th century.[36] Mendicant orders had a larger urban presence than the previous Benedictines, so their churches were included into the fabric of the Venetian community. They were open to the public rather

34. Ibid., 26.

35. Howard, 28.

36. Ibid., 75.

than closed off and secluded like the Benedictine monasteries.[37] These churches were large and impressive, but many lack the same level of exterior, and sometimes interior, décor associated the major basilicas in Italian cities. Examples of this would be the Church of Santi Giovanni e Paolo (Figure 5) or Santa Maria Gloriosa dei Frari (Figure 6). The exteriors of both churches are plain brick. There are hints of the gothic style with decorated portal doors that utilize pointed arches. They have decorative rooflines with the Gothic motif of pointed arches, but otherwise, the facades are relatively plain.

The interiors of these churches are vast. They have a distinctly different type of beauty than the interior of San Marco. In some instances, they have been described as solemn and serene. The aim of these buildings was to embrace Gothic building techniques but to also lighten the structure and make it stable on Venice's ground. Both buildings lack the iconic flying buttresses of Northern Gothic cathedrals and highlight more Venetian traditions such as decorative wooden tie beams spanning the nave.[38] These churches both notably differ from the central plan that had become popular in Venice, opting instead for a Latin cross form with an extended nave. This was common for Gothic churches elsewhere in Europe, but Northern Gothic architects often held their buildings to much more precise proportions than seen in Venice. Venetian architects were less inclined to follow these strict guidelines.[39]

As addressed above, religious architecture reflected European Gothic style most directly. Much of the Gothic style in Europe was focused on new engineering features that made impressive interior vaults and extraordinary height in churches possible, but because of problems with ground stability, large stone buildings with flying buttresses were not possible in Venice. In

37. Ibid., 76.
38. Concina., 78.
39. Concina, 75.

secular architecture, this formed a particular Venetian Gothic style.[40] The Gothic architectural period in Venice was important because it coincided with the pinnacle of wealth and power of the city state. During this time, trade was increasing, and Venice was able to expand its power to have land holdings on the mainland.[41] The added resources and wealth from both trade and the *terraferma*, or the expansion of Venetian territory outside of the lagoon, would have helped with major building projects. No matter what architecture style was occurring, buildings in Venice were still confined by the engineering discussed in part one.

The Palazzo Ducale off Piazza San Marco (Figure 7) can be described as the epitome of the secular Gothic style in Venice. Sitting next to the basilica, this site also had a building from the 9th century. Like the church, there is little known about the early building on this site, but it is something that art historians love to speculate about. The exterior that remains of the building today was most influenced by a rebuild in the 14th century.[42] By normal European standards, the Palazzo Ducale is an unusual Gothic building. The bottom two stories have repetitive colonnades spanning the whole building. The bottom row creates a covered archway while the top creates a covered balcony. This gives a lifted feeling because the solid walls of the lower half are hidden behind arches.[43] The bottom colonnade has plain pointed arches while the second story has a more decorative ogee arch with quatrefoil roundels in between each point. All of these are common Gothic elements, but they are included into the former Veneto-Byzantine secular palace style that heavily used repetitive rows of arches. The upper part of the building shows Persian

40. Howard, 89.
41. Ibid., 74.
42. Ibid., 91.
43. Ibid., 93.

influence with its tile pattern.[44] It breaks up the solid upper half of the building with the light-colored geometric pattern. The upper section also has large arched windows, which would provide the most possible light for the large, decorated rooms within. [45]

While the style set forth by the Palazzo Ducale would eventually show its mark on palaces across Venice, the first Gothic palaces were much more conservative with their decoration. By the 15th century the more extravagant effect of Palazzo Ducale started appearing in other palaces.[46] Most notably, the heavily decorated Ca' d'Oro (Figure 8). This building includes various types of marbles, no less than six different types of arches (at least in its current state), and gold leaf on the original facade. While the Ca' d'Oro is very striking and almost overwhelming, it is obviously far from the norm for Gothic palace architecture. It does indicate that Venetians began to accept a more lavish style by the end of the Gothic period.[47] Despite being an extreme example, even the Ca' d'Oro shows some of the patterns for Gothic palace architecture. The building was most likely planned with a three-part façade. This was common because it reflected the interior layout on the outside. The colonnades in the center fall over the main hall of the *piano noble,* or main floor, of the palace. The less intricate portions of the façade reflect the location of bedrooms or other side rooms around the main hall. [48]

In the rest of Italy, Gothic architecture was superseded by the early Renaissance. This movement was led by artists in Florence. Because Venice lacked these classical roots that the early Renaissance drew on, architects in Venice turned to the area's Byzantine past instead.

44. Ibid., 94.
45. Ibid.
46. Ibid., 102.
47. Ibid., 103.
48. Concina, 98.

Some facades reflected the Roman triumphal arch, but these were mostly designed by architects who came from other locations in Italy. The early Renaissance was not nearly as popular in Venice as in Florence and Rome.[49] In religious architecture, there was a return to the central plan church rather than the long nave seen in the monastic Gothic churches. Some of the most notable early Renaissance religious architecture can be connected to the architect Mauro Codussi. Before this point, there were very few buildings that could be tied to specific architects. It was likely that many craftsmen worked on each building or the owner had a large say in the style, but Codussi left his mark on the city through his own designs.[50]

During his time in Venice, Codussi became one of the most popular architects of the early Renaissance. After his death, the attribution for his works was quickly forgotten and has had to be attributed by art historians.[51] Codussi worked on notable buildings, drawing influence from his surroundings in Venice and his travels. He was familiar with the architecture in Ravenna and the work of Leon Battista Alberti, combining these influences in San Michele in Isola.[52] While previous Venetian architecture had often included the use of colored marbles, Codussi introduced the plain white, Istrian stone façade to the city. The campanile of San Pietro di Castello designed by Codussi was the first tower entirely clad in Istrian stone. He also built parish churches—taking inspiration from Byzantine architecture and using the Greek cross plan—which was unusual after the Gothic tradition of elongating the nave.[53] Despite his identity later being lost to history, Codussi was prominent enough when he was alive to earn a

49. Howard, 119.
50. Ibid., 132.
51. Ibid., 133.
52. Ibid., 134.
53. Ibid., 136-137.

commission in Piazza San Marco. The Torre dell'Orologio (Figure 9) is an arch structure with a clock tower that marks the street that led from San Marco toward the Rialto area. The arch form reflects the arches at Palazzo Ducale as well as following Alberti's instructions for building monumental towers in city centers. [54]

Palazzo Ducale also gained its own pieces of early Renaissance architecture after a fire in 1483. The east wing was replaced with a façade that mixed the previous Gothic style and the new classical revival. The whole courtyard is stylistically confusing. The eastern façade includes Gothic pointed arches, but the rounded arch also returns with classical pediments being used around windows.[55] There were also rounded niches meant to hold statues, which was quite common in the Renaissance. At first glance, the façade seems almost completely nonsensical. The mismatch of styles with outdated Gothic arches was meant to display continuity with other sections of the palace as well as other prominent buildings around Venice. Continuity of architecture was being used to show continuity of power.[56] While the bottom two stories have the pattern and order expected from the Early Renaissance, the upper two stories have a chaotic layout of windows. These reflect the previous interior layout of the building, which did not change with the remodel of the façade.[57]

The other sides of the courtyard were completed over the 16th and 17th centuries, so they also display different architectural styles. The Renaissance triumphal arch is also prevalent in the *Arco Foscari* (Figure 10), which was not completed until the 16th century despite being started in

54. Ibid., 148.
55. Ibid., 126.
56. Concina, 146.
57. Concina, 146.

the 15th century.[58] The architect Antonio Rizzo is credited with finishing the design of the arch, which also takes inspiration from the mix of Veneto-Byzantine and Gothic architecture seen at the Basilica di San Marco.[59] Rizzo also designed the most unified piece of the courtyard, a very regal staircase referred to as *Scala dei Giganti* (Figure 11). The staircase displays a command of the Early Renaissance that was often missing from Venetian buildings. The harmony that comes with order and simplicity made the staircase a perfect place to display classical style statues by Jacopo Sansovino.[60] The staircase was often used for ceremonies and events, making it a symbol of the power of the Doge and Venice.

It is also important to note that Piazza San Marco also gained a new building during this time. Between the cathedral, the palace, the new Procuratie Vecchie (Figure 12), and later the works of Sansovino, the square would become a microcosm of Venice's many architectural influences. The Procuratie Vecchie had previously been rental housing, but after a fire in 1513, the owners decided to completely rebuild the complex. It is important to note that this was happening during the Cambrai wars, which drained money out of Venice. Due to the lack of funds, there was a lull in large scale building projects between the brief introduction to the early Renaissance and the later effects of the Roman Renaissance. The Procuratie Vecchie was an exception to this rule. The opportunity to build a new structure in such a prominent and visible location led to this building being a display of Venetian strength and pride.[61]

The architectural elements of the Procuratie Vecchie employ features of the Classical style but not without influence from previous Venetian architecture. The building has

58. Fenlon 48.
59. Howard, 123.
60. Fenlon, 47.
61. Howard, 150.

semicircular arches using both Tuscan piers and Corinthian columns. The roof line has crenellations like many Gothic buildings, but they are more decorative than their predecessors, which appeared more defensive. The crenellation alone indicates this building's Gothic roots, and the pattern itself is a mix of classic vases in traditional Venetian Istrian stone.[62] The plan of the building is assumed to be similar to the building that came before it, which implies an influence of the Veneto-Byzantine.[63] The repetitive nature of the façade is very Venetian. It is almost dizzying to look upon the extensive row of arches, but this is an architectural tendency that can be tracked back to the Palazzo Ducale or possibly even the Fondaco dei Turchi. The design of the Palazzo Ducale is believed to have seeped into buildings all over Venice because the repetitive nature of the columns could be extended to any length of building. In the Procuratie Vecchie and later buildings around the square, this idea is taken to the extreme.

While the early Renaissance was not as prevalent in Venice as the rest of Italy, the height of the Roman Renaissance made its mark on the city. Just as Codussi embodied the early Renaissance in Venice, there were a handful of artists who led the Roman Renaissance. Jacopo Sansovino, Michele Sanmicheli, and Andrea Palladio are credited with most of the notable High Renaissance buildings. Much of Venice's history and architecture up until this point separated itself from the rest of Italy. Venetians prided themselves on the being different, but in some ways, they still wanted the prestige that Rome held by having such an extensive history. While Rome was at its weakest after the sack of 1527, Venice was actively incorporating more traditional Roman architecture to be the next Rome. The sack of Rome by imperial troops also led to the resettlement of elite artists to other metropolitan locations in Italy.[64] The ambition of

62. Concina, 150.
63. Howard, 152.
64. Ibid., 161-162.

the Renaissance period does little to detract from the challenges of before. Venice's economy was still rebuilding from conflict on the mainland, and wood was difficult to obtain for foundations, making new buildings difficult.

Sanmicheli and Sansovino worked during the same period in Venice, but Sanmicheli made a name for himself in defensive architecture, whereas Sansovino worked within the historical city center. Sanmicheli was eventually put in charge of all military defenses in the Venetian Republic.[65] This was a large task that included overseeing structures both within Venice as well as in the *terraferma*. His most famous structure within the city was the Fortezza di Sant'Andrea (Figure 13). The fortress building encompassed an older castle that had been on the site.[66] It is important to note that Renaissance military architecture had to be both innovative to attempt to adapt to the new threats of gunpowder artillery as well as being progressive stylistically. Sanmicheli succeeded at doing both. The arrowhead layout of the building was useful for attacking invaders, and the façade works to convey a sturdiness to the building. The arches and Doric columns are imposing while the rough stone gives the viewer the sense that the fortress is impenetrable.[67]

Defensive architecture blended with secular architecture in Sansovino's plan for the Zecca off Piazza San Marco (Figure 14). The building was meant to function as a place to make and store money and therefor needed to seem as if it was defended. The third story was added later, but the first two stories were conceived of by Sansovino.[68] He achieved a strong look by using repeating rounded arches on the lower story with rusticated stone front. The second story

65. Ibid., 166.
66. Ibid., 168.
67. Ibid., 168-169.
68. Ibid., 170.

has sturdy lintel construction with large columns. The imposing and closed off nature of this building was a distinct departure from other secular buildings that used an open arcade on the ground floor. It implies defense above all else, which was fitting for the building's use.[69] This was just one of many of Sansovino's buildings that perfectly tailored the exterior to express the interior function.

Sansovino was a jack of all trades in Venetian architecture and was extremely popular with state sponsored projects. He worked on secular, religious, and private buildings, and left his own Roman Renaissance mark on Piazza San Marco with the Zecca, the library, and the Logetta. Piazza San Marco held great importance to the Venetians and all these buildings were part of a project to elevate the square using the classical style. This was likely done with aspirations of being the new Rome.[70] As discussed before, the Zecca façade is perfect for a building associated with money. On the other side, Sansovino's decorative library (Figure 15) was fittingly open and impressive to face Palazzo Ducale. The building itself was once again a blending of Venetian and Roman roots. It has the large *piano noble* windows on the second story allowing for a bright interior for the library. The second story includes a balcony over an open arcade with shops. All of this was common for Venetian buildings, but these features were skillfully blended with rounded arches, classical columns, and a beautifully decorated relief freeze spanning the whole building.[71]

Just as Sansovino could express different purposes in the Zecca and the library, he did the same with the Loggetta at the base of the San Marco campanile (Figure 16). The Logetta was meant to be used for ceremonial events. This meant that Sansovino had a large budget to guide

69. Ibid., 171.

70. Fenlon, xx.

71. Howard, 175.

his highly decorative base for the campanile.[72] The small building includes an elaborate frieze and a dramatically symmetrical façade with three grand, rounded arch doorways. The tripartite façade alludes to a Roman arch while the relief and free-standing sculpture draws on classical mythology as allegory for the Venetian Republic.[73] While much of the major architecture during this time had started to embrace a plane, white façade using Istrian stone, the Logetta returns to the Venetian tradition of multicolored marble to cover the façade. This flair for the dramatic was the closest Sansovino's architecture came to his peer Palladio despite its use of color.

Palladio's work was imaginative and inventive, but for the leadership of Venice, this was often too forward thinking. They often opted towards safer architects like Sansovino for city projects. Instead, Palladio got his first major works in religious architecture.[74] Two of Palladio's great works include San Giorgio Maggiore (Figure 17) and Il Rendentore (Figure 18). Both churches show an immense knowledge of classical temples, but Palladio chose to create facades that have multiple pediments. It is as if the front pediment of the temple and the back pediment were on the same plane.[75] He used columns on a massive scale, creating a dramatic and imposing aura. Palladio embraced the use of Istrian stone for the whole façade, making his buildings brilliant against the earth toned surroundings of Venice. The white walls are prevalent on both the exterior and interior of the churches. The white interior is only highlighted by the thermal windows that pour light into the space. This is in line with Reformation and Counter reformation values circulating, which brought light figuratively and literally into churches. The thermal window, which takes its inspiration from Roman baths, would become extremely popular in

72. Howard, 178.
73. Fenlon, 79.
74. Howard, 198.
75. Concina, 217.

Venetian architecture.[76] Palladio's buildings would also have a lasting impact on Venetian architecture. They would later inspire Neo-classicism and Palladianism in the late 17th century.

Through other areas in Italy, the Roman Renaissance was superseded by the Baroque after the Catholic church survived both the Reformation and the Counter Reformation. The renewed confidence in the Papacy led to new dramatic and decorative architecture, which modified classic features in undulating, decorative facades.[77] While the Baroque flourished in Rome, the buildings in Venice were more restrained. The designs of the Baroque often required the spectator to believe in the artist's illusions, but in Venice, there was skepticism toward religion due to former conflicts with the Papacy.[78] The illusions of artists and architects like Bernini were less prevalent in Venice due to this. That is not to say that Baroque architecture did not appear in Venice.[79] Artists who studied Palladio and Sansovino integrated their architecture into new forms that rivalled the churches of Bernini and Boromini in Rome. There was an architectural line of influence drawn from Palladio and Sansovino through their lesser-known pupils Vittoria, Scamozzi, and Sorella to inform the work of the more well-known Baroque architects Longhena and Sardi.[80]

Baldassare Longhena and his works were a source of great Venetian pride because he himself was a Venetian. One of his greatest works, which spanned much of his career was the Santa Maria della Salute (Figure 19).[81] Like Il Rendentore designed by Palladio, the Santa Maria della Salute was built in hopes of saving the people of Venice from plague. Within both the

76. Howard, 120.
77. Ibid., 232.
78. Ibid.
79. Ibid., 207.
80. Ibid., 220-221.
81. Ibid., 213.

interior and the exterior of the Santa Maria della Salute, Longhena was able weave Byzantine influence, Palladio's importance in Venetian architecture, and the new inventions of the Baroque.[82] The central plan was a nod to the Byzantine tradition while Longhena created an interior that was perfect for processions. When you enter the church, only the main alter is visible, and each of the other alters is revealed as you walk further through the nave.[83] The exterior embraced the classical ideas of Palladio with large niches for statues and the theme of the triumphal arch in standard Venetian Istrian stone. In Baroque fashion, Longhena was not afraid to break some classical traditions and play with geometric shapes. This is clear with the octagonal nave transitioning into a large, rounded dome.[84] All these factors make the church an ideal example of how architecture is always a combination of influences from the past and the present, the location, and the genius of the architect.

The Baroque was a period where the majority of buildings needed wealthy patrons. While there were hints of Baroque architecture scattered in newer private buildings in Venice, most Baroque monuments were either religious or paid for by the state. Many of these jobs went to Longhena during his life, but the architect Giuseppe Sardi was also hired to design some smaller religious buildings. His architecture took after some of the classical traits of Sansovino and Palladio with large, paired columns, niches, and extravagant statues. He also embraced the various types of pediments, such as broken and segmental, and massive volutes from Baroque architecture outside of Venice.[85]

In most of Europe, the Baroque became more grandiose, turning into the Rococo style. In

82. Concina, 244.
83. Howard, 218.
84. Ibid., 220.
85. Ibid., 229.

Venice there was a revival of a simpler style in exterior architecture instead. Venetians still appreciated the lavish interiors of the Rococo period, but the exteriors were drawing from Palladio's designs. This juxtaposition has been read as a reflection of Venice's failing society. While the fabric of their society was changing, Venetians were still having parties and investing in lavish operas and art as a distraction.[86] Because of the shift in the ancient aristocracy, the noble class was decreasing, and they were forced to accept outsiders into the nobility. Most of the architects during this time were designing buildings for these new members of nobility or religious architecture because the church still had the funds to be patrons for architecture projects while the older nobility and the city did not.[87] Most of the artists that fall into this style of Palladianism or Neoclassical are a blend of Palladio's influence, hints of the Baroque and Rococo, and other European influences, but each architect seemed to have a different focus.

The churches designed by Domenico Rossi and Andrea Tirali were mostly influenced by Palladio. They were both poorly educated Venetians, so it is assumed that they were taking inspiration from the buildings they knew within the city to appease the growing interest in plain exteriors.[88] Giorgio Massari was one of the most notable architects during this time. He was more willing to embrace the Rococo elements especially in interior architecture. Massari worked in both religious and secular buildings and both in Venice and in the *Terrafirma*, but even he began to bow to the strong movement for stark architecture by the mid-eighteenth century.[89] One of the last great architects before the fall of the Venetian Republic was Giannantonio Selva. He won the competition to design a new theater in Venice, which would become the Teatro la

86. Ibid., 237.
87. Ibid., 235
88. Ibid., 242.
89. Ibid., 248.

Fenice (Figure 20). This project was able to survive through the transition of power, hosting Napoleon when he visited.[90]

After power transferred to Napoleon, Venice no longer had complete autonomy. Building projects subsided and the unique architecture that had been a symbol of Venetian pride became less prevalent. Buildings were instead being used to impose Napoleon's rule over Venice. Napoleon updated some pieces of the city, reinforcing and replacing bridges, but he also ordered the movement of artifacts out of the city, and his administration had iconoclastic tendencies.[91] Some of the focus was shifted to the preservation of buildings by academics or at least reusing them. This does not mean that there were no buildings constructed in Venice after the fall of the Venetian Republic, but the city and its unique stance on architecture would never be the same. The history laid out here would be the most relevant for the preservation of the city as the modern buildings would have had better technology to combat the harsh environment.

Much of this art historical analysis revolves around landmark buildings and in particular Piazza San Marco. That happens for a couple of reasons. For a start, these monumental buildings have the clearest historical timeline, including dates, influences, and sometimes architects. They are also the most cohesive or best examples of art movements. Their preservation history is often the most well documented. That does not mean that architecture throughout the rest of the is unimportant. It must also be preserved to preserve the whole city. For the sake of conservation, it is important to look at the city through the implications of the simple "ca" used in the titles of major palaces. The term "ca" was used for most of Venetian history and translates to house rather than something more extravagant like "palace." Some have connected this with a unique

90. Ibid., 260.

91. Ibid., 262.

amount of unity within Venice despite wealth disparities. There was still a large gap between the nobility and everyone else, but there may have been Venetian pride spurred by the challenge of living in a lagoon, which all Venetians experienced.[92] Both the decorated palaces and the plain buildings face the same issues due to their location, so preservation techniques must respond to the city as well as individual projects.

Architecture in Venice moved alongside that of Europe, but much like the Venetians themselves, there was immense pride in being different from the rest of Italy. Architects in Venice were able to choose from a wide range of influences when designing their buildings. Whether this was architecture from Florence, Rome, Greece, Constantinople, or even just previous monuments in Venice, the buildings created were completely unique. Not only were Venice's buildings a blend of European and Eastern influences, but Venetians created their own engineering solutions to the lagoon's problems. This great historical feat means we must do all we can do keep Venice intact for art historians to come.

Part 3: Preservation History

During a small lecture during the summer of 2019, Nikolas Vakalis, who works in stone conservation, told his students that the most dangerous thing for a historical object or site is the preservationist themselves. There is no better way to learn this lesson than to look at the history of preservation. The field is constantly changing, and the techniques used on past projects may not be accepted today. Short term benefits can have long term adverse effects. These unintended consequences only show with time, making them important for modern conservationists to study. Large scale changes to the lagoon environment and the demographics of Venice have had lasting

92. Ibid., 32.

consequences for the preservation state of the site. To solve these problems today, preservationists must fully understand them. Only from there can we begin to create well rounded plans for moving forward with the contemporary preservation of Venice.

It is no mystery that the upkeep of Venice would be a constant problem, meaning there is a long conservation history. It was typical for cities as old as Venice to go through major rebuilding through the years. Fires were common in medieval cities, and while they were less of a threat in Venice due to the immense amount of water, these still led to rebuilds and restorations. When cities like Paris and London were rebuilt, it led to new innovations, but Venice's adaptions were meant to keep buildings safe from flooding and involved reinforcing the soft soil. Much of the history of rebuilding, restoring, or preserving is not well documented, but there are some instances of early projects to stabilize buildings and protect their longevity.

While the standard architectural history often focuses on the San Marco area, the Rialto district was equally important to Venice's history, holding various markets and churches. Its importance, much like the San Marco area can be seen in the conservation history. The market area had to be completely rebuilt after a fire in 1514, but some of the surrounding buildings survived.[93] The original church of San Giacomo de Rialto was built in 421 (Figure 21). It was also renovated in 1071 and 1531. By 1601 the building was almost completely rebuilt. The church was popular with the public due to its central location in the city's major market district, so many of its original features were retained during the renovation. In this process, the church was placed on a higher base with the intent of preventing flooding and damage during the acqua alta.[94] This substantial reconstruction of the church would have been criticized by modern

93. Howard, 152.

94. Howard, 16.

preservationists because it significantly changed the building. Despite trying to keep some of the original features, this rebuilding does not fall under the scope of restoration or preservation in the modern sense. It does show that Venetians as early as 1601 had an interest in protecting their culturally important buildings from Venice's harsh environment and accepted that this would require drastic measures.

One of the biggest attempts to protect Venice from flooding and erosion was the construction of the Murrazi Sea wall, which spanned from 1744 to 1782. The sea wall was made of large Istrian stones and pozzolana. Pozzolana is a Roman invented concrete that sets under water, but it was not commonly used in Venetian construction. Concrete lost prevalence as a building material after the fall of the Roman Empire and did not regain it until the 19th century,[95] so its use as a building material did not overlap with the growth of Venice. Concrete is also not common in modern conservation but was perfect for this purpose. The walls were originally meant to cover 5 kilometers of the edge of the lagoon but ended up spanning around 20 kilometers.[96] The wall was meant to combat the erosion of Venetian beaches and land edges that the city had been fighting since the 1300s by breaking harsh waves before they reached land.[97] The Murrazi was split into three sections to avoid blocking off the lagoon entirely and still leaves gaps for incoming ships. It was meant to protect the natural border created by islands, which were quickly being worn away. The original sea wall is almost entirely ineffective today, and during the flood of 1966, water poured over the walls.[98]

95. Pao-Chi Chang and Alfred Swenson, "Construction." *Encyclopedia Britannica*, January 10, 2020.

96. Enzo Pranzini. "Coastal Erosion and Shore Protection: A Brief Historical Analysis." *Journal of Coastal Conservation* 22, no. 5 (2018): 828.

97. Aldino Bondesan, "Geomorphological Processes and Landscape Evaluation of the lagoon of Venice," in *Landscapes and Landforms of Italy*, ed. Mauro Bondesan and Mauro Marchetti (Cham, Switzerland: Springer, 2017), 188.

98. Giuseppe Gambolati and Pietro Teatini, 38-39. *Venice Shall Rise Again* (Elsevier Science, 2013), 38-39.

While Venice always had its challenges based on location, as is clear by the building of the sea wall, its true trouble with upkeep and preservation really began with the downturn in the economy. After the fall of the Venetian Republic in 1797, Venice lost the autonomy that it had held for thousands of years. During the next century, Venice passed between Napoleonic and Austro-Hungarian rule before becoming part of a unified Italy. Through the 1800's, there was occasionally an interest in reviving the port and increasing traffic through Venice. Unfortunately, for most of the Austro-Hungarian rule, Venice was treated just as another city in their large empire with no special effort made to help its economy.[99] This treatment caused Venice to lose some of its pride and identity that had been built over centuries. As Venice depended less and less on trade and more on tourism to support its economy, Austrian rulers thought of the city more like a museum and less like a living community. The city that was once vibrant, seemed to be a shell of itself.

Through the first half of the 19th century, there were three main types of building alterations in Venice. This included the repurposing of large spaces like convents into military barracks. This shift was quick and sometimes temporary but paid little attention to the historical importance of buildings.[100] Some of these reconfigurations were abandoned within a decade or two and others were changed in the early 20th century to return the buildings to a stable state. The second type of building alterations revolved around the constant upkeep of private buildings. While the government tried to get landlords to renovate buildings that were deemed ruinous, landowners often elected to demolish buildings rather than spend the time and money to renovate

99. Gianfranco Pertot, Venice: Extraordinary Maintenance. Translated by Christine Donougher (London, Paul Holberton Publishing, 2004), 17.

100. Ibid., 34.

them.[101] When private buildings were renovated, there was little documentation and few rules and regulations about the process. Private restoration during this time has been described as "anarchy."[102] The third type of restoration during this time was the constant focus on monumental buildings through the city. These were mostly churches, and many of the projects were clearly in the realm of restoration rather than preservation. This will be seen in examples like Giovani Battista Meduna's restoration of the Basilica di San Marco and Frederico Berchet's work on Fondaco dei Turchi.

During the 19th and 20th centuries, restoration was made even more difficult by a lack of skilled stone masons. This impacted the city's upkeep on every level into the mid-20th century. Replacing anything as small as the Istrian stone steps down to the water or paving stones required more skill than an average paver in any other historical city.[103] Without replacing stones with hand cut and original methods and materials, restorations can take away the historic nature of a building. This happened with two building projects in Venice in the late 19th century. An Austrian restoration group took on the church Santa Maria e San Donato (Figure 22), a good example of Byzantine religious architecture. Because of the use of stone cutting equipment, the restoration has been critiqued for being "cold," "mechanical," and distracting from the building's historic nature.[104]

Similar critiques have been made of the restoration of Fondaco de Turchi carried out under Austrian rule (Figure 1 & 2). As discussed before, this building is important for being an example of Veneto-Byzantine architecture that was probably widespread through the city. The

101. Ibid., 35.

102. Ibid., 36.

103. Peter Lauritzen, Lewinski, and Magnus, Jorge Lewinski, and Mayotte Magnus, *Venice Preserved* (Bethesda, Md: Adler & Adler, 1986), 70.

104. Ibid., 48.

restoration was carried out by Berchet from 1858 to 1869.[105] The building was in terrible condition before the project began with the façade being almost entirely worn away. While the product was guided by what Berchet thought was rigorous historical accuracy, it was described as "harshly modern" due to the stone used and extensive replacement of original materials.[106] The restoration followed the theory of contemporary French methods led by Viollet-le-Duc, but this approach to restoration has since been rebuked by modern conservationists. While more technical than the 19th century methods, today's projects are more similar to John Ruskin's "noninvasive" theory of conservation.[107] The Fondaco dei Turchi project was accused of being too fanciful because there was not enough historical precedent for the choices made in the rebuilding.[108] The criticism reflects modern preservation rules. It is now commonplace to save as much original material as possible, avoid overly distracting materials, and only make changes or additions when there is complete historical knowledge. The reversal of any historical additions must now be justified by more than just architectural aesthetics or harmony. For the most part, "restoration" of buildings has been left behind unless a disaster of some sort has affected a culturally important site. This becomes clearer during the 20th century with the rebuilding of the San Marco campanile after its collapse or the Teatro La Fenice after a fire.

While some of the Basilica di San Marcos' long building history was addressed above, the church has a lengthy restoration history as well. One of the earliest restorations was meant to reinforce the large dome structure. The heavy dome structure turned out to be a bad idea on the weak soil. In fact, the whole square of San Marco went from being one of the highest points of

105.Ibid., 49.

106. Ibid.

107. Myriam Pillutti Namer, "Safeguarding Venice: Giacomo Boni and John Ruskin." Change Over Time 6, no. 1 (2016): 26.

108. Pertot, 53.

the city (Howard 48) to one of the lowest points today due to the large number of large buildings placed there. By the time Jacopo Sansovino in 1527 oversaw the square's buildings, he took on a process of reinforcing the domes through buttressing.[109] Dome architecture was common during the Renaissance, and these innovative techniques were later used to reinforce the iconic domes of San Marco to keep them from sinking. In 1721, Bernardino Zendrini had to surround the dome with an iron loop and redirected the weight of the domes to the walls rather than the vaulting to try and protect the ceilings.[110]

San Marco was under constant restoration through the years, but prior to the 20th century, one of the largest and most infamous projects was done under the supervision of Giovanni Battista Meduna in the 1870's. The project was controversial because he took down sculptural and marble pieces from the outside of the building that he deemed too worn, and reversed additions to the building that he believed detracted from the original intentions of the architect. Some of these stone pieces ended up being sold and placed outside of the public eye, which was critiqued by people such as John Ruskin.[111] The replacement of these pieces was seen as destroying the historical authority of the building, but the restoration did have some admirable aspects. The reinforcement of the exterior walls through placement of new stones and foundations is still keeping pieces of the building from collapsing. The full project was not completed, and the areas where the walls were not reinforced have been causing problems ever since.[112] Meduna's aesthetic approach to the restoration was extremely questionable, but his structural work was beneficial to the church.

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109. Howard, 19.

110. Horatio F. Brown, "The Present Condition of St. Mark's, Venice: L.—Structural Restorations." *The Architectural Review (Archive:1896-2005)* 17, no. 100 (Mar 01, 1905): 101.

111. Namer, 28.

112. Brown, 103.

Both Meduna's restoration of St.Mark's and the restoration of Fondaco de Turchi highlight the warring views on preservation during the second half of the 19th century. Some prominent projects sought to restore the buildings to the architect's original intention.[113] This often meant getting rid of more modern alterations to the buildings, sacrificing original materials to do so. The opposition held the belief that historical changes over time should be preserved. Their opinions came closer to preservation or conservation rather than restoration, focusing on what was necessary for the longevity of the building rather than having cohesive aesthetics for the building or city.[114] Some of the support for restoration came from a revival of Gothic popularity in Venice in the 19th century. This pushed restorationists to seek the Gothic roots of buildings like the Doge's Palace or the Basilica di San Marco and heighten their importance above all else. This also guided what buildings were restored. Due to cost, it was common for landlords to push for demolishing buildings rather than restoring them. Some buildings met this fate, especially ones that were deemed artistically less important such as those from the Baroque.[115]

All of this is not to say that all projects were binary, taking a path of restoration or preservation. Repairing the façade of the Doge's palace included both. The project kept windows from a later addition with the restorationist Forcellini admitting that "we cannot preserve only the beautiful in monuments." At the same time, he closed one window, which was a later addition to the façade and took down walls between arches that had been put in place in 1577.[116] All of this displays the slow shift in the approach to restoration at the turn of the century. The

113.Pertot, 66.

114.Ibid.

115.Ibid., 77.

116.Ibid., 68.

urge for restoration subsided but still lurked under the surface.

There are a handful of fateful moments that changed the progression of preservation in Venice. One of them came during the morning of July 14, 1902. The San Marco campanile collapsed, filling the square with rubble, and destroying Sansovino's Loggetta (Figure 23). After investigation, it was found that the problem had not been with the wood pile foundation but was due to changes made to one of the building's original walls. The alterations had exacerbated cracking in the wall.[117] The building was being monitored for this, and the problem had gotten steadily worse until the building collapsed. Even though the situation had been monitored, the collapse shocked most Venetians. It started a string of building evaluations on the most important sites in Venice. If the campanile collapsed, what other buildings were in danger? It also brought up the heated debate over rebuilding and restoration all over again. Some were in favor of rebuilding the tower as close to the original as possible while others wanted to replace it with a more modern approach. Another group fought to leave the square without a tower all together rather than rebuilding what would essentially be a copy.[118] In the end, the campanile was rebuilt with slightly different dimensions to be more stable and house concrete reinforcements within the central stairs (Figure 24). Whatever could be saved from the Loggetta below was used to rebuild it as well.[119]

The public fear for Venice's buildings brought on by the collapse of the campanile launched multiple projects in Venice leading up to the First World War. They generally focused on repair and stabilization of buildings and worked with a fervor previously unseen on this

117.Ibid., 97.

118.Ibid., 98.

119.Ibid., 99.

scale.[120] During this period, the demolition of "artistically unimportant" buildings or additions and upper stories continued. Many of the reinforcements included using concrete or iron stays and rings.[121] The use of these materials is less common in Italy today due to flexibility issues. As discussed before, adding rigid materials to historic ones can lead to more harm than good by preventing the original materials from shifting. Many buildings in Italy have been damaged due to concrete reinforcement that prevents the building's natural motion during events such as earthquakes. The concern with iron ties and rings is similar but with the added concern of humidity. The rusting of these pieces in Venice's climate risks staining traditional materials.

Almost any preservation project comes with controversy and these did as well. Many questioned the materials used and others accused the workers of improper cleaning techniques. The *Ufficio Regionale* was accused of embarking on too many projects to meaningfully complete any of them.[122] Supporters of these projects highlighted the fact that they left behind the idea of "remaking" buildings and instead focused on saving them. While demolition of any addition seems tragic, many of them were justified by the stress they put on the original building. Either way, this interest in preserving Venice was short lived. As WWI started, these projects were abandoned and the call for modernization of Venice was revived by "futurist iconoclasts."[123] Luckily, Venice's monuments were fairly unharmed by fighting in both World Wars. In many parts of Italy, the focus of restoration between the wars and after had to be shifted to rebuilding landmarks that had been destroyed. This was less prevalent in Venice.[124] There were only a small

120.Ibid., 110.

121.Ibid., 104-105.

122.Ibid., 111.

123.Ibid.

124.Ibid., 132.

number of individual projects spanning this time and many of them were a reversal of Meduna's Gothic focus.[125] Instead, the biggest project in the area was the introduction of the port and industrial area of Marghera and Mestre.

Fixing buildings was not the only focus in the area through the 19th and 20th centuries. Human input in the lagoon did not end with the Murrazi in the 1700s. By the 1920's new land reclamation projects in the lagoon's surrounding area began.[126] The reclamation project was meant to expand land for the Marghera industrial area. The manmade canal and reinforcement of the shore made degradation in the lagoon worse by changing the flow of the tides. This project was completed by the 1960's, but due to its adverse effects on the depth of the canals and the change to water exchange in the city, some of the pieces of this project were reversed as early as 1986.[127] The creation of an industrial area in the vicinity of the historical center of Venice was meant to breathe new life into the Venetian community.[128] Not only did this process worsen the state of the lagoon and throw off its delicate ecosystem, it also did not revive the community within the historical center. The growth of Marghera led to an increase in people moving out of Venice to the surrounding area, weakening the amount of money in the city and decreasing the interest in the preservation of its buildings.[129] The project was meant to revive Venice and its surrounding areas, but despite their good intentions, human influence can make things worse.

With the growth of the industrial area, there was a need for water to cool machinery in the newly founded coastal factories and to supply those living in the area. The solution was to

125.Ibid., 122.

126.Bondesan, 188

127.Bondesan, 188

128.Pertot 112.

129.Pertot, 132.

pull water from aquifers deep underground. This process had unexpected consequences for the historical center of Venice. It led to land subsidence, causing Venice to sink. The city sank 11 centimeters between 1952 and 1969.[130] Once the problem was identified, Marghera changed its water source. By the 1970's a new aqueduct was built to bring water to the area rather than pulling it from underneath Venice. This stopped the sinking that had been rapidly occurring and even lifted Venice a few centimeters as the aquafer refilled, but the damage had already been done. In the floods of 1966, it became clear that this shift of a few centimeters had large effects during high tide events. Subsidence during this time also inspired modern ideas for the preservation.

The poverty and neglect in Venice did not start with the building of Marghera but was exacerbated by it. While other major cities in Italy were industrializing, they were able to build large, cheap, modern housing. This was not an option in Venice. The draw of modern amenities led to many people that were already commuting from Venice to move out of the city all together.[131] In the 1920's an increasing number of people in Venice were living in dilapidated and unsanitary housing.[132] Updating historic buildings in the city to modern standards was too difficult, and even into the 1980s, some homes' plumbing was still washed into the canals and carried out by the tides twice a day.[133] The lack of interest in upkeep led to a building abundance but a lack of livable housing.[134] Some of the routine pieces of upkeep in Venice were falling by the wayside. Because of the human interference in the lagoon's ecosystems, the movement of the

130.Gambolati and Teatini, 41.

131.Lauritzen, Lewinski, and Magnus, 60.

132.Perot, 118.

133.Lauritzen, Lewinski, and Magnus, 63.

134.Pertot, 118.

tides was not able to wash all the debris out of the canals. This meant that the canals periodically needed to be closed off, drained, and cleaned by a process referred to as dredging. This project was put off through the early 20th century but was taken up again in the 1980's. The cleaning process is important for the hygiene of the city, but it also gives building owners the opportunity to inspect the foundations of their properties.[135] An extended period without this process could be problematic for the stability of the buildings.

Aside from the movement of people, there was also a political aspect to the money flow out of Venice leading to its early 20th century neglect. The industrial area of Maghera was included into the same political unit as the historical center of Venice.[136] This meant that tax money was funneled out of Venice and into the surrounding areas. It became difficult to justify the money for the upkeep of buildings in Venice when fewer taxpayers were residing there.[137] The solution to the money problems only came after the devastating events of November 4, 1966. A high-water day, referred to as an acqua alta, caused the water to rise in the city, and a combination of weather and tide events kept the water from moving back out within hours as it usually would (Figure 23). While no major artworks were damaged, preservationists were afraid of the long-term effects of the flood.[138] Walls can soak up water by a process referred to as rising damp. This can cause structural problems long after the water has receded. The following year, another flood made many fear that acqua alta events were becoming more frequent and treacherous.[139]

135.Lauritzen, Lewinski, and Magnus, 70.

136.Ibid., 56.

137.Ibid., 68.

138.Ibid., 30.

139.Ibid., 29.

The floods brought international attention to Venice. The world was talking about how Venice needed saving. Scientists began making predictions about sea level rise and the effects of pollution. While Venice needed the attention, many of the claims were over exaggerated. The acqua alta was getting more common but not at the rate claimed by scientists.[140] The horrifying pictures of sculptures eaten away by pollution were the minority of stone features. The most common Istrian stone can be blackened on the surface but retain structural integrity beneath the crust. The problem was with Carrara or Greek marbles that could provide a more intricate sculpture but were unable to withstand the pollution, salt, and humidity.[141] The reports also brought extreme concern for the air quality in Venice. Much of the pollution was blamed on Maghera, but it was later found that the distance and wind patterns made it impossible for the industrial area too have much of an effect on Venice. Instead, it was the outdating heating systems in historical buildings.[142] Some of the pollution problems were solved as the heating systems in Venice were upgraded, but many sources still blame the sulfur dioxide from the factories in Marghera for the deterioration of stone. If Marghera was not blamed for directly harming sculpture, then it was said to create a type of ceiling that prevented Venice's pollution from escaping the historical center.[143]

The preservation projects that would take place in the twenty years after the flood of 1966 would be the center of books and exhibitions. They worked on buildings but also focused on stonework, sculptures, and paintings. The focus of the first decade of architecture projects was mostly on churches. With a lack of public funding, even some of the most lavish and famous

140.Ibid., 30.

141.Ibid., 108.

142.Ibid., 105.

143.Pertot, 116.

Venetian churches were restored with the funds of international entities and private donors. Six different groups gave funding for the restoration of the church of the Frari.[144] The French Comité pour la Sauvegarde funded the restoration of the façade of the Santa Maria della Salute, San Stae's update was funded by the Swiss government, and a private donor gave the money for the church Il Redentore.

The church of Santa Maria dei Miracoli was restored by a German team during this time (Figure 26). The late Renaissance building has marble slabs decorating both the interior and exterior of the church. While ineffective for the weight of the building, the restoration team found that the marble had been encasing terribly degraded bricks. Their consistency was described as "powdered sugar" due to the salt and water from the canal that runs directly next to the church.[145] With consolidation techniques at the time, there was no way to help the degrading walls without making the building substantial heavier. This finding supports modern research that indicates that a building's proximity to water plays a large factor in degradation. One side of this church is on the bank of the canal, leading to rising damp eating away at the interior brick.

The problem of consolidation was a common topic of debate during this time, just as it is now. Consolidants are injected into the stone to strengthen the stone's exterior and protect it from degrading. During the conservation problems of the 1970's, using consolidants was controversial. Silicon resins for preservation were relatively new, and conservationists had every right to be skeptical of them. Their long-term effect on stone had not been thoroughly studied. They could change the color of the stone and cause interior degradation. By only injecting consolidants to the first few centimeters, the new exterior strength could increase the rate at

144.Lauritzen, Lewinski, and Magnus, 95.

145.Ibid., 102.

which the inside degrades.[146] When any material is changed or new material is introduced to a historical object, its flexibility is important. If the new material expands and contracts at different rates than the original stone, it will cause further degradation. This can happen with consolidants as well as structural reinforcements, which means that any alteration or addition to a historical monument needs to be thoroughly evaluated before it can be used on a structure. The caution in the Venetian's conservation techniques continued into cleaning methods. They were wary of chemical cleaning techniques and sought a non-abrasive method to ensure that Venice's stonework could return to its previous glory without sacrificing its strength.[147]

These debates over cleaning and consolidation are perfectly illustrated with the cleaning of the Loggetta in Piazza San Marco (Figure 16). This project also highlighted the shift in the mid-1970's to the restoration of secular buildings rather than just churches.[148] Cutting edge technology was used on the Logetta for both cleaning and consolidation with different levels of success. A new method was used for cleaning, which came from British researchers. The technique included a new tool, which had the appearance of a drill but rather used glass particles moving at a high pressure to blast dirt away from the surface.[149] This method, which is similar to modern sandblasting, worked well on the Loggetta and revealed its colorful marble surface under years of grime. The stone was then consolidated using a silicon resin. This unfortunately left a grey film over the surface. Modern conservationists would likely balk at the use of silicon resins because they are not reversable. The reversable nature of conservation techniques has become more and more important through the history of preservation and is a large part of why silicon

146.Ibid., 111.

147.Ibid., 111.

148.Ibid., 127.

149.Ibid., 110.

resins are banned by many preservationist groups today.[150]

While the Loggetta cleaning did not go completely to plan, the project brought more focus to the restoration of stone in the city. A new research lab was established and donations to the Venice in Peril Fund increased.[151] It also inspired the cleaning and restoration of other monuments on the square. Porta della Carta (Figure 27), the Gothic entrance to the Doge's palace was cleaned and consolidated with much greater success than the Loggetta. The central doors to the church and other areas of the palace were also restored, adding another chapter to their long saga of restorations.[152] This conservation effort was revisited in 2005 when a team reevaluated Porta della Carta. It was found that the consolidant had almost completely pulled itself away from the stone, making it ineffective. Evidence of waterproofing from the 1970's project was found in covered areas but had already worn away on most of the sculptures. This left the arch vulnerable to weathering once again.[153]

The work on the Logetta also continued the conversation about the effects of pollution on statues in the city. With this discussion came one of the most controversial preservation arguments in Venice from the last century. In 1974, The Golden Horses of San Marco (Figure 28) were removed from the loggia of the church to be fully examined.[154] While not explicitly architecture and also not stone, the horses do not fall under the concerns of this survey, but they are an important lesson for any conservationist working in Venice. The Golden Horses were

150. Ibid., 111.

151. Ibid., 111.

152. Ibid., 112.

153. Monica Favaro, et al., "The Four Virtues of the Porta Della Carta, Ducal Palace, Venice: Assessment of the State of Preservation and Re-Evaluation of the 1979 Restoration." Studies in Conservation 50, no. 2 (2005): 115.

154. Laurizen, 118.

brought to Venice as spoils of war during the crusades and were grandly placed on top of the cathedral.[155] Their origin is a mystery and even their material was unknown until the tests run in the 1970's, which proved that they are mostly copper rather than bronze. The horses were removed from the façade and went through numerous evaluations. It was decided that they would remain inside, and replicas would be placed on the exterior of the church. This angered many Venetians who believed that the horses were a major piece of Venetian pride and a symbol for the city. Many saw no reason to move the horses when they had already survived hundreds of years in the same environment. [156]

Despite the bickering, the decision was made to keep the four horses on display in a building attached to the church. The display has since been critiqued for being too cramped and having poor ventilation, but this is where the statues remain.[157] Equally controversial was the decision to allow one of the statues to be toured around the world in blockbuster shows. Venetian's took great offense to foreign museums making significant amounts of money off the sculpture while it toured around the world, but in the eyes of critics, Venice gained no benefit from these shows.[158] This story, while not about stone, is a reminder that conservation is both about the protection of objects and buildings as well as their importance to their own culture. An open conversation between preservationists and locals is important to ensure the greatest success of a project with minimal backlash. In the end, the horses remain inside. This decision probably became more popular with time as other major monuments moved their sculptures in doors to protect them from pollution. The doors to the baptistry in Florence have been cleaned and moved

155.Fenlon, 25.

156.Lauritzen, Lewinski, and Magnus, 121.

157.Ibid.

158.Ibid., 123.

inside, the Equestrian Statue of Marcus Aurelius now sits indoors with a replica on the Capitoline Hill, and the sculptures of the Sienna Cathedral have been moved into an adjoining museum. It is now in fashion to protect pieces of cultural significance by moving them indoors. If only it was this simple with architecture.

While the flood harmed Venice, it also shifted national attention to the decaying site. Projects with foreign funding soon took over the city. Many of these were coordinated through the United Nations Educational, Scientific and Cultural Organization (UNESCO) who would hire locals to coordinate projects, working in tandem with experts from around the world.[159] Before the floods, there were some projects within the city, but most of them were the focused on basic structural work. Many buildings were plagued with leaking roofs and flooring that that would need to be replaced because of constantly shifting foundations. Walls were unsound due to rising damp, and constant mitigation was necessary for buildings to remain livable. Even with all the challenges to the common buildings in Venice, most of the money for restoration projects went to large monuments.[160] The restoration of private property was too complicated, but after 1966 there was shift towards trying to save Venice from flooding or sinking. This was a step in the right direction to bridge the gap between the Venice of the tourists and Venice of the Venetians.

The surge of projects between 1966 and 1986 also marked an important change in the Italian government's stance on Venetian conservation. Going into this period, the government took the stance that Venice had no greater claim to funding or help than any other culturally significant town or city in Italy.[161] The international focus that Venice gained after the flood

159.Ibid., 34.

160.Ibid., 33.

161.Ibid., 148.

pressured the Italian government to admit the unique circumstances and level of decay threatening Venice. By 1973 the Special Law for Venice was put in place in Italy to ensure that the lagoon was protected. Even the tax code started to shift to help fund projects. Initially, private donations to restoration efforts were discouraged for Italian citizens by the tax code,[162] but by 1983, these policies were loosened to make private donations more feasible, helping the funding issues in the city.[163]

The history of restoration and preservation on any site is important for understanding the work that will need to be completed moving forward. It is particularly important in Venice because the lessons learned through the 19th and 20th centuries from successful and unsuccessful attempts at saving Venice are inspiring projects today. New preservation efforts for monuments must build off the science of the previous restorations. Some of the newest solutions to city flooding and sea level rise take their inspiration from the city's history. The new moveable sea gates take inspiration from their predecessor the Murrazi sea wall. New ideas about raising Venice from below have grown out of the city sinking due to water extraction, and the risks of tampering with the lagoon's equilibrium has caused immense caution and thorough research before any new changes can be made. Understanding the complexities of Venice's decay, including the scientific, political, social, and financial causes, will be the basis for fixing the problems that still afflict the city. Being adaptable was part of the Venetian identity. Without this, the city never would have survived as long as it has. Taking lessons from Venice's history can be beneficial to preservationists. Looking toward the inception of Venice's problems can provide solutions for reviving the city.

162.Ibid., 104.

163.Ibid., 142.

Part 4: Venice in the 21st Century

The current state of conservation in Venice is complex. Scientifically, it is a difficult issue from the small scale of materials up to the large scale of the lagoon ecosystem. Venice's conservation challenges also stem from deep rooted issues with the demographics and politics of Venice. These have been steadily shifting through the past century with the number of resident Venetians decreasing while the number of tourists visiting each year increases. A thorough survey of the conservation efforts in Venice must address the major problems facing the city on the small and large scale while also making suggestions for moving forward with preservation projects. Venice must work to become a sustainable city once again, and this requires an acknowledgement of the residents and not just tourists. The city must balance its relationship with the environment, which becomes increasingly difficult as the water level constantly changes due to climate change. Preservationists, citizens, and the municipal government must create a sustainable plan for tourism and climate change that will hopefully foster the renewal of genuine culture in the city center.

The history of preservation in the lagoon makes it clear that building materials are under constant attack from the harsh environment. On a small-scale, this means that preservation must focus on understanding the state of the main materials in Venice and exploring innovative techniques for their conservation. The most important materials in question are wood, brick, and stone. While the wood foundations of Venice would seem like a concern to the average reader, they cause less problems than other materials. Larch and oak were the most popular woods used for the foundations because they have some natural water-resistant properties, but new studies that analyzed wood piles from around the city have found further variation in the types of woods

used such as Alder, Scots Pine, and Norway Spruce.[164] The same study found that the wood was in an advanced state of degradation and had lost large percentages of tensile strength. Despite this, the decrease in mechanical strength does not seem to correlate to the stability of the building.[165]

The largest problems that arise with wood in preservation happen when a piece of wood gets wet and then is exposed to oxygen again; this can lead to organism growth, rot, and deterioration. In the case of the wood piles of Venice's foundations, they are inundated with moisture constantly. This factor mixed with the mineral rich sand has left the wood in a petrified state rather than a constantly decaying one.[166] As discussed with the section on building techniques, the wood piles in Venice are often not weight bearing, so their mechanical strength is less important. If the piles take up space to compact the ground around them, they can continue to do their job. This was realized with the collapse of the San Marco campanile. This was one of the first times that the state of Venice's foundations was called into question and one of the few times in the early 20th century that they could be evaluated. The team found that the campanile foundations needed little reinforcement, and they were able to build on top of them when the tower was replaced.[167] All of this implies that the wood pile foundations should be continually monitored to ensure building stability going forward, but they do not need to be a top priority for materials conservation in the city.

Wood was used in other structural forms in Venice. There is little research on the state of conservation for wood timbers, but Venetians chose to build with wood types that could handle

164. Nicola Macchioni, Benedetto, and Capretti, Pizzo Benedetto, and Chiara Capretti, "An Investigation into Preservation of Wood from Venice Foundations." *Construction & Building Materials* 111, (2016): 654.

165. Macchioni, Benedetto, and Capretti, 660.

166. Foraboschi 174.

167. Foraboschi 174.

humidity. This would not have prevented degradation entirely but could have slowed it. When structural wood pieces needed to be replaced, they would be. This was common over time and was not considered as sacrilegious as replacing exterior stones on a building. Structural pieces are usually out of sight and therefore have less artistic importance. The International Council on Monuments and Sites (ICOMOS) has guidelines for the conservation of wooden built historical structures. They prioritize preserving the structure with as much historical accuracy as possible and conserving original materials but also understand the need for replacement to keep a building structurally sound. When replacing timber pieces, historical methods and woods should be used if possible. New materials should be identifiable from original ones but not aesthetically distracting.[168] In Venice and other historical cities, wood conservation must be approached differently. Wood can be vulnerable to degradation, but it is also vital to the structure of buildings.

Another material important to the architectural conservation of the city is stone. For Venice, this mostly includes Istrian stone, but the preservation of other types of marbles should also be considered. Much like wood, many problems with stone arise when it is exposed to moisture and then allowed to dry. The lagoon is salt water, so once water enters the pores of the stone and dries, it leaves behind salts. These can be extremely harmful for masonry because the crystallization takes up space and puts pressure on the interior walls of the stone's pores. This can cause mechanical damage and can lead to cracks and fractures as well as the exterior layer of stone crumbling.[169]

When stone begins to deteriorate, it must be consolidated before any further cleaning can

168. ICOMOS, "Principle for the Conservation of Wooden Built Heritage," 2017, 3-4.

169. Serena Andreotti, et al., "New Polymer-Based Treatments for the Prevention of Damage by Salt Crystallization in Stone." *Materials and Structures* 52, no. 1 (2019): 1.

be done to prevent further loss of original materials. As talked about before, the 1970's saw the use of silicate consolidants. These have proven to be the wrong choice for carbonate-based stones. While the quality of silicate consolidants has increased since they altered the color of the Loggetta, they are still best suited for silicate-based stones. When used on limestones, they are less effective and can change the size of pores or the color of the stone.[170] Instead, new research has turned to phosphate based consolidants. Aqueous diammonium hydrogen phosphate (DAP) is now being studied for its use on limestone and marble. It can be brushed on and has proven to be effective in preventing pulverization and the effects of salt and ice. New methods are finding that adding small amounts of calcium chloride and alcohol to DAP makes it more effective so less DAP needs to be used.[171] While studies are seeing promising results for DAP, it would be important to continue research on Istrian stone. Istrian stone is similar chemically to marble and common limestones, which have been tested with DAP, but it has different pore sizes. It would be important to explore any effects of DAP on Istrian stone specifically before using it heavily on Venetian architecture or sculpture.

New processes for treating and removing salt from historical stones are emerging constantly. There are chemicals used as crystallization inhibitors that work to control the crystallization of salts within the pores. There are also emerging techniques to use polymers to allow salts to exist in the pores of stone without the detrimental effects of the repulsive properties between the stone and salts. This repulsive force is one way that salts cause breaking in the interior of stone.[172] There are many benefits to this new method. It does not change the rate of

170. George W. Scherer et al., "Phosphate Consolidants for Carbonate Stones." *APT Bulletin* (1986) 49, no. 2-3 (2018): 62.

171. Scherer et. al., 65.

172. Andreotti et. al., 2.

water evaporation or the water transport properties of the stone and does not block the pores. This is important because any preservation technique must avoid trapping water or salts within the stone permanently, which would only accentuate damage.[173] These polymers can also be tailored to be water based, environmentally friendly, and biodegradable. These factors mean that the treatment can be better for the environment and reversable, which are two important factors for modern preservation. The process also increases its effectiveness when used in tandem with DAP, making it useful in combination with consolidation.[174]

While these preventative treatments for avoiding salt saturation in stones can be useful, salts must also be removed from stones before some of these treatments can be carried out. This can be done through aqueous extraction and the use of poultices.[175] A poultice is a thick paste that can be applied to walls. For desalination purposes, clay-based poultices have been used to draw salt out of pores. Clay poultices are now being shown to be most effective if left on for an extended amount of time or used repeatedly, but they have their limitations. Weaker stones that are damaged must be handled with care, which often means that the poultices must be held together with gentler materials such as cellulous pulp.[176] Poultices are also commonly used for cleaning purposes because a combination of products can be mixed into the base material. These can include physical and chemical cleaning ingredients. Recently, new cleaning tactics that involve gelatinous materials has proved useful for cleaning and desalination.[177] Cleaning stones

173. Ibid., 3.

174. Ibid., 26.

175. J.M.P.Q. Delgado, et. al., "Salt Damage and Rising Damp Treatment in Building Structures." *Advances in Materials Science and Engineering*, (2016): 6.

176. Delgado et. al., 7-9.

177. Kory Berret, Naude, and Wolbers, Virginia Naude, and Richard Wolbers, "A New Method for Cleaning Marble," *Objects Specialty Group Postprints* 14 (2007): 197.

also includes the mitigation of biological attack. Previously, conservationists have used harsh biocides, but these have been heavily critiqued for being harmful to people and the environment. This would be a particular issue for Venice where so many monuments are in close contact with the lagoon. Emerging techniques using natural biocides such as essential oils have become a popular area of research in conservation and could be effective in Venice.[178]

Brick is the third material in the trifecta of historical building materials in Venice. It can also arguably be the most problematic material for conservation. There seems to be a lack of research that is specifically devoted to brick. Some have suggested that this was the product of previous conservationists studying "more noble" materials rather than everyday brick.[179] Historical preservation efforts seem to support this with many projects being unable to consolidate crumbling brick due to a lack of effective consolidants. It seems that because Venice's bricks have been out of sight, they were not considered by early preservationist. The deterioration of brick will also only get worse as the sea level rises. When originally planned, Venetian historic buildings were meant to protect the bricks from water, but now that the sea level is higher and the city has sunk, brick that was not supposed to be exposed to moisture is now in contact with water.[180] Both stone and brick have now been exposed to the water of the lagoon and increased rising damp.

Rising damp occurs when moisture in the ground is carried up the wall and into building materials through capillary action. This is a problem from many materials, but in Venice it

178. Franco Palla, et al., "Essential Oils as Natural Biocides in Conservation of Cultural Heritage." *Molecules (Basel, Switzerland)* 25 (2020), 197.

179. Nick Schiavon, Mazzocchin, and Baudo, Gian Antonio Mazzocchin, and Fulvio Baudo, 768. "Chemical and Mineralogical Characterization of Weathered Historical Bricks from the Venice Lagoonal Environment." *Environmental Geology (Berlin)* 56, no. 3 (2008): 768.

180. Dario Camuffo, Chiara Bertolin, and Patrizia Schenal, "Climate Change, Sea Level Rise, and Impact on Monuments in Venice." *Science, Technology, and Cultural Heritage* (2014): 13.

affects both brick and stone. Water is pulled up into the wall until it reaches an equilibrium point below which the wall stays damp. Above this level is an area where water evaporates, leaving this section with a large amount of salt build up.[181] One solution for decreasing the effects of rising damp is to insert a material into the wall that does not transport water. This is not a common solution for historical buildings because it is too invasive to the original structure.[182] Rising damp in Venice has proven to be a larger issue for some buildings than others. This has little to do with a building's location within different areas in the city but rather the building's proximity to the canal. Factors such as the height of equilibrium for rising damp are often similar for buildings that are the same distance from a water source.[183]

Solutions for rising damp in historical buildings can be difficult. In many cases, the solution is to solve the problem at its source, eliminating the water supply and moisture. In Venice, this is obviously impossible. Other mitigation efforts include desalination processes that use the same tactics as the ones suggested for stone, but without methods to decrease rising damp, the process of desalination would have to be repeated periodically. There are a couple of direct preventions for rising damp that are more suitable for historic buildings. There are structural options to decrease rising damp such as include maintaining embankments on the edges of the lagoon and canals to decrease the contact of open water.[184] Foundations have been raised to help with rising damp due to flooding, and the use of pumps can be effective quickly reverse the effects of acqua alta events by removing flood water as quickly as possible.[185]

181. Laura Falchi et al., "Rising Damp in Historical Buildings: A Venetian Perspective." *Building and Environment* 131, (2018): 118.

182. Delgado et. al. 4.

183. Falchi et. al. 131.

184. Delgado et al. 4

185. Falchi et al 126

For prevention when walls cannot be separated from a water source, there is new machinery that could be beneficial in Venice. These instruments circulate air with controlled humidity up from the base of the wall to promote drying. This would decrease the amount of moisture creeping up the walls.[186] Testing of these systems is still relatively new, so they would need to be thoroughly tested with saltwater rising damp before they could be implemented in Venice. Conservation is very site specific. Each project must evaluate materials to find the techniques that will be least invasive or harmful and most effective. All of the new research presented here would need to be thoroughly tested on materials in Venice before it could be widely used.

After the rapid increase in preservation projects from 1966 to 1986, there was a commitment to more widespread prevention and preservation efforts. The project that dominated the end of the 20th century and the start of the 21st was the Experimental Electromechanical Module (MoSE), which is a moveable sea gate. MoSE emphasized preserving the city rather than just its most famous monuments. By the 1980's it was clear that large scale action would need to be taken to protect the lagoon from flooding.[187] The challenge would be finding a solution that fit the long list of specifications that the lagoon required. Any solution would have to protect the city from high water days but could not cut off the lagoon from the sea. Cutting the lagoon off entirely would keep the water from cycling in and out of the area, ruining the natural forces that sweep pollution out of the lagoon. It would cut off function to the ports in the area, which would be devastating to the economy.[188] As was seen with the modifications to the lagoon in the early 20th century, manmade changes can cause more harm than help. Any new project would need to

186. Delgado et al. 8

187. Gambolati and Teatini, 48.

188. Passino and Todisco, 323.

ensure that it would not worsen the degradation of the bottom of the lagoon or interfere with the surrounding ecosystem more than necessary. A 1984 evaluation put forward a plan for a system of moveable gates which would be able to cut off the lagoon at high water levels but keep it open to the sea most of the time.[189] This theory formed the basis for MoSE.

The MoSE project was started in the late 1980's but construction on the gates did not begin until 2001. There were multiple groups who attempted to evaluate and comment on the environmental impact of the project, and it was finally agreed that there would be more efforts to restore the lagoon before the gates were put in place. Many of these projects were left unfinished or never started, and instead, money and effort went to MoSE.[190] Pieces of the gate have already been used to prevent flooding in 2020. The gate is now functional in a trial period through the rest of 2021, meaning that the national government decides when it is raised. There has already been one instance where the government decided not to raise the barriers based on inaccurate sea level predictions, causing flooding through the city.[191] The sets of gates cut off all three inlets to the lagoon when the sea level in the Adriatic hits a certain height. The large gates are imbedded flat into the bottom of the lagoon and can be raised up at an angle from the floor to block off the water flow (Figure 29 & 30). The plan for the gates was optimized for use as well as maintenance,[192] but the project has already been critiqued for not carrying out the difficult task of upkeep.

The gates will hopefully protect the lagoon for the next century, but the project has been

189. Passino and Todisco, 328.

190. Emanuela Molinaroli, Stefano Guerzoni, and Daniel Suman, "Do the Adaptations of Venice and Miami to Sea Level Rise Offer Lessons for Other Vulnerable Coastal Cities?" *Environmental Management (New York)* 64, no. 4 (2019): 406.

191. Julia Buckley, "Venice Flood Causes 'Serious' Damage Two Months After Flood Barriers were Introduced." *CNN Wire Service*, Dec 09, 2020.

192. Gambolati and Teatini, 51.

riddled with critiques every step of the way. With a price tag over six billion euros, the MoSE project has run into various issues and taken much longer than expected. While the project claims that it will protect the lagoon for decades to come, some of the current models show that the days per year that the Adriatic will rise above the level needed to employ MoSE will increase substantially over the coming decades.[193] This could cause MoSE to be used more as a permanent sea wall, which would make the water in the lagoon stagnant, destroying the quality of living in Venice and the surrounding area.[194] There are also various concerns about the preservation of wildlife, but any complaints that have been brought up formally have been dismissed and the project continued. People are still arguing about MoSE and its effectiveness, but many people invested in the future of Venice see it as security. If Venice is not being constantly bombarded by flooding or the constant fear of having projects ruined by an extreme acqua alta situation, it could give scientists the room to brainstorm and implement new ideas before MoSE becomes out of date.[195]

One of the major comments in support of MoSE claims that even if it does not last as long as it was originally promised, getting Venice out of the large risk for flooding will open up the possibilities for focus to be shifted to new solutions.[196] Notably, MoSE will protect Venice from flooding events for now but will decrease in its effectiveness as the sea level rises. It does not protect Venice's structures from the slowly rising seas, which will make issues like rising damp and salt crystallization worse. Therefore, expanding the preservation research presented above to be applicable in Venice is vital. While MoSE's price tag would be difficult to ever

193. Choco Harlan and Pitrelli and Stefano Pitrelli. "How Venice's Plan to Protect itself from Flooding Became a Disaster in itself." The Washington Post, Nov 22, 2019.

194. Gambolati and Teatini, 55.

195. Harlan and Pitrelli.

196. Harlan and Pitrelli.

make up, it will hopefully save Venice both time and money going forward that can be focused on new projects. Each major flood in Venice can cause millions of dollars' worth of damage and always presents the risk of all recent conservation efforts being wiped out in the span of twenty-four hours.

There are few solutions that can combat sea level rise for the whole of the historical center of Venice. It often feels like Venice is at the mercy of the world, depending on bigger entities like the EU, USA, or China to put a stop to climate change. Venice seems to only have defensive methods and no active way to face the problem head on. The one major model put forward to provide Venice a self-contained way to combat sea level rise on a citywide scale takes its inspiration from a previous failure in the lagoon. The proposal to anthropogenically uplift Venice is based on the subsidence that occurred through the middle of the 20th century. The thought would be to raise the city by inserting salt water into aquifers deep underground.[197] The project claims that it would be able to raise the city almost 30 cm over 10 years.[198] This would be enough to decrease the number of flood days, outrun the pace of sea level rise, and even keep MoSE useable for a longer period of time.

This project is obviously met with suspicion by many people. It feels a little bit too much like science fiction to be feasible. While the models are promising, there is still a large concern that uneven lifting would occur across the city.[199] This presents a clear danger to the historical monuments themselves, and while the project can be modeled, it may be difficult to understand the true implications until it is under way. The supporters boast a lower cost than the MoSE

197. Gambolati and Teatini, 57.

198. Gambolati and Teatini, 65.

199. Alison Abbot, "Plans resurrected to Raise Venice Above the Encroaching Sea," *Nature* 427, 184 (2004).

project as one of its major benefits.[200] Through the MoSE project, many felt that Venice had put all of their eggs in one basket. They funneled money and resources from other lagoon updating projects to get MoSE done, and it still took a decade longer than expected.[201] There may be pushback about entering into another long term, and possibly costly, project that much of the public may not understand.

Outside of these large-scale projects, there have also been efforts to return the lagoon to a more natural state. These have included reinforcing the barrier islands of the lagoon and coastal dunes that had been washed away by high tides. It also included recreating salt marshes, riverine forests, and wet meadows.[202] These benefit the ecosystem of the lagoon that has been increasingly changed by human presence. The idea is to return the lagoon to a previous state where the tidal flows were less harsh. Many of these plans were supposed to be started or completed before MoSE was put in place, but they had been put off.[203] However, they are now being carried out and will continue forward to create a healthy lagoon ecosystem. They have been cited by UNESCO as having a positive effect on the lagoon and should continue to help positively reshape the lagoon environment.[204]

An important part of keeping the lagoon ecosystem healthy and in balance is to decrease the effects of erosion on the bottom of the lagoon. This problem increased through the first half of the 20th century when large human modifications to the surrounding land took place. One of the largest threats to the lagoon ecosystem right now is cruise ships. While the largest ships have

200. Gambolati and Teatini, 75.

201. Molinaroli et. al., 410.

202. UNESCO, ICOMOS, and RAMSAR, "Report of the Joint UNESCO/ICOMOS/ RAMSAR Advisory Mission to the World Heritage Preperty 'Venice and its Lagoon,'" (2020), 51.

203. Molinaroli et al 406

204. UNESCO, ICOMOS, and RAMSAR, 51.

recently been banned from the lagoon, waves from smaller cruise ships may still be doing damage to foundations of the city as well as causing erosion.[205] There is also a proposal to deepen waterways to allow large ships through the lagoon. This proposal comes with a lot of push back not only because it threatens the foundations of the city and the ecosystem but also because there has been a growing movement amongst Venetians to ban cruise ships from the waterways around the historic center if not through the whole lagoon.[206] Banning large ships would not only work to preserve the buildings physically. Many Venetians claim that it would preserve the historic atmosphere and views of Venice that are now constantly disturbed by cruise ships (Figure 31).[207] This may be the perfect time to change the policy surrounding cruise ships in the lagoon. Due to the Covid-19 pandemic, cruise travel halted in early 2020 and likely will not resume until 2022.[208] Making changes now would allow cruise companies to change their itinerary plans if ships needed to be routed to a port outside of the lagoon. There have been tentative plans to create a new terminal at the port in Mestre so that ships are routed away from the historical center, but this project has yet to begin. This may be the best option because the cruise industry employs around 5,000 Venetians, so relocating their jobs to somewhere nearby rather than forcing all ships out of the lagoon would be less detrimental to current residents.[209]

The issue with cruise ships is just one piece of a much larger problem in Venice. Tourism is growing past sustainable levels. When discussing tourism, it is important to at least acknowledge the economic benefits of tourists. It is the main factor keeping Venice's economy

205. "Venice Bans large Cruise Ships from Historic Center," *BBC*, (2019).

206. UNESCO, ICOMOS, and RAMSAR ,51.

207. Paula Hardy, "Sinking City: How Venice is Managing Europe's Worst Tourism Crisis," *The Guardian* (2019).

208. Vivienne Nunis, "Will Cruise Ships Return to Venice?" *BBC* (2020).

209. Nunis.

afloat, but it has grown beyond the capacity of the city and far past a sustainable level.[210] Large floods of tourists enter the streets of Venice by the millions every year (Figure 32). The strain they put on the city is high, causing damages as well as making everyday life harder for Venetians. Because of the large economic draw, it is common that both the national and municipal governments can be slow to limit or regulate tourism. Instead, they have tended to make tourism in Venice more accessible and affordable, trying to market it to the rest of the world and stay competitive amongst other tourist destinations.[211]

Tourists can be extremely harmful for cultural heritage sites. While most tourists mean well, they contribute to damage of both tangible and intangible culture. In Venice, the strain that tourists put on bridges and sidewalks can often be fixed. The revenue from tourist activities is usually sufficient for covering these costs, but irreversible damage to historical sites due to tourists is more difficult to handle. Opening up a heritage site to tourists immediately increases its risk. This often does not have anything to do with actions of the visitors, but the increase in people going in and out of a room or building can cause higher levels of degradation. Oils on visitor's hands, moisture due to sweat, or bugs and dirt tracked in by tourists can be harmful to objects and buildings. Conservationists are working to prevent this kind of damage in locations around the world.

More threatening to Venice than the physical effects of tourism is the threat that they pose to living cultural heritage. As preservation progressed through the 20th century, a larger focus was placed on preserving the city rather than individual monuments. This idea has grown in the 21st century to include preserving the city as a living monument rather than a location

210. UNESCO, ICOMOS, and RAMSAR, 42.

211. UNESCO, ICOMOS, and RAMSAR, 39.

prioritized for tourists. Large numbers of tourists make it increasingly difficult for residents to stay in Venice's city center. If preservationists want to preserve Venice as a living city, they must depend on their colleagues who focus on the social aspects of conservation and city planning.

Recently, there has been an acknowledgement that the pace at which tourism is growing in Venice cannot continue. This has caused a shift in policy when it comes to entrance fees, hotels, and tourist infrastructure. In 2017 restrictions were put on hotels and restaurants in Venice, putting a stop to new food locations in the historical center. Only a few new hotels would be opened that had secured the permits before restrictions were put in place. The limit on hotels has many exceptions, which has been critiqued by parties such as UNESCO. The idea was that rather than creating new lodging and tourist infrastructure that would only supply beds beyond the capacity of the city, the current infrastructure should be upgraded.[212]

Most recently, Venice introduced a new fee for day-trip visitors to pay for the upkeep of public spaces. The fee can range from 3 euros to 10 euros depending on the time of year and how busy a day is projected to be within the city. The busier it is, the higher the price.[213] Day-trip tourists are the least likely to spend money within the historical center because they do not stay overnight, but they still contribute to the amount of strain tourists put on the city.[214] Overnight stays are taxed differently through hotel fees, but previously there had been no fee for day trips. The new fee also gives a small incentive for people to spread out their visit to a less busy time during the year because of the differing cost. The fee can be paid with train fare to the city or

212. UNESCO, ICOMOS, and RAMSAR, 42.

213. Francesca Street and Livia Borghese, "Venice to Charge Day Trippers Up to $11 to Visit," *CNN* (2019).

214. UNESCO, ICOMOS, and RAMSAR, 39.

through an app when entering the city.[215] An app of this sort could open new opportunities for the city to give directions to tourists. Some fear this will turn Venice into an experience more like Disneyland, making the whole city a museum (Street and Borghese),[216] but it would be possible to use the app for good, promoting local businesses and restaurants that could use the tourist traffic. This tax also ensures that Venice gets funding for local projects. It has long been commonplace that tourists staying in the historical center are affected by a tourism tax, but those staying on cruise ships or those who only get off their cruise to spend the day in Venice did not have the same financial responsibility for the city's upkeep.[217] The new day-trip fee was supposed to go into effect during the summer of 2020, but due to the pandemic, it was not needed. Its first relevant season may be the summer of 2021, but its effectiveness will not be evaluated for years to come once tourist patterns have gone back to normal after the pandemic.

While Venice has a variety of threats to material culture that can be counter acted with cutting edge science and high-tech sea gates, its intangible culture is being threatened and may be even harder to save. Venice will likely continue to have the funds to save restore its churches and other historical monuments however preserving the city will require social and political work as well. Currently, the historical center of Venice is losing 4% of its population per year while its surrounding areas are gaining about the same amount.[218] The reason for resident's exodus from Venice has changed slightly since the mid-20th century when the slow decline in population began. Rather than explicitly seeking more modern accommodations, they are mostly

215. UNESCO, ICOMOS, and RAMSAR, 39.

216. Street and Borghese.

217. Karen Fox, "Venice Becomes the Front Line in the Battle Against Overtourism," *CNN Travel* (2019).

218. UNESCO, ICOMOS, and RAMSAR, 44.

seeking larger housing that they can afford and job opportunities.[219] Both problems stem from Venice's municipal government having little say over the function of private buildings. This is a distinct problem for Venice when habitable residential and commercial space can be difficult to come by.

The issue of employment in Venice is a very circular one. Without companies having the space or money to have offices or other employment opportunities in Venice, there are few jobs for those living in Venice that are not related to tourism.[220] The lack of employment and high cost of living push people out of Venice. Without permanent residents, businesses that do not cater to tourists cannot survive, decreasing the number of jobs once again. It makes it difficult for places like grocery stores—which depend on a steady number of people living in the area—to survive.[221] Without these convenient businesses, it becomes more difficult and even more expensive to reside in the area. Because this problem is so cyclical, it will take a combination of solutions to solve. The first one that UNESCO suggested in its 2020 report was to restrict building use for large public buildings when they are being sold to private entities. By defining their use in categories such as residential space for locals or workspace for local enterprises, the city could increase the number of jobs in Venice or increase the amount of affordable housing for locals.[222] Otherwise, these previously public owned buildings could be turned into small timeshares or travel rentals, which only make the housing problem in Venice worse.

The next intervention would need action from both the national government as well as the municipal government. While Venice has put strict regulations on the building of new hotels, it

219. Fox.

220. Fox.

221. Robert Good, "Tourist Commodification of Residential Vernacular Architecture in Venice: Livability and Conservation in an Historic District." *Traditional Dwellings and Settlements Review* 17, no. 1 (2005): 56.

222. UNESCO, ICOMOS, and RAMSAR, 45.

has done nothing to stop the increase in vacation rentals and timeshares within the city. There is a long list of issues with vacation rentals and companies like Airbnb that many large cities are now taking issue with. One of the biggest issues is that renting out a small apartment to tourists weekly or monthly makes more money that renting it to Venetian residents at a reasonable price.[223] This also makes it easy for one person or group to buy up many apartments in the area and rent them out for a high price. Often this means that the income from the vacation rentals is being funneled out of Venice to international property owners.[224] At the same time, it is also raising housing prices and making it difficult for locals to find housing.

Vacation rentals and time shares can also justify charging tourists extremely high costs for small amounts of space. This means that many people who rent spaces to tourists have renovated them by dividing apartments and increasing sleeping space while decreasing living space. Tourists do not need a fully functional kitchen, dining room, or even a large living room.[225] While these types of renovations are frowned upon, the municipal government does little to discourage them or even monitor vacation rentals. This means that renovations for vacation rentals permanently change the layout of apartments in ways that are less conducive to permanent residents.[226] It discourages people who want to build families from settling in Venice. Time shares impose an extra issue. On top of the same problems with renovation that other vacation rentals have, time shares make it almost impossible to sell spaces because so many people own shares in a unit. Once a unit becomes a time share, it often stays that way.[227]

223.Good, 69.

224.Hardy.

225.Good, 70.

226.Ibid., 71.

227.Ibid., 73.

Along with the limitations that vacation rentals impose on residential space, they are increasingly abundant in the historic center. Other major cities have cracked down on Airbnb and other temporary rentals and have strict rules. Rather than allowing outside people to buy property and rent it out year-round, San Francisco requires rental owners to be permanent residents of the city. They are only allowed to rent out their units for 90 days in a year and must reside on the property the rest of the year.[228] While these may be strict, it could be beneficial for Venice to restrict owners to locals or to require that a single owner cannot rent out multiple properties. All these measures would require a robust registration system for temporary rentals. The city would also have to enforce these measures to make any difference in the community. The city could also tax owners higher for hosting tourists while providing incentives to owners who prioritize renting to residents.[229] The idea behind most cities' plans to restrict Airbnb was to even out the playing field so that there was not a clear monetary advantage to renting to tourists vs. residents, but it would take change to federal policy, which currently states that it is an Italian's right to rent out their own property.[230] A service called Fairbnb was also started in Venice as an alternative to Airbnb. They built these restrictions into their platform to encourage sustainable tourism. A portion of the money from rentals is also donated to a local project of the renter's choosing.[231] This is intended to promote conscious tourism and help the community.

There are a few public projects to expand residential space because there is a hesitance to restore more buildings if they are going to be immediately sold and turned into space for tourists. The few relevant projects that have taken place have focused on the renovation of buildings with

228. Tun.

229. Tun.

230. UNESCO, ICOMOS, and RAMSAR, 43.

231. Hardy.

low tourist value to become low-income housing. Some publicly owned buildings have been restored to be residential space that can be controlled by the municipal government.[232] The issue with this solution is that it cannot completely solve the lack of housing. There are not enough public buildings suitable for being repurposed to make this happen. The other project going on is to provide the funding and tools necessary to convert currently unlivable spaces into housing. These include first floor rooms that have been abandoned because they lack the proper measures to avoid flooding. They were not traditionally used for living spaces because they are often damp and dark, so this solution to the housing issue is helpful but also not ideal.[233] The most direct way to increase affordable housing would be for the city to take more control over the tourist industry and make living in the city center more enticing again.

From the long list of projects carried out through UNESCO and the Save Venice Fund it is clear that there is project money for monuments and churches. From the myths of its origin to the narrative that the city is still sinking, Venice has inspired people from around the world to pitch in to save its monuments. It is true that the city needs constant funds. The most recent flood in November and December of 2019 caused 360 million euros worth of damage to public buildings and infrastructure alone. Even San Marco will have to undergo further conservation after the crypt was flooded however completing the high-profile projects will not be sufficient for saving Venice. Architecture is important, but the urban fabric of a city also relies on its residents. Venice will be a shell of itself if we continue to let tourists take over and make it harder and harder to live in the city center.

Without residents protecting a living culture within the historic center, Venice will truly

232.Good, 68.

233.Good, 68.

become the massive museum that has been threatening to take over since the fall of The Venetian Republic. It will be little more than a well-preserved archaeology site of a previously thriving culture. Another city like Pompeii for tourists to pour into to see buildings erected by people warring with nature. While there is plenty to learn from somewhere like Pompeii, the experience of Venice would be diminished if there was no longer any living culture. Despite the threats from nature, the buildings will survive. Right now, the threat is to the intangible culture. There are still Venetians, and preservationists need to ensure that their actions are making it easier for them to stay in their city and not harder. This task will not be easy. It is difficult to turn down the draw of the tourist industry, especially when it plays such a large part in the economy, but the short-term monetary benefit cannot outweigh the long-term risks of unsustainable tourism. Tourists may keep the monumental buildings preserved, but it takes investment in the community and residents to keep the whole city alive. In our search for solutions in Venice, these facts cannot be forgotten.

Conclusion:

A cohesive plan for preserving Venice will have to account for the city's history as well as its future. Knowing the roots of Venice's preservation problems will be the key to both technical and cultural solutions. Through Venice's history, the city was stubborn, creating new engineering techniques just to survive. It was a republic ruled by its nobility rather than the church, and when the city lost this independence, it began to lose its fight against nature. Looking to the past will be important for understanding Venice's problems, but modern technology will be vital to the city's survival as the sea level rises and floods become more common. Recognizing the Venetians' spirit is also important for acknowledging the city's

residents today. They fight their own battles with nature and tourists just to stay within their homes, and this plight cannot be pushed aside while international preservationists "save the city." Preserving the city requires saving its living culture.

The problems that face Venice, sea level rise, mass tourism, and the decline of living culture, are not entirely unique. While few cities feel these issues as acutely as Venice, locations around the world face the increasing pressure of the same problems. The choices Venice makes now will determine how other cities view it in the future. While there is no guarantee that the solutions presented here will work, Venice may soon face another preservation revolution like those seen after the fall of the San Marco campanile or the flood of 1966. This revolution would have to include addressing sustainable tourism, reviving the city's population, and creating long-term plans for protecting Venice as the sea level rises. These factors will determine whether Venice will sink or survive for future generations. Will Venice become the model for how to save a city and its cultural heritage, or will Venice become a horror story to other coastal locations?

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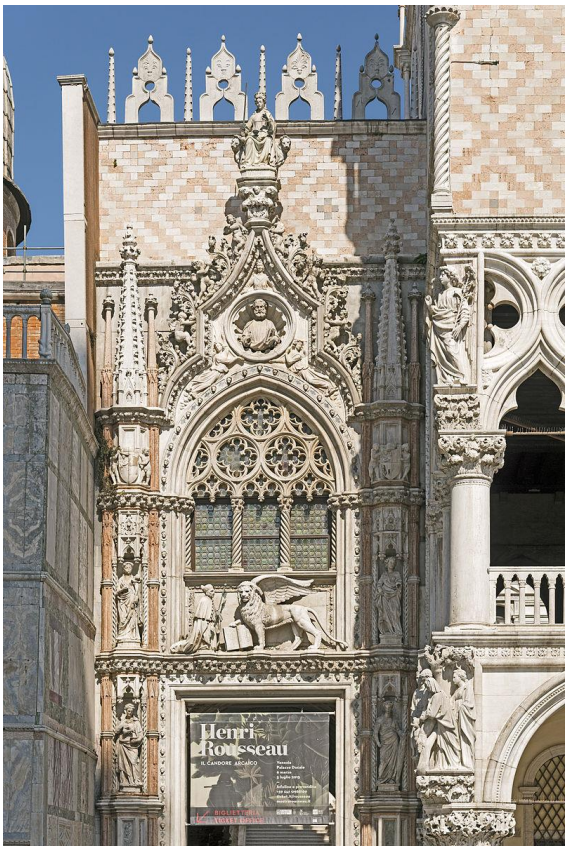

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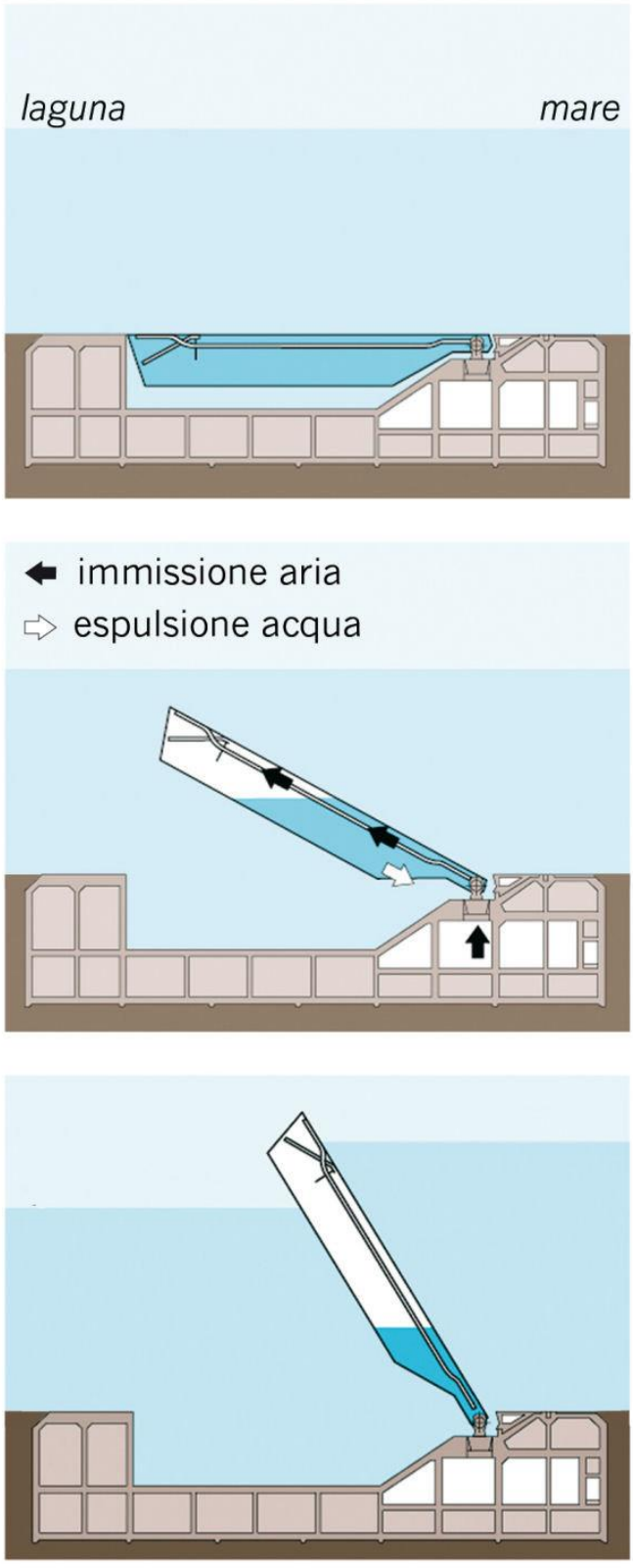

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