

**Investigating Representations of Space Through the Intersections of Digital and Analogue  
Objects: Georeferencing Sanborn Maps**

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## **Audience**

This research and project is directed towards archaeologists and historians. Different perspectives and understandings of space and its use is considered by both of these disciplines often, and inform their work frequently. Maps depict and describe space and assume its use in their very nature. Archaeologists and historians alike use various forms of maps and mapping techniques to understand human impact and movement over time in terms of space and use.

The field of applied archaeology, also known as Cultural Resource Management (CRM), is a prime example of an industry concerned with maps and mapping. Archaeologists in CRM work conduct Background Reviews prior to beginning a field survey to understand the scope of expected work and expected findings. Background Reviews consist of researching prior archaeological surveys and can include conducting primary research of archival materials, including deeds and maps. Archaeologists also review the natural and built environment in which their project area encompasses, from landforms and soil compositions to evidence of human existence, such as buildings and roads. Maps play an important role in devising the Background Review, as they depict past activity of an area and therein point to potential archaeological deposits.<sup>1</sup>

Moreover, archaeologist build and create their own maps digitally using Total Data Stations and ArcGIS. Understanding the abilities of digital map creation, combined with analogue mapping methods, is of great use in conducting archaeological research.<sup>2</sup> My project and research speaks to this need specifically, and investigates the abilities and downfalls of

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<sup>1</sup> Alicia Valentino, "Using Maps to Aid Out Understanding of a Site's History," 2009, 40-44.

<sup>2</sup> Ibid.

perceiving space both digitally and via analogue, as well as when the two mediums intersect. Recognizing the differences and similarities of each is vital in determining evidence derived from archaeological investigations and research including space and its use and change.

Historians utilize maps in their field too, and perhaps with even more diverse and nuanced methods than within the field of archaeology. For example, historians investigate space through the use of digital and analogue means to determine demographics, migration, and economy. For my project specifically, historians can utilize the “invaluable historical record of urban growth in the United States over more than a century” included in Sanborn map data.<sup>3</sup>

## **Methods**

This project explores how space is perceived and depicted by both analogue and digital means. To do so, I investigate the production of space at the intersections of digital and analogue maps, utilizing a modern satellite map, fire insurance maps, and data points of Texas historical markers. Harnessing Quantum Geographic Information System (QGIS) to georeference and layer this data, I explore the discrepancies and commonalities of the same block of land in Austin, Texas. This project begins to question the validity of evidentiary value derived from digital and analogue forms of maps and renderings of space.

QGIS is an open source mapping tool that allows the user to upload, manipulate, and create maps. It also holds relative databases to connect points, lines, and polyline data, including object attribute information. Georeferencing is one feature QGIS offers. Formerly

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<sup>3</sup> Walter Ristow, “Sanborn Maps: introduction to Collection,” 2020, 1.

known as rubber-sheeting,<sup>4</sup> georeferencing is the process of connecting an unscaled map to an absolute location on a coordinate grid consisting of universally understood longitude and latitude measurements of the globe. This process helps scale hand drawn maps to a coordinate system in which other maps are drawn too, such as satellite maps. Using QGIS and the georeferencing application, I will be able to explore multiple projections of space between various forms of digital and analogue maps.

My objects of study include Sanborn maps. Sanborn maps are fire insurance maps created by surveyors from the late 18<sup>th</sup> century through mid 20<sup>th</sup> century. I will georeference five Sanborn maps created between 1877-1900 depicting the 900 Block of Congress Avenue and 9<sup>th</sup> Street in Austin, Texas.<sup>5</sup> The maps are digitize by The Briscoe Center for American History, and accessible online via the University of Texas Libraries.

I chose Sanborn maps as my object of study as they reveal the built environment, human impact and use outside of their purposes for fire insurance policies. These maps hold qualities of interest in terms of space and how past peoples perceived and used land. For example, Sanborn maps include colored keys describing dwellings versus commercial buildings, and what the buildings were used for, such as mansions, jewelers, and drug stores.

Sanborn maps are also drawn with consistency and precision, a quality necessary when comparing space as a semi-micro level. Accompanying this precision is consistency in scale of location and of buildings and roads, including street names and building numbers. These qualities assist in to exploring space as seen via an analogue method, and the comparable

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<sup>4</sup> Alicia Valentino, "Using Maps to Aid Out Understanding of a Site's History," 2009, 41.

<sup>5</sup> The University of Texas Libraries, "Perry Castaneda Library Map Collection," 2020, 1.

differences once layered against modern digital maps, due to their accuracy in scale, and attention to detail.

A satellite map from the Environmental Systems Research Institute (ESRI) will be used as the digital comparison and geographic reference to the Sanborn maps. This satellite map is an absolute location map connected to a coordinate grid that represents the globe via longitude and latitude measurements, and is produced by ESRI, the company who created QGIS. Updated in 2018, the satellite map is a representation of the modern built environment and depicts current land use. However, qualities such as street names or building numbers are not included in this satellite map, giving the viewer visual representation of the globe rather than a semantic one. Georeferencing Sanborn maps onto a modern satellite map will ensure the Sanborn maps are fit and representative of a consistent scale with modern day projections. Moreover, it will further my research into understanding space perceptions of the current day then of the turn of the century.

Lastly, I will layer point data of Texas historical markers created and compiled by the Texas Historical Commission<sup>6</sup> onto both the satellite and Sanborn maps. Point data is a representation of space that is uniform and consistent in size, regardless of the information it holds. The point data of Texas historical markers is connected to the same coordinate grid the satellite map is, and Sanborn will be, and they represents similar data, such as historic buildings. This is a different method of representing space than the depictions given by both the satellite and Sanborn maps. This is useful as the information and place of historical markets

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<sup>6</sup> The Texas Historical Commission “Historical Markers,” 2020, 1.

in the form of points will be compared against the other two forms of space projection, resulting in critical and nuanced investigation of the perception of space, its changes, and use.

## **Introduction**

The objective of my project is to use open source Quantum Geographic Information System (QGIS) to georeference Sanborn maps of Austin, Texas, onto current satellite imagery of the same location. Thereafter, I will digitally layer point data of Texas historical markers. Ultimately, I will investigate each map layer for its qualities and claims to space and its use. Throughout this research, I will recognize the different abilities and purposes of each object of study and data set. In doing so, I will analyze the change in use of the space overtime, and question the validity of each medium in its perspective of space and its use. This will lead to a discussion on the use of digital versus analogue methods to depict and describe space, and what forms of knowing and meaning making occur at the intersection of these methods, as seen by georeferencing and layering maps. This will aid in determining how archaeologists, historians, scholars, and the public derive evidence of human impact based on conceptions of space.

## **Literature Review**

First, I will consider scholarship concerning Geographic Information Systems (GIS) and spatial humanities. While researching, two themes appeared prevalent among the academic material: (1) quantitative methods and impacts of mapping the globe and the built or natural

environment, and (2) how to analyze the meaning derived from mathematical mapping methods, like human impact and use.

Created by the discipline of geography, GIS “evolved in a context of precision, quantitative measurement, and notions of accuracy,” and focuses on “the collection, modeling, management, display, and interpretation of geographic information.”<sup>7</sup> GIS mapping is built upon the idea of space as measured upon a flat grid, with each infinitesimal unit of space attributed to an absolute and individual location. Within this grid, objects (like buildings or mountains) and fields (such as regions) are all autocorrelated,<sup>8</sup> and relate to one another via the construct of their existence in space. This notion of absolute location and spatial autocorrelation attends to the mathematical mapping of space to precise detail, leading a user to understand the space we live in exists compartmentally and is of absolute nature. The impact of systems like QGIS, which harnesses databases, categories, ontologies, and mathematical correlation, assumes space as fundamentally finite.<sup>9</sup> Nonetheless, there are methods available to approach and analyze the humanistic qualities within the computational mapping processes GIS functions within.

The intersection of space and the humanities is called the spatial humanities, a field which concerns itself with the study of human impact in terms of space.<sup>10</sup> To achieve the inquiry of spatial humanities in terms of GIS, Milan Talich argues that value-added digital maps are necessary.<sup>11</sup> Value added maps include harnessing the abilities of GIS to layer, compare, and

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<sup>7</sup> Karen Kemp, “Geographic Information Science and Spatial Analysis for the Humanities,” 2010, 31.

<sup>8</sup> Ibid.

<sup>9</sup> Ian Gregory, “Exploiting Time and Space: A Challenge for GIS in the Digital Humanities,” 2010, 61.

<sup>10</sup> Ruth Mostern & Elana Gainor, “Traveling the Silk Road on a Virtual Globe: Pedagogy, Technology and Evaluation for Spatial History,” 2013, 1.

<sup>11</sup> Milan Talich, “Digitization of Old Maps and Possible On-line Tools for Their Use,” 2020, 1.

manipulate the information within maps and their mapped objects (such as attributes found in databases) to inform humanistic inquiry.<sup>12</sup> One way to perform these methods is through the digitization of analogue maps and to qualify them with digital applications, such as georeferencing their depictions to a coordinate grid. This ensures they are relative to modern digital-born mapping seen today, and can be compared against such information with accuracy.

Professors Ruth Mostern and Elana Gainor explore these methods used in spatial humanities in *Traveling the Silk Road on a Virtual Globe: Pedagogy, Technology, and Evaluation for Spatial History*. Mostern and Gainor used value-added techniques, such as georeferencing and geocoding, to investigate the social and cultural impact of the Silk Road across continents. By doing so, their students were able to turn the “absolute” data given by GIS into meaningful information, producing interactive maps that revealed human social and cultural impact from the Silk Road across the globe. By applying layers of conferred and georeferenced information, Mostern and Gainor’s students found meaning at the intersections between analogue information, and digital mapping.

Specifically pertaining to my audience, archaeologists investigate time, space, and human impact through excavations of the Earth’s surface. To locate areas of interest and potential cultural deposits, maps are often referenced. Archaeologists have already begun utilizing value added tools in digitized maps, such as georeferencing.<sup>13</sup> By georeferencing digitized maps, the progression and destruction of buildings and roads concerning archaeological sites lends evidence to the history that may have taken place within the area. Moreover, the

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<sup>12</sup> Milan Talich, “Digitization of Old Maps and Possible On-line Tools for Their Use,” 2020, 1.

<sup>13</sup> Alicia Valentino, “Using Maps to Aid Out Understanding of a Site’s History,” 2009, 41.

archaeological methods surrounding precision and context are applicable through georeferencing, as analogue maps are able to be scaled to minute measurements and layered upon hundreds of years of history to view changes in space and time.

Historians have begun harnessing the abilities of GIS to aid in understanding urban growth or decline, migration, economy and countless other human action and impact via georeferencing. Analogue fire insurance maps is one use of such inquiry, although not without its limitations. Fire insurance maps were created in the late 18<sup>th</sup> century in London, and made their way across the world during the 19<sup>th</sup> century.<sup>14</sup> Surveyed with precision and consistency, fire insurance maps hold information historians can utilize outside of fire safety needs. To do so, digitizing and georeferencing these maps is crucial, as layering them upon other maps of the same location point to changes in the built environment.

Although accurate in location, the information fire insurance maps hold can be obtained in a manner unfitting to the exact and finite ideals of computing. Only mapping the “builtup part of the town or city” surveyors were directed to seek information from “the Court House, or . . . some real estate agent[s who] may have the necessary data. [However] if records [were] not easily obtainable do not waste too much time, but proceed to measure up the territory with tapeline, and plot sheets from notes so secured. In plotting put on the street names and widths and real estate description.”<sup>15</sup> The ambiguity of the sources of information assigned to these maps is juxtaposed greatly to the absolute GIS mapping demands. While neither source

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<sup>14</sup> Walter Ristow, “Sanborn Maps: introduction to Collection,” 2020, 1.

<sup>15</sup> Ibid.

is more validating than the other, understanding their differences in function and purpose is crucial when drawing conclusions from their data.

Once reviewing the relevant research surrounding GIS and analogue mapping, it became apparent the differences between space perceived mathematically and visually, versus the same space understood dynamically and in terms of use. I situate my project at the crux of this quandary. I will explore how space is perceived in both digital and analogue mediums as well as their use simultaneously, and discuss what this inquiry reveals of my objects of study, digital tools, and preconceived understandings of space and its use.

## **Discussion**

Upon georeferencing five Sanborn maps depicting the 900 Block of Congress Avenue and 9<sup>th</sup> Street in Austin, Texas from 1877, 1885, 1889, 1894, and 1900, I observed three changes and or conflicts in the recording and perception of space. My observations include the (1) change or discrepancy in street addresses, (2) the change in street names, and (3) the creation and location discrepancy of the M.M. Long Opera House. I will examine these differences and discrepancies seen between Sanborn maps, and the layered point data of Texas historical markers. Additionally, in my analysis, I will point to the limitations of my objects of study, dataset and digital tool.

### *Street Addresses and Street Names*

One fundamental difference observed when georeferencing and layering the 1877 and 1885 Sanborn maps was the change in street address number. **Figure 1.** depicts the west side of



This occurrence may be a faux pau in the surveyors knowledge, as it was reported by Walter Ristow that a Sanborn surveyor's priority was to accurately survey buildings, and any additional information was secondary to the final product. Information about the surveyed built environment in terms of humanistic application, such as use and naming conventions, was of less concern to the means of fire insurance policy.

Nonetheless, this discrepancy in street addresses could point to a change in perception of location and its use. While the address numbers changed between 1877-1885, the buildings and their production did not. When researching the activities held in these buildings via street numbers (a common search query used in archival institutions when locating deeds and land information) the research could be provided misleading or inaccurate information, due to the discrepancy in street addresses.

Similarly to the change in street addresses was a change in street names in Austin, Texas between the years of 1885-1889. **Figure 2.** shows streets traversing east and west changed from names of trees to a numbering system by 1889. In this case, East Ash changed to East 9<sup>th</sup> street. Due to both street names, East Ash and East 9<sup>th</sup>, being present on the 1889 Sanborn map, it could be inferred that there were no other Sanborn maps produced since the last available rendition in 1885, therefore an update to the street name was in order once a new Sanborn map surveying this land was created. Although, another inference could be made that 1889 was the very first year the city implemented this change. This could point to a Sanborn map being created in 1889 *due to* the street name change, and not a coincidence of it. Indeed, the time between the creation of the 1885 and 1889 Sanborn maps is the shortest amount of

time between surveys, at only four years compared to other gaps in surveys ranging from seven to five years.

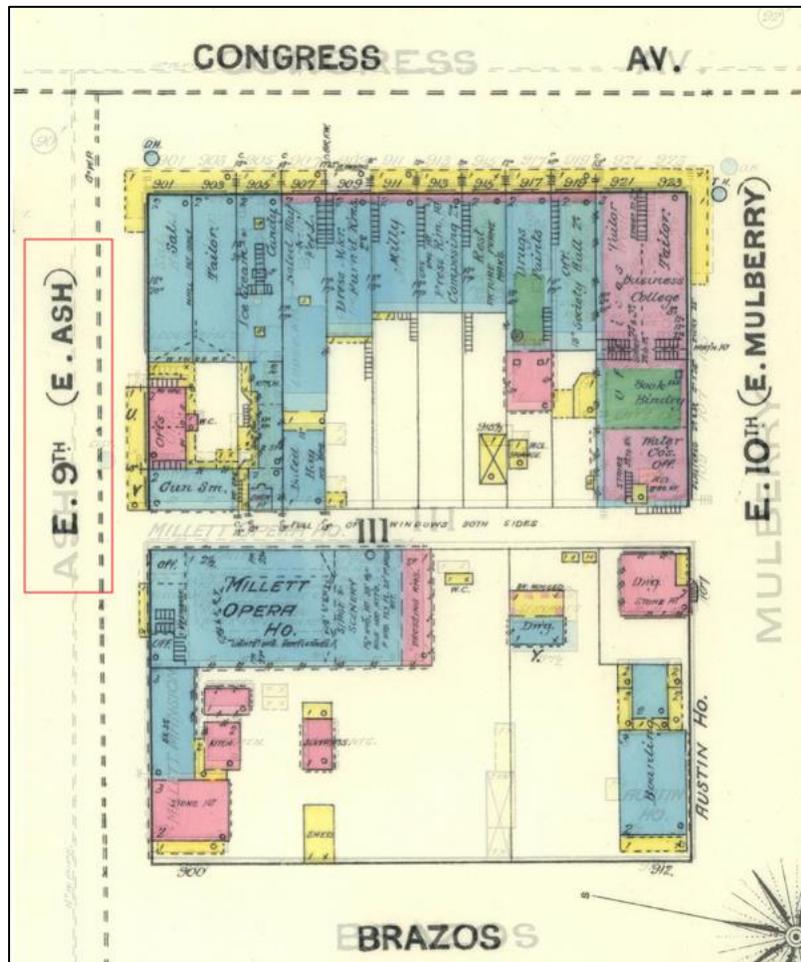


Figure 2. 1889 Sanborn map layered on top of 1885 Sanborn map

Both the change in street addresses and street names pose important pieces of information in the archaeological and historical record. When researching land use and ownership prior to field excavations, archaeologists conduct archival research and create Background Reviews of the area of investigation. This includes synthesizing information from deeds and historic documents, and correlating those findings to historic maps to understand

the use of the area to determine potential types of cultural deposit. Thereafter, this knowledge is imposed upon the modern built environment via georeferencing and layering in QGIS.

Recognizing the discrepancy in street addresses and names, and most importantly, *when* the changes occurred, helps point to different use of the space. For example, an historical hypothesis that could be inferred from the change in street names is a change in development of the city pointing to its growth. Changing street names from text to numbers attends clearer and more efficient forms direction for cities or large towns with many roads that may hold many travelers. This may imply this area the map depicts is growing in use, and would be of interest to historians who study patterns of urban growth including economy.

Nonetheless, it is seen in the 1894 Sanborn map that many of the commercial buildings are vacant when they were not in the previous 20 years, albeit with frequent turn over in businesses.<sup>16</sup> Does this point to a decline in urban growth or, perhaps, construction of the area – pointing to a positive correlation of growth? Indeed this space, when layered upon a Sanborn map from 1900, reveals all previously vacant buildings from 1894 as “S”, indicating they are “Stores”<sup>17</sup> (see **Figure 3.**). Moreover, layering these Sanborn maps upon modern satellite imagery reveals the current built environment to consist of skyscrapers and large buildings in the same location of these spaces.

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<sup>16</sup> The University of Texas Libraries, “Perry Castaneda Library Map Collection,” 2020, 1.

<sup>17</sup> Walter Ristow, “Sanborn Maps: introduction to Collection,” 2020, 1.

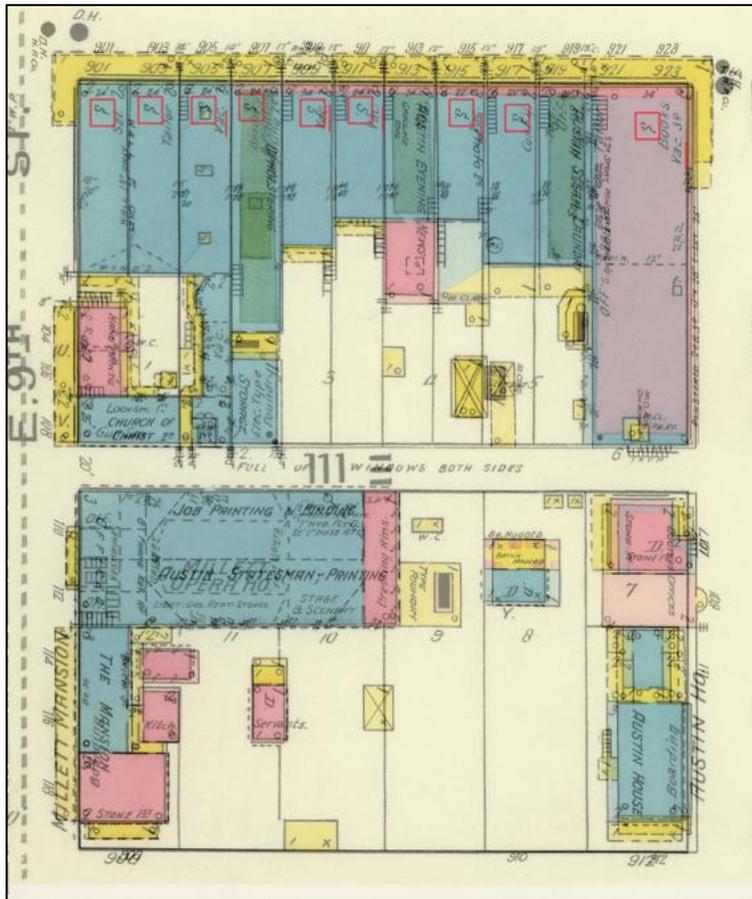


Figure 3. 1900 Sanborn map layered on 1894 Sanborn map

After these observations many limitations of both my chosen objects of study and digital tool are becoming clear. Remembering the purpose of Sanborn maps – fire insurance policies – is crucial when drawing conclusions about the use and perception of this space during this time period. As seen with the discrepancy of address numbers between the 1877 and 1885 Sanborn maps, one should be careful before relying too heavily on evidence derived purely from semantic qualities of Sanborn maps. Surveyor’s form of information gathering about these space was limited, inconsistent, and objectivity unreliable in many instances.<sup>18</sup> Therefore,

<sup>18</sup> Walter Ristow, “Sanborn Maps: introduction to Collection,” 2020, 1.

drawing evidence from these maps without strong corroboration from other sources is of poor conclusion.

Moreover, while using the digital tool of georeferencing in QGIS does corroborate the *location* of these buildings as consistent with the Sanborn depictions, it does not correlate their use nor the perception of the space by peoples who existed within them. Again I call upon my quandary derived from researching GIS in the spatial humanities: space perceived mathematically and visually does not equate to the dynamic and intangible use occurring in the same or related space. This argument and investigation will be furthered by my final observation, the creation and location discrepancy of the M.M. Long Opera House.

#### *The M.M. Long Opera House*

The M.M. Long Opera House was registered by the Texas Historical Commission as a Texas historical landmark in 1979. A building in which the Opera House resided first appears on a Sanborn maps in 1877, but is noted as occupied by C.F. Millet Sash, Door & Blind Factory. The location or existence of the Opera House occupying another building within the confines of the same Sanborn map is unfound in 1877. The C.F. Millet building becomes occupied by the Opera House in 1885, and the Opera House continues to exist in the same location according to the available Sanborn maps in 1889 and 1894 (see **Figure 4** and **Figure 5.**). By 1900, a Sanborn map depicts the same location and building, but labels it as a double occupancy including the Job Printing and Binding and the Austin Statesman & Printing (see **Figure 5.**). The Opera House does not appear elsewhere in the 1900 Sanborn map.

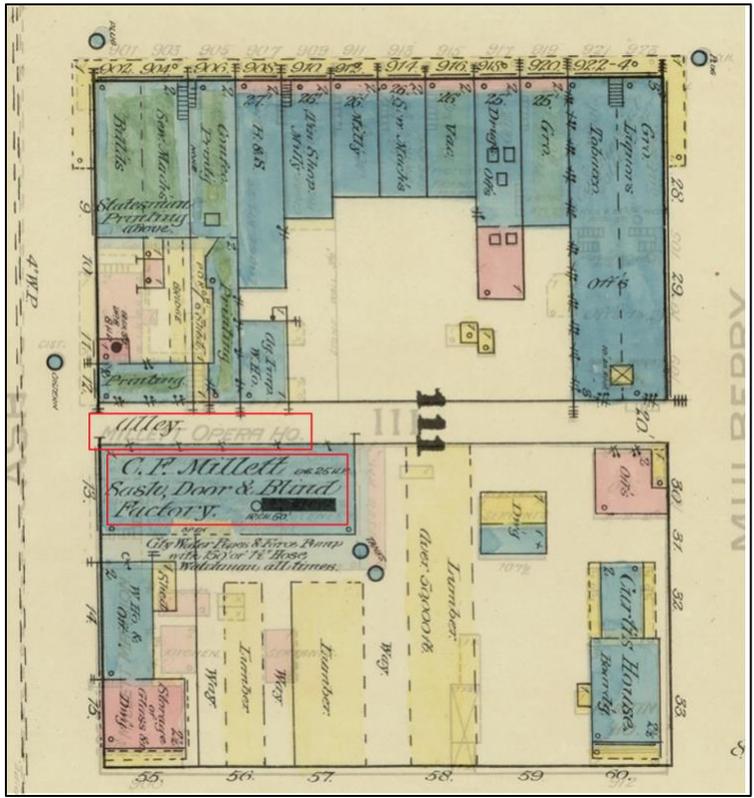


Figure 4. 1877 Sanborn map layered onto 1885 Sanborn map

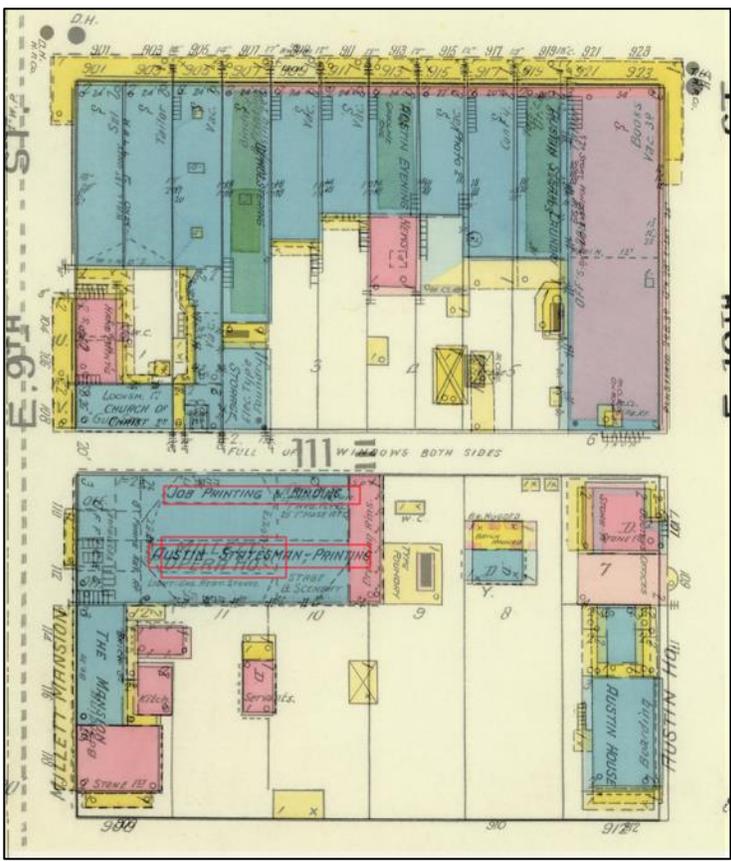


Figure 5. 1900 Sanborn Map layered onto 1894 Sanborn map

Uninteresting on its own, the Opera House did not stand out as significant in the georeferencing and layering of the Sanborn maps upon each other in chronological order. It appeared in 1885 and disappeared in 1900, but was of no merit compared to other businesses depicted on the Sanborn maps with similar vacancies and new storefronts who made their appearances and disappearances throughout the 23 years of surveying as well. However, once the Sanborn maps were layered with the Texas historical point data, it was realized there was a discrepancy in the use of space as depicted by the Sanborn maps and by the Texas Historical Commission.

The Texas Historical Commission gives an absolute location of 901 Congress Avenue, Austin, Texas, as the location of the M.M. Long Livery Stable and Opera House. However, according to all five Sanborn maps, 901 Congress Avenue was never occupied by the Opera House between 1877-1900, but instead operated within an unnumbered building directly behind (west) 901 Congress Avenue between 1885-1900 (see **Figure 6.**). Understanding this discrepancy in use of space takes research beyond the abilities of GIS or Sanborn maps, as these tools only depict *location*, but do not give true evidence of *use* or the intangible qualities of the lifeways or experiences created from these spaces.



**Figure 6. 1894 Sanborn map with Texas historical marker**

The Texas historical marker for the M. M. Long Livery Stable and Opera House reads as follows:

*“When M. M. Long and his family moved here from Bastrop in the early 1860s, the floor served as the livery stable for Long’s Austin to Burnet and Lampasas stage line, On the second floor, Long ran an opera house which was used for public meetings and concerts, In 1866 a Federal courtroom and in 1900 an Odd Fellows hall occupied the second story, Through the years a publishing company, a saloon, and a billiard parlor, tobacco, drug, jewelry, and dry goods stores have used the centrally located building. (1979).”*

This description provides clarity for the location of the historical market at 901 Congress Avenue, as the Opera House apparently existed in this building between the years of circa 1860 to 1866, before it became a Federal courtroom followed by an Odd Fellows hall (a description unfound in the buildings description in the 1900 Sanborn map. Although, that does not contend that an Odd Fellows hall did not indeed occupy the second story of the building). This location

of the Opera House could not be corroborated by the Sanborn maps as they only date back to 1877 for Austin, Texas.

Nevertheless, what I interrogate is not the lack of evidence from Sanborn maps, but the absolute location of the Texas Historical Commission's data point inferred by QGIS as the only location of the Opera House. Moreover, the official recognition of the Opera House is of a building it occupied for less than six years; whereas the building the Opera House later moved too existed within its walls for at least nineteen years with no official historic recognition via the Texas Historical Commission.

This points to the perception of space and its use. According the Texas Historical Commission, this block of land and its space is determined by a a person who founded a business, and not by the events and happenings of the business itself. As the historical marker assigned to this building with Opera House in its name is assigns historical merit to a person, while describing 50+ years of history they were not necessarily a part of. The Opera House as a business, its impact, and history in Austin, Texas reached further than the 901 Congress Avenue building and M.M. Long, both physically and intangibility as an experience to its employees and customers. However, this perception of space is not recognized by the point data provided by the Texas Historical Commission.

The discovery of the discrepancy in the location of the Opera House reveals the limitations of QGIS most distinctly. As stated by Karen Kemp, QGIS is formed on the "context of precision, quantitative measurement, and notions of accuracy,"<sup>19</sup> and it fails to underscore the human experience in these spaces it measures and represents, as it perceives space as

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<sup>19</sup> Karen Kemp, "Geographic Information Science and Spatial Analysis for the Humanities," 2010, 31.

“absolute and finite.”<sup>20</sup> Most importantly, QGIS measures, represents, and maps *location*, not humanity. This investigation points to the requirement of humanistic application and analysis to determine the nuance and subjectivity present in spaces depicted by both analogue and digital mapping.

## **Conclusion**

It is important to investigate representations of space at the intersections of digital and analogue objects to begin to understand how the creation and projection of these spaces via these two mediums shapes our perception of their use and existence. While neither medium is inherently wrong nor deceitful, neither medium is capable of attending to all assessments of the space in which they represent. Nevertheless, utilizing digital means for humanistic inquiry can help aid discovery that would otherwise be out of the grasp and scope of a single researcher employing analogue means alone.

Further areas of research outside of this project’s scope are bountiful. One includes an investigation into the Texas Historical Commission’s system of awarding Texas historical markers. Discovering the rubric for this historical recognition, and thereafter how the location of a person, event, business, or era is digitally saved, mapped and projected could assist in exploring what is prioritized in Texas history, including how it is digitally understood and viewed.

Another area of further research includes the digitization of analogue maps themselves. Activating analogue maps by digital means creates varied and nuanced sources of evidence for

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<sup>20</sup> Ian Gregory, “Exploiting Time and Space: A Challenge for GIS in the Digital Humanities,” 2010, 61.

humanistic scholars. Other forms of digitally activating Sanborn maps outside of georeferencing include 3D-modeling of the structures surveyed, and manipulating the colors describing the building material to project them in a more tangible form other than a two dimensional object. This application could potentially be processed through software like Automatic Computer Aided Design, also known as AUTOCAD. Reckoning with the physical space the Sanborn map buildings encompassed, including height, volume, and material could lead to research and discovery of new preservation methods of historic architecture, as these fire insurance maps were specifically created with a priority focus on buildings structure and material.

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