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Interactive Cartographic Storytelling with Complex Spatio-Temporal Structures and Social Connections

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Abstract. In this paper, we describe the design of an interactive cartographic storytelling platform for the 1906 Atlanta Race Massacre, a horrific incident that had a profound impact on the civil and human rights movement in the United States. This four-day event happened at various locations in downtown Atlanta and involved many people. Although multiple books and articles have been written about the 1906 Atlanta Race Massacre, they described the past events using conventional storytelling methods. We want to tell this story from a cartographic perspective because the locations are essential to this story. We also want to connect the past with the present because most people walking on the same streets today do not know the history and significance of the locations. Furthermore, most people are unaware that some major institutions are intricately connected to the people involved in the 1906 events. Telling the story this way requires us to handle a complex spatio-temporal structure and an extensive social network, which is unusual in traditional cartographic storytelling. In this paper, we discuss our design decisions and rationals. We believe our discussion will benefit other interactive story designers who deal with similar complex stories.

Keywords: Interactive narrative design · Cartographic storytelling · Historical event · Case studies

1 Introduction

Cartographic storytelling [8,9,12,18,20,21,26] is a type of visual storytelling [16,17,24]. Although there are different cartographic storytelling genres, almost all assume a linear narrative sequence [21]. However, in telling the 1906 Atlanta Race Massacre story, we encountered a more complex spatio-temporal structure and an extensive social network.

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The Atlanta Race Massacre happened in September 1906 in Atlanta, Georgia, United States. For four days, White mobs roamed downtown streets, destroyed Black-owned properties, and beat and killed many Black people. Many prominent White politicians, journalists, and businessmen in Atlanta were directly or indirectly involved in the incident. These people had a complicated social network, and their legacies are still deeply connected to some major institutions today. Although the record of the ordinary Black people's experience in this period is hard to find, many Black business leaders and intellectuals were deeply affected by the incident. They took actions that profoundly impacted the civil and human rights movements in the US. In addition, many streets and buildings where the 1906 incident happened are still standing today. But most people are not aware of their history and significance.

Although this event made national and even international headlines at the time (Fig. 1b), it was largely forgotten until the 2000s.s. Since then, the story was told in many articles and several books [2,4,7,13,25,27]. All the publications about this event have used conventional storytelling methods, such as text and pictures. They mostly told what happened in 1906. Our work differs from the previous works in several ways. First, we want to tell the story from a cartographic perspective because locations are essential to this story. Much of the story happened on the streets, and most of the same streets and some key buildings still stand today, and they can be easily found on Google Earth. Second, we want our readers to connect the past with the present because most people are unaware of what happened in 1906 on these familiar streets. Third, we want our readers to explore the stories of the characters closely related to the 1906 event, their complicated social network, their legacies, and their deep connections to the major institutions around us today. Overall, we want to provide readers with a broader and deeper understanding of the 1906 event and its intricate connections to our surroundings.

Our story has a complicated structure. There is a location-driven story structure and a social-network-driven story structure. We also deal with three types of timelines: the timeline of the 1906 events, the timeline of a person's history and legacy, and the connection between a location in 1906 and the same location in the present day. Telling the story in such a way, we realize that our project differs from the existing interactive cartographic storytelling framework, which focuses mainly on the spatio-temporal structure. Therefore, we need to explore new techniques to tell the story.

In this paper, we describe our design decisions and rationals for the visual interface layout and user interactions. Our storytelling UI, built on the Google Earth Engine, has four synchronized components: locations, event narratives, characters narratives, and social networks. Each component allows readers to explore a different dimension of the story. The locations, event narratives, and character narratives each deal with a different timeline: locations for the past and present, event narratives for the chronology of the 1906 incident, and character narratives for the personal history and legacy of the characters.

The interactive story platform we are building will be an educational tool for learning the 1906 Atlanta Race Massacre, with a purpose similar to the New York Times’ interactive story for learning the Tulsa Massacre [11]. The techniques discussed in this paper can benefit other storytellers who need to tell stories with similar complex structures.

2 Related Work

There have been several surveys and classifications of narrative visualization [16, 17, 19, 24]. Segel and Heer [24] conducted a design space analysis of narrative visualization based on 58 examples. They divided the design space into three main features: genre, visual narrative tactics, and narrative structure tactics. They also placed narrative visualizations along a spectrum of author-driven and reader-driven approaches. Based on their framework, our project belongs to the “Annotated Graph/Map” genre, with a combination of linear and random access ordering in narrative tactics. Our story is primarily reader-driven.

Hullman and Diakopoulos [16] classified many rhetoric techniques used in narrative visualization. Based on their framework, our project used the rhetoric techniques of contrast and similarity. Ojo and Herav [19] analyzed the story typologies in 44 award-winning data stories. Our work relates to one of their story types: “Enable deeper understanding.”

There have also been multiple reviews of cartographic storytelling [8, 10, 18, 20, 21, 26]. Phillips [20] identified eight basic plots of storytelling in earth sciences, but they are not related to our telling of historical events. Tally [26] explored the relationships between map and literature, and presented the idea that writers, readers, and critics are map creators and navigators. Caquard and Cartwright [8] identified two types of relationships between map and narrative: the narrative of map and the narrative of mapping. Our work belongs to the narrative of map, presenting spatio-temporal structures of our story and their relationships with places.

Mocnik and Fairbairn [18] compared cartographic and textual representations and concluded that texts have a stronger affordance of telling a story than maps because, although time and non-spatial aspects play an important role in stories, they are structurally underrepresented in a map. However, maps are good at depicting the relationship between locations. In our project, we use both cartographic and textual representations to tell the story. Spatial relationships are depicted in Google Earth, and the time structure is presented in texts. The synchronization of maps and texts establishes the spatio-temporal structure of the story.

Cortes [10] developed a conceptual framework for interactive cartographic storytelling that consists of two main components: visual narrative tactics and rhetoric devices.

Roth [21] pointed out the limitations of the taxonomy by Segel and Heer [24] for cartographic storytelling, proposed a different set of visual storytelling genres, and identified many visual storytelling tropes. He stated that visual storytelling

genres differ by the visual or interactive technique used to enforce linearity in the narrative sequence. Given the non-linear structure of our story, we find it difficult to fit our work into Roth's genre framework. Perhaps the closest classification of our work is a combination of multimedia visual experiences and dynamic slide shows.

Many previous works have dealt with complex spatio-temporal structures in cartographic storytelling [3, 5, 6, 9, 15, 22, 23] but very few have dealt with both complex spatio-temporal and social network structure. Caquard and Fiset [9] developed a cybercartographic application for narrative cartography. They used it to visualize the spatio-temporal structure of the events in a movie. But the characters were not part of the visualization. Bogucka, et al. [5] described their cartographic narrative of cultural maps. It allows the comparison between Vienna, Paris, London, and New York. Also, it deals with multiple temporal dimensions, such as the city's spatial development, historical gender biases and modern responses to mitigate them, and the rise and fall of occupations throughout history. But there are no individual persons in the narrative.

Dos Santos, et al. [22] developed spatio-temporal storytelling techniques to analyze the relationships between violent events. The analysis focused on the location and time of the events but not on the connections between people. In another work, Dos Santos, et al. [23] used spatio-temporal storytelling techniques for intelligence analysis. Although social network data, such as Twitter, was used as an input into the system, the focus was on spatio-temporal analysis, and the social network itself was not explored.

Hewitt [15] created a cartographic narrative of the Battle of Hastings, showing the spatio-temporal nature of the events but not the relationship between the characters. Brown [6] developed a web-based cartographic narrative of the slave revolt in Jamaica in 1760–1761. The narrative is organized as interactive, animated slideshows of locations and timelines. The relationship between the characters is not explicitly explored or visualized.

The main difference between our work and the previous works is that we are dealing with a complicated spatio-temporal structure and a complicated social-network structure.

In terms of content, the New York Times' interactive story about the Tulsa Massacre [11] is the closest to our work. They used computer-generated 3D models, camera animations, maps, and historical pictures to help provide a guided tour of the event. But overall, it is largely based on a traditional journalism storytelling layout, and user interactivity is limited.

Our work was also inspired by two interactive media applications. One is the Google Earth-based game "Where on Google Earth is Carmen Sandiego?" [14]. The other is Arcade Fire's music video website "The Wilderness Downtown" [1].

3 1906 Atlanta Race Massacre and Its Legacy

A horrific event happened in Atlanta, United States, between September 22nd and 25th, 1906. White mobs roamed downtown streets, destroyed black-owned properties, and beat and killed Black people. At least 25 Black people were killed.

This incident was preceded by the 1906 Georgia governor's race between Hoke Smith and Clark Howell. Both candidates played to White fears of a Black upper class. Multiple newspapers of the time published articles about the unsubstantiated accounts of White women being attacked by Black men. White men were particularly enraged by these unjustified accounts and felt largely compelled to harm Black people. As thousands of White men gathered on Peachtree Street's Five Points during the afternoon of September 22nd, the tension from the articles and the growing economic competition between White and Black Atlantans reached a breaking point. Their violence continued up Peachtree Street where Black businessman Alonzo Herndon's barber shop was destroyed by the mob. Simultaneously, a large group of the mob moved through Marietta Street, where the US Post Office and Henry Grady statue were located. A couple of Black people were engulfed by the mob at the post office, and one Black man was killed and thrown on the steps of Grady's Statue as he tried to run away. That same night on Decatur Street, the White mob destroyed several Black businesses and harmed any Black person they saw on the street.

Many prominent White politicians, journalists, and businessmen were involved in the 1906 incident. James W. English, former Mayor of Atlanta and chairman of the City Police Commission at the time, did not prevent the riot from happening. Ernest Woodruff, the future owner of Coca-Cola, and many other business leaders signed a public petition that condemned the (mostly imaginary) alleged assaults on White women that supposedly triggered the attacks and blamed the situation on African-Americans. But the petition also expressed criticism of the Ku Klux Klan. This group of elite White citizens was closely connected, and their legacies are deeply connected to some major institutions today.

Although Black families hoped to defend themselves following the brutal events of Saturday, the Fulton County police arrested and disarmed them while the White mobs continued their rampage. In the aftermath of this event, there were several discussions between both communities to prevent any continued violence. Even though this stopped the massacre, additional issues arose that strengthened the racial segregation in the city for the long term [13].

The 1906 incident profoundly impacted the civil and human rights movement in the United States. Civil rights leaders, such as William E. B. Du Bois and Walter White, were deeply affected by the 1906 incident and advocated a more confrontational stance, which led to the founding of NAACP (The National Association for the Advancement of Colored People).

The 1906 Atlanta Race Massacre was largely buried and forgotten until 2000s when several scholars published books on this event (Fig. 1a) [2, 4, 7, 13]. There has been growing interest in this event and its legacy [25, 27].

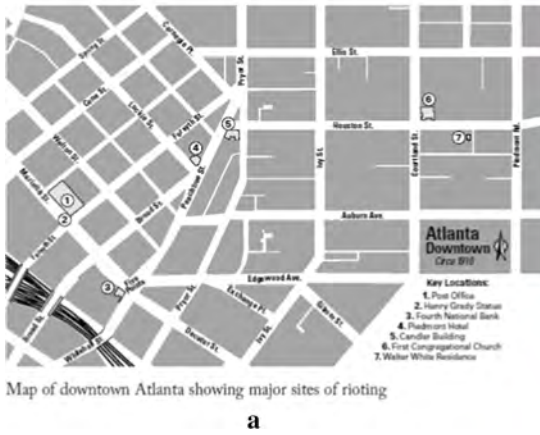


Fig. 1. a. Key locations of the 1906 event [7]; b. The cover of Le Petit Journal (France), from October 7, 1906, is titled “Massacre of Negroes at Atlanta.”

4 Interactive Narrative Design

A story event has four main components: location, time, character, and actions. Our interactive visual interface is divided into the following windows (Fig. 2).

- Window for the present day locations (Google Earth)
- Window for the past locations (showing old pictures)
- Event narrative window for the 1906 events
- Character narrative window for a character’s history and legacy (a pop-up information window)
- A social network diagram (Fig. 4)

Our goal is to enable a deeper understanding of the 1906 Atlanta Race Massacre and its legacy. To achieve this goal, we need to handle the following tasks.

- Present the events of 1906.

We decided to tell the story primarily based on locations rather than in chronological order. This is because the 1906 events mostly happened on the streets. The locations of the events are usually clear, but the timelines of some events are uncertain. In addition, some events happened simultaneously. Therefore, it is more logical to present the story by location. Readers explore the story by moving from location to location. The narrative of the events for each location is shown in the event narrative window (Fig. 2).

- Contrast the locations of the 1906 events to the same locations today.

All the streets where the 1906 events happened are still there today. Some buildings, such as the Hurt Building, the Grady Statue, and possibly the Herndon Barber Shop, are still standing. The locations of the past are shown

in old pictures (Fig. 2). There are a few photos of the 1906 event and some drawings. We also have a collection of postcards from the 1900s that show the streets and buildings of downtown Atlanta during that time. The same locations of the present day are shown in Google Earth (Fig. 2). We are exploring the possibility of superimposing and aligning old pictures on top of Google Earth.

- Present the histories and legacies of the characters closely related to the 1906 events.

For each event and location, we present the pictures of characters closely related to the event (Fig. 2). The history and legacies of each character are displayed in a pop-up character narrative window (Fig. 3b). The character's legacy is also presented in a social network diagram (Fig. 4).

- Present the social connections between the characters.

The social connections between the characters are described in the character narrative window (Fig. 3b). The social network diagram shows all the social connections in one picture (Fig. 4).

- Connect the characters to the institutions.

The connections between characters and institutions are presented in the character's narrative window. When a past institution is clicked, an old picture is displayed in the past location window. When a current institution is clicked, the Google Earth window will display the location of the institution.

- Present the connections between the institutions, both past and present.

The connections between the past and current institutions are presented in the social network diagram (Fig. 4). If an old picture is available, the old picture and the present-day location in Google Earth will be displayed.

Figure 3a shows the internal structure of our story.

4.1 Google Earth

Google Earth (Fig. 5) was selected for development due to its geolocation tools and accessibility. Google Earth's street view is a powerful visual tool that allows both the developer and the user to customize the perspective of a real-life location, allowing a simultaneous presentation of the past and present when placed alongside historical images of the same location. The ability to rotate 360° within the location and "walk" virtually along the streets of downtown Atlanta also allows for greater user immersion and interactivity, effectively placing the user on the physical route of events during the 1906 Atlanta Race Massacre.

Additionally, Google Earth projects can be further customized using HTML, CSS, and JavaScript. By editing the Google Earth info box and creating an HTML/CSS template, an adaptable code framework that included location, non-linear movement, and character connections was formed. In combination with Google Earth's drag-and-drop UI, our project could be shared and edited to suit other complicated historical stories as necessary.

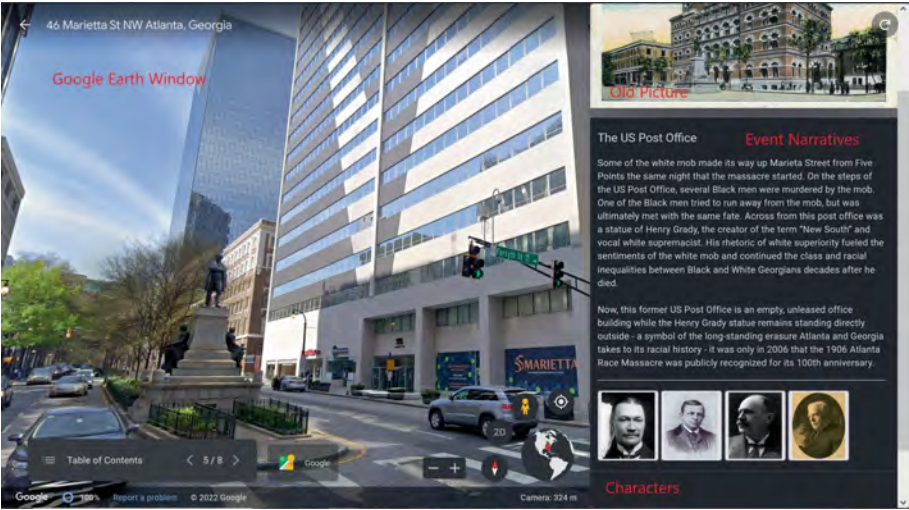


Fig. 2. The visual interface of our interactive narrative

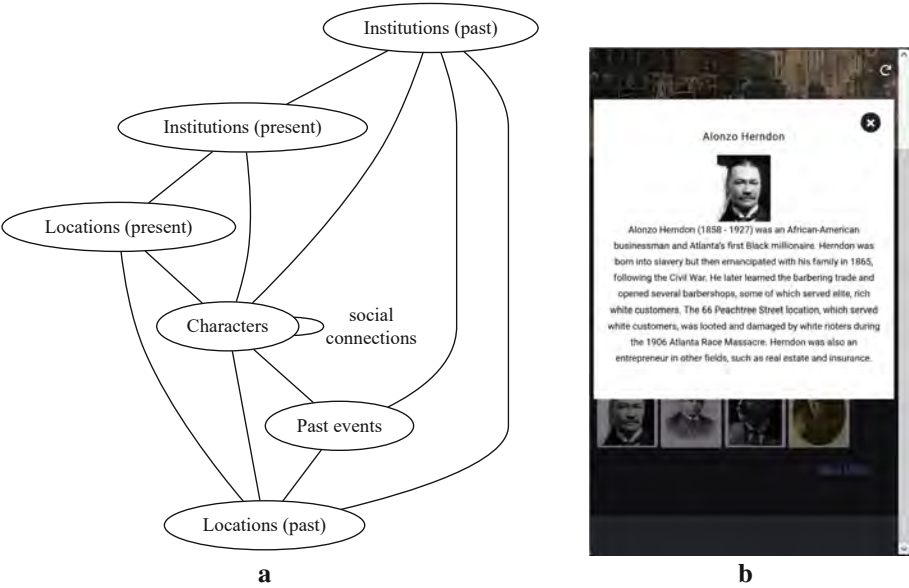


Fig. 3. a. Internal structure of our story; b. Character information window



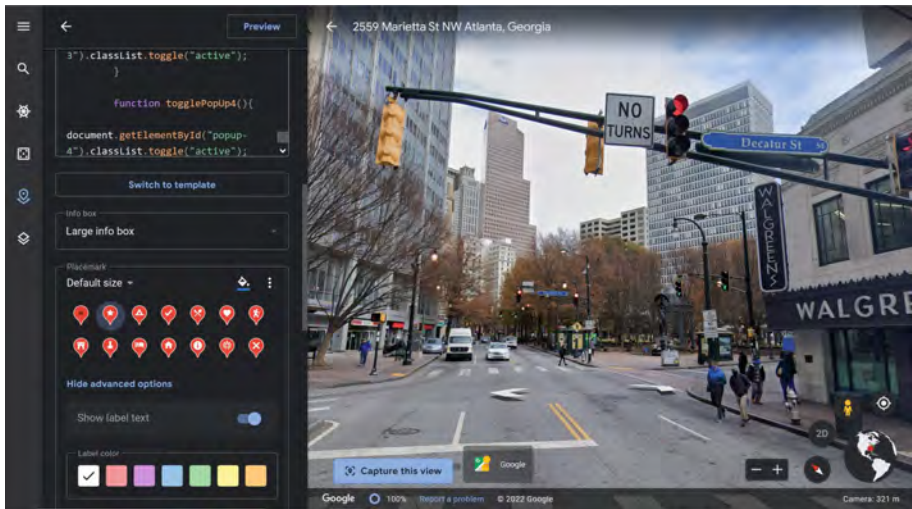


Fig. 5. Google earth studio

4.2 Locations

The 1906 Atlanta Race Massacre happened around the streets of downtown Atlanta. The key locations include Five Points (where the mob congregated), the old Post Office (where a Black men was killed), Henry Grady Statue (a rallying point for the mob), Herndon's barber shop (Black-owned business), Candler Building, Fourth National Bank, Piedmont Hotel, etc. [7]

We have completed the narratives for four key locations: Five Points, Henry Grady Statue and the Old Post Office, Herndon's barber shop, and Candler Building. Our project is still a work in progress, and we are continuing to add more locations.

Figure 6 shows the visual interface for Five Points, including the Google Earth window, past location window, narrative about the 1906 events, and the related characters. When a character's picture is clicked, a window will display the narrative for that character (see Fig. 3b). Figure 2 shows the visual interface for the old post office and the Henry Grady Statue. The statue is still there today. Figure 7 shows the visual interface for Herndon's Barbershop. Figure 8 shows the visual interface for the Candler Building, which is still standing today.

Since this is a location-driven narrative, we provide two interfaces for readers to navigate the story. One is a slide show-based navigation where users can click the arrows in the Google Earth window to go to different locations (see Fig. 6). Another is a random access navigation control where readers can select locations on a Google Map view (Fig. 9).

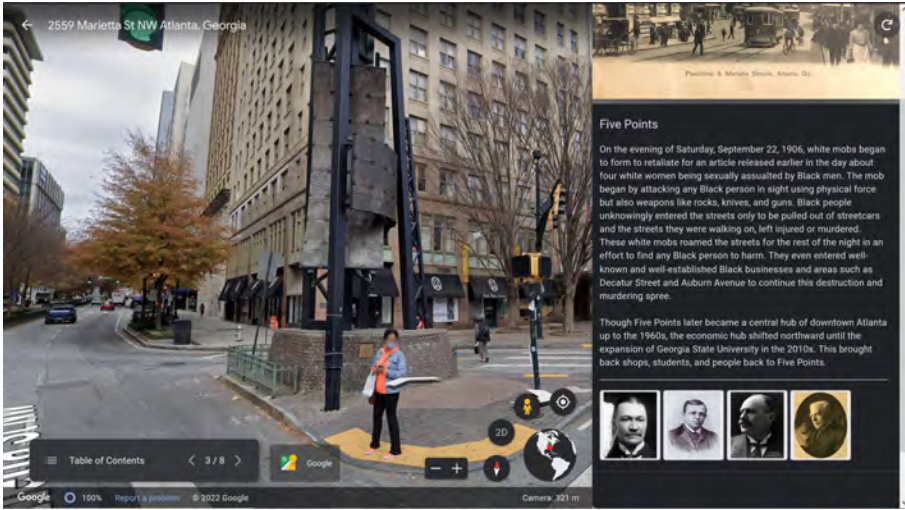


Fig. 6. The visual interface for five points. This was where the riot started. The mob moved from this location in all directions.

4.3 Time

There are three types of timelines in our story. First, there is the timeline of the 1906 events, which contains some uncertainty. We present these events in the event narrative window (Fig. 2, Fig. 6, Fig. 7, and Fig. 8). As discussed earlier, we have adopted a location-driven structure. But for each location, the event is described chronologically. Second, there is the history and legacy of each character. This part of the story is told chronologically in the pop-up character narrative window (Fig. 3b). Third, there is the comparison between the location of the present day and the same location in the past. This is achieved by displaying the Google Earth (location of the present day) window and the “location of past” window side by side (Fig. 8).

4.4 Characters and Their Legacies

A key feature of our interactive narrative design is to let readers explore the intricate social connections between the characters and their connections to the major institutions in Georgia. This is the main difference between our work and the previous descriptions of the 1906 Atlanta Race Massacre. We want to show how the past is connected to the present, not just via locations but also through social connections because most people are unaware of such connections.

For example, the 1906 Atlanta Race Massacre was the key event that led William E. B. Du Bois co-founded NAACP. Walter White, who witnessed the 1906 events, later became the Chief Secretary of NAACP. Alonzo Herndon, whose barbershop was attacked by the White mob, founded Atlanta Life Insurance, whose successor Atlanta Life Financial Group is still operating today, with

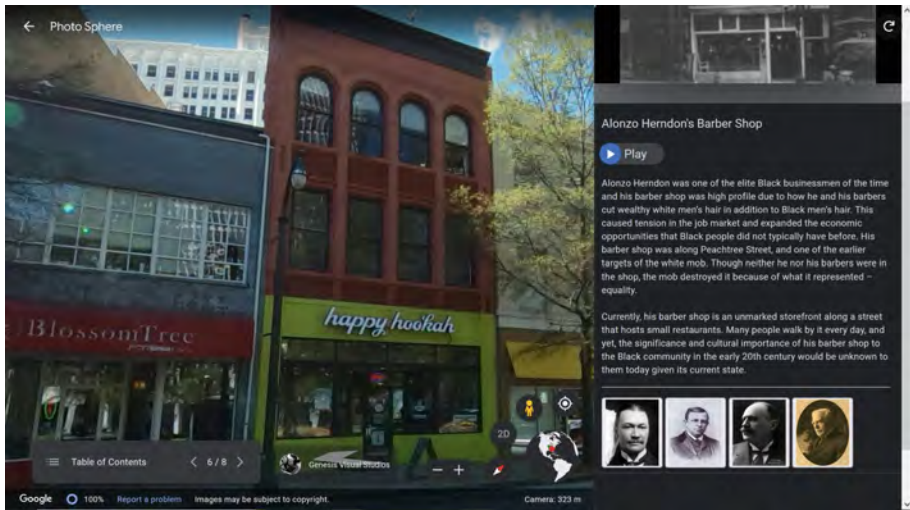


Fig. 7. The visual interface for Herndon's barbershop. This business was attacked by the mob. Based on the old picture, it seems that the old building is still there. But we have not confirmed it.



Fig. 8. The visual interface for the candler building. This is a key landmark around which the riot happened. The building is still standing today.

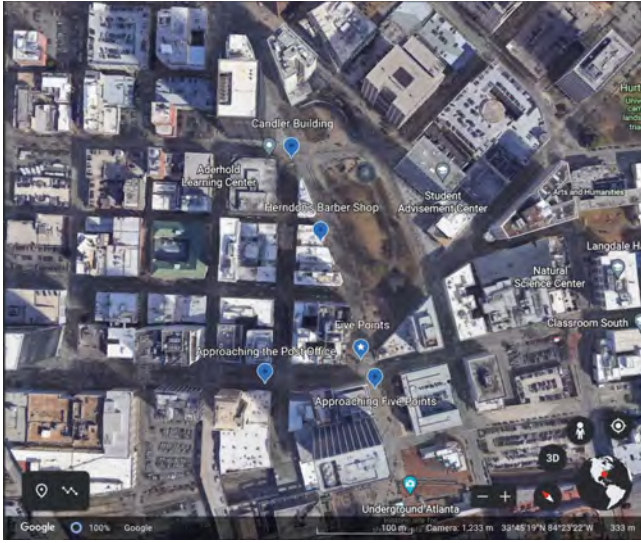


Fig. 9. Key locations related to the 1906 Atlanta Race Massacre. A reader can click on a location and read the narrative.

its headquarter in downtown Atlanta. James W. English, a former Mayor of Atlanta and a key figure in the 1906 events, was the president of the Fourth National Bank of Atlanta (a key location of the 1906 events), whose building is now occupied by Georgia State University’s Andrew Young School of Policy Studies.

Although such connections can be presented in texts, a more effective method is data visualization. We have created a social network diagram (Fig. 4) that shows the connections between the major characters, their legacies, and their connections to the major institutions in Georgia. The data visualization is created with GraphViz. We plan to convert it into an interactive social network diagram using Plotly so that a reader can click on a character or an institute to read the narrative and see the location.

5 Conclusion and Future Work

We have presented the design of interactive cartographic storytelling for the 1906 Atlanta Race Massacre. Our goal is to provide an educational platform that enables a deeper understanding of this event and its legacy. We not only want to tell what happened in the past but to connect the past with the present. We also want to explore the histories and legacies of the characters closely related to the 1906 event and their intricate connections with the institutions around us today. To achieve this goal, we must deal with a complex spatio-temporal story structure and an extensive social network. In this paper, we discussed our design decisions and implementations.

This project is still a work in progress. We will continue to add narratives for additional locations. Multimedia content such as audio and voices will be added. The social network will be expanded and converted to an interactive diagram. We also plan to conduct user studies to evaluate the project.

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