Applying the Panopticon Model to Historic Plantation Landscapes through Viewshed Analysis

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> Without any physical instrument other than architecture and geometry, [the Panopticon] acts directly on individuals; it gives "power of mind over mind."[1]

Settlement, architecture, and use of space are familiar themes for historical archaeologists as well as historical geographers. Both economics and power are prominent in the archaeological analysis of plantations. The conscious decision-making on the part of planters to maximize profits, exercise surveillance and reinforce the subordinate status of enslaved people resulted in "a geography of power." The surveillance and control model, suggested by Terrence Epperson, focuses on the issue of visibility as a primary motive for planters to design spaces to "make things seeable" while also producing "spaces of constructed invisibility" to monitor slaves' behavior and conceal their presence.[2] The panoptic plantation reinforced the master's control over the enslaved population through the intervisibility between the big house and the slave settlement. Cumulative Viewshed Analysis and other geostatistical methods are employed in this paper, to critically assess the relative utility of panoptical model as applied to plantation archaeology on a regional scale. Empirically, the paper is set along the East Branch of the Cooper River in South Carolina, where the political economy of rice plantation production structured the placement of slave settlements.

Plantations modeling the panopticon

The logic behind the panopticon is that the structure or layout of buildings mold behavior; therefore, bodies in space become the medium through which the struggle for control takes place. In the application of the panopticon as a model for plantations, historical archaeologists often conflate the concepts of Bentham and Foucault. Foucault is often credited with explaining the concept of visibility as a tool for surveillance and control. Foucault's concept, however, differs from Bentham's in that the former subscribes to the idea that those being surveilled will not only be aware of

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being surveilled but will also engage in self-surveillance between and among themselves. In contrast, Bentham's model focuses directly on how landscape structure, in terms of buildings and layout, impose surveillance and control from a particular point. Bentham's model should be considered when exploring the plantation as a panopticon. I argue that using one approach over the other results in different information when exploring the plantation as a panopticon. Further, I argue that within the plantation system there are multiple observation points rather than only one.[3]

Historical archaeologists James Delle, Terrence Epperson, Theresa Singleton, and architectural historian Dell Upton have applied the panopticon model to explain how planters spatially exercised their power to achieve domination over the enslaved population. For instance, at Sherwood Forest and Clydesdale plantations in Jamaica, Delle examines how colonial elites manipulated landscapes that may have allowed land owners to be in visual sight lines, and possibly aural communication, with each other and thus allowed planters to exert control over the entire length of the Negro River valley of eastern Jamaica. Singleton summarizes that "Delle demonstrates how the placement of the overseer's house served as a central point in the surveillance in much the same way a guard tower does."[4]

Focusing on how spaces are designed to make things seeable in a specific way, Epperson argues the possible linkages between panopticism in the landscape and political philosophies by examining the ramifications of a panoptic reading for preservation and presentation at Gunston Hall and Monticello, Virginia. For instance, Epperson argues that although enslaved people actually constructed the gardens and landscape, Mason and Jefferson manipulated space so as to render the enslaved invisible.[5]

Arguing that a roof, a second level of the slaveholder's house, a rooftop terrace, or similar construction are structures where owners and overseers could observe activities taking place within the slave settlement (as well as other locations on the plantation), Singleton examines the spatial dialectal relationship between slaveowners' control of plantation space and enslaved laborers' resistance of that control in Cuba. Singleton argues that the bell tower at Angerona and El Padre located in present day Cafetal del Padre in the Havana Province possibly served as a surveillance device.[6] In examining eighteenth-century Chesapeake tobacco plantations, Upton demonstrates that the planter's house serves as a center of power constructed to dominate the landscape visually. According to Upton, the planter's house would occupy higher ground than other buildings, allowing it to be seen from a long distance, and set apart from the surrounding countryside by fences and terraces.[7] While the above archaeological and architectural studies focus on individual plantations as a single entity from the viewpoint of the owner or overseer, Delle and Whitley attempt an interpretation of the plantation on a regional scale. Despite their regional focus they, too, take the plantations out of context of their surrounding landscapes by emphasizing the manifestation of that landscape on individual plantations.[8]

Delle uses viewshed analysis as a tool to see how surveillance operated on nineteenth century coffee plantations at two scales in his examination of big houses in the aforementioned Negro River valley. First, Delle uses a single viewshed of seven big houses to examine how the landscape was used to reinforce visual domination at the regional scale. Second, at the local scale, Delle interprets how domination was reflected in the specific layout of two neighboring plantations—Sherwood Forest and Clydesdale. Delle identifies two positions at the overseer's house at Clydesdale as possible surveillance points: (1) the veranda, which provided views to the quarters and fields and (2) the entrance door, which allowed views of the domestic quarters. Delle calculates the viewsheds from three meters (the height of a man on horseback) above the surface without taking into account sight line obstruction by tree growth stating that one cannot know at this point how much land was cleared. Delle concludes that the big houses were strategically placed to "encompass the location of at least two other great houses" thereby creating a communication network with one another.[9]

Similarly, Thomas G. Whitley considers the surrounding regional data yet specifically uses localized archaeological and environmental datasets in examining the complex cognitive landscapes of bondage at Ford Plantation, which historically comprises three antebellum rice plantations—Silk Hope, Cherry Hill, and Dublin/Richmond (Henry Ford's 1937 mansion)—on the Ogeechee River in Bryan County, Georgia. Whitley employs Geographic Information Systems (GIS) in three primary ways: (1) as an information management tool, (2) as a reconstructive-analytical tool, and (3) as a cognitive-interpretive tool. Whitley's model predicts integral relationships among space, labor control, risk management, and social identity that he refers to as "the cognitive landscapes of bondage." Whitley uses GIS as a cognitive interpretive tool to examine how ideas and behaviors influenced the way the enslaved population envisioned their environment. Looking at the local level and including the surrounding regional data, Whitley explores three perspectives regarding cognitive landscapes: coerced labor, communal and ritual space, and motivation for escape. At Cherry Hill Plantation, Whitley uses four "surfaces" to model the location of African American ritual space. Two surfaces model the cost distance from the overseer's house and along the main entrance road as well as the road to the rice mill. Cost distance is a procedure for determining least cost paths across continuous surfaces, typically using grid representations. Sometimes a straight line is not the easiest path between two points, even though it is the shortest; the GIS calculates accessibility based on cost of travel rather than a simple function of distance. The other two surfaces simulate the viewshed analysis from the overseer's house and the two roadways. Whitley concludes that the ability to model material culture, environmental parameters, and analytical surfaces contributes to making cognitive interpretations.[10]

Do visibility, distance, and location support a panoptic plantation model? Employing Cumulative Viewshed Analysis and other geostatistical methods, I examine the relative utility of the panoptical model as applied to plantation archaeology on a regional scale, which investigates several plantations as an integrated community rather than just individually. This study is a simplified representation of the role viewshed and intervisibility played in creating a landscape of surveillance and control on Carolina rice plantations. Acknowledging that planters exercised surveillance and domination from various points on the landscape, this study builds upon previous works that use the big house as a point of departure for recognition of a landscape of surveillance. The focus of this preliminary analysis is to model intervisibility of slave villages on the landscape from the viewpoint of multiple plantation big houses to the slave settlements. The results identify areas within which it would be likely for the planters to maintain visual control over their plantations (panopticon model) on a regional scale.

Study area

Located north of Charleston, South Carolina, in the Lower Coastal Plain and on the northern boundary of the Sea Island Coastal Region of the South Atlantic Slope, the Cooper River is a relatively short river system (Figure 1). The Cooper is formed about twenty miles north of Charleston by the confluence of the East branch, which flows southwest from Huger, South Carolina, and the West branch, which flows southward from Moncks Corner, South Carolina. Historically, the study area comprised territory from St. John's Berkeley Parish along the north bank of the East Branch of the Cooper River, and St. Thomas and St. Denis Parishes along the south banks of the East Branch of the Cooper River. The physical landscape along either side of the East Branch includes swamps as well as creeks and branches with mixed pines and hardwoods on the uplands.[11]

Throughout the late eighteenth and early nineteenth centuries, rice plantations flourished along the East Branch of the Cooper River. Using historical maps and documents, Leland Ferguson and David Babson have developed a composite map of the East Branch of the Cooper River focused on visualization of where people lived, the settlement pattern, and the development of the rice agriculture. It is not the purpose of this paper to discuss the development of various plantation layouts in detail, which can be found in the research of Merle Prunty and John Vlach; the cartographic work of Ferguson and Babson, however, suggests the application of a

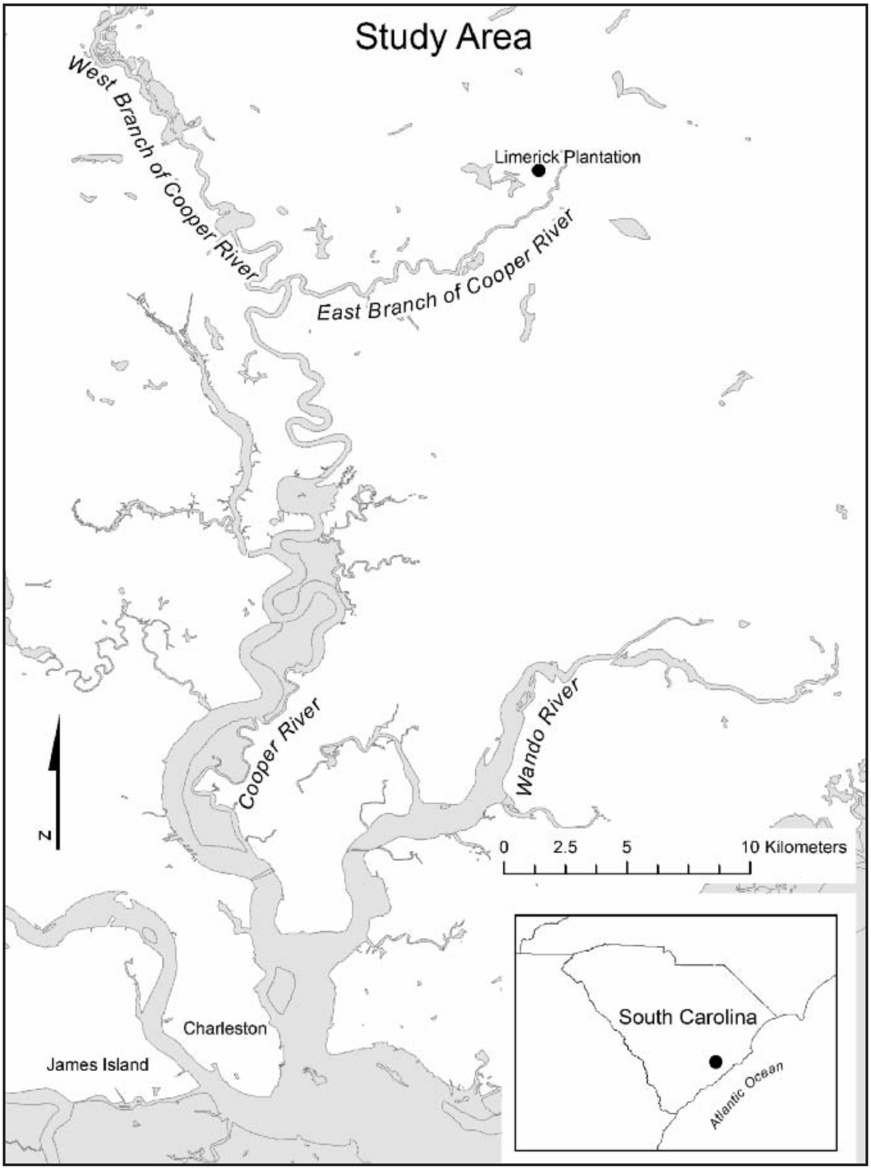

Figure 1. East Branch of Cooper River (showing Limerick Plantation) twenty miles north of Charleston, SC.

typical panoptic plantation layout where the big house was usually located on the highest point surrounded by gardens, barns, slave quarters and over looking rice fields and waterways. Additionally Ferguson and Babson note that large settlements, except So-Boy and Boss's, were located on promontories above twenty feet (6.10 meters) in elevation and within sight of the marsh, as well as, within one mile of the main river channel and one-half mile along the creeks. The overseer/planter's house, analogous with Bentham's central guard tower, would have served as the central point of surveillance. Complete visibility of the plantation landscape becomes an important determinant of spatial layout.[12]

Viewshed analysis

GIS, as a tool, can assist archaeologists to progress "from inventory to analysis, to addressing integrated decision making systems." Although it is not necessary to use GIS to understand spatial relationships, studies including GIS are greatly enhanced by its powerful analytical tools. The application of GIS methods can be used as a starting point to provide graphic representations of archaeological areas.[13]

A single viewshed displays what can be seen from one observer point on the landscape. A multiple viewshed requires visibility from multiple observer points. Within the generic toolbox of ArcGIS, standard functions provide full details for implementing the viewshed function. Viewshed and visibility analysis provide a rapid, quantifiable and repeatable means of investigating the interaction of human vision and the landscape by applying an algorithm based on how the topography of a particular landscape affects the visibility of that landscape (Figure 2). Next, the start and end locations are used as input points along with the height of the observer above the surface in running the line-of-sight calculation algorithm, the smallest analytical unit. In a viewshed analysis, each raster cell within a Digital Elevation Model (DEM) is treated as a target. A raster is a spatial data model that defines space as an array of equally sized cells arranged in rows and columns. Identifying whether or not a cell has a topographically unobstructed line of sight from an observation point, the resulting binary map reveals whether that cell is visible or not visible. This study employs modifications to the generic viewshed functions, including Tadaheko Higuchi's viewshed analysis distance calculation and David Wheatley's Cumulative Viewshed Analysis (CVA).[14]

Landscape planner Tadaheko Higuchi offers a method for holistic viewshed analysis that relies on the geometric dissection of the landscape to reveal its many viewshed components. Higuchi's viewshed model replaces undifferentiated viewshed analysis with a field-of-view calculation structured around quantifiable view-distance classes. According to

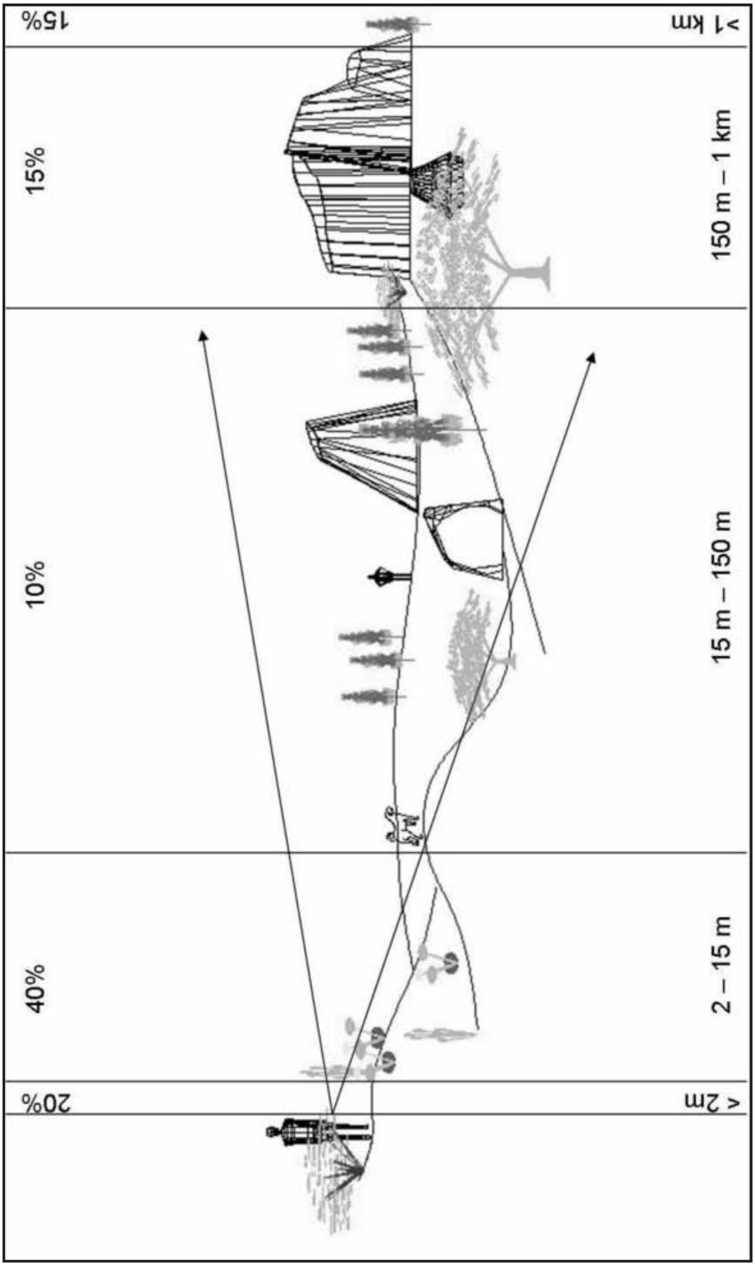

Figure 2. Visibility in a viewshed incorporating Tadaheko Higuchi's viewshed analysis distance calculation. Adapted from Laura La Kose, "Viewing Landscape Though GIS: The Higuchi Viewshed Approach," Thesis, West Virginia University (2004), Figure 2.3, page 16. Used with permission.

Higuchi, people have a tendency to view distances differently. People spend sixty percent of their time viewing objects less than fifteen meters away. Of that sixty percent, forty percent of their time is spent viewing objects within five meters and twenty percent on objects less than two meters away. Approximately ten percent of time is spent viewing objects in the middle ground, between one hundred fifty and one thousand meters, while more than twenty percent of viewing time is spent on objects in the distance. Based on Higuchi's view-distance classes, a differentiated viewshed could be weighted as follows: (1) near distances of less than fifteen meters equal 0.60 or sixty percent, (2) middle distances of fifteen to one hundred fifty meters equal 0.10 or ten percent, and (3) horizon distance equals 0.30 or thirty percent. Weighting the distances is not necessary in this study because the objective of the planter or overseer is to be seen at a conspicuous observation point intended to draw attention. Higuchi uses landscape rather than cross cultural samples to derive his classes. Percentages should vary depending upon one's intention such as sightseeing verses surveying, long verses short distance targets, etc.[15]

Wheatley introduces Cumulative Viewshed Analysis (CVA) to test intervisibility in his examination of long barrow locations in Avebury and Stonehenge regions of southern England. While multiple viewshed analysis involves the union of a series of individual views that yield an in-view or out-of-view map, CVA involves the generation of individual viewsheds that are then summed using simple map algebra to create a single composite map which reveals how often a portion of the landscape is in-view. Summing the viewshed on a cell-by-cell basis increases the value by one for each cell when that cell is in the viewshed. A point-select operation (select by attribute) on the surface reveals the number of other cells that are visible from that point. An adjustment must be made to account for the line of sight of the point to itself. This is performed by either subtracting one from the cumulative viewshed surface before the point select operation or by subtracting one from the result of each point selected. The resulting surface is considered as a statistical population. The viewsheds are applied to a "barren landscape" without regard to height of the observer, angle of view, vegetation, buildings, or temporal and cyclical changes.[16]

There are limitations to GIS-generated viewsheds. First, viewshed models require a three-dimensional model (Digital Elevation Model or Triangulated Irregular Network) of the study area with elevation data embedded into it. The quality and accuracy of the Digital Elevation Model (DEM) is the most important concern in visibility studies; small variations in topography near the observer are more likely to have a greater effect than similar variations further away. For this reason, Light Detection and Ranging (LiDAR) imaging is preferred over traditional DEMs, especially when the topography is relatively homogenous. LiDAR produces a vector-based file containing points, lines, and polylines rather than a continuous surface. A LiDAR DEM is created by converting the vector file to a raster file, and the resulting surface contains considerable detail.

Closely associated with the DEM is the issue of changes in topography through time; modern landscape topography may be very different than that in the late eighteenth and early nineteenth centuries, yet it is the modern topography that is the foundational data layer in viewshed analysis. Furthermore, DEMs present the ground surface as bare of vegetation, thereby creating the problem of determining the historic extent, height, and seasonality of vegetation cover. (There are tools that capture vegetation in LiDAR.) Because the study area on the East Branch is little changed topographically, and many features found on the late eighteenth and early nineteenth century maps can be seen on the ground today, the use of modern topography is not a problem. However, only topography is considered in this study; additional factors affect the accuracy of the viewshed analysis, particularly vegetation as described above.

The presence or absence of trees/plants has a dramatic effect on visibility and invisibility. Marcos Llobera presents a new viewshed algorithm that calculates the probability of locations being visible in the presence of vegetation. Llobera argues that the probability of a location being visible across a volume of vegetation decreases exponentially depending upon density. While this new algorithm extends current GIS viewshed capabilities, it remains theoretical and has yet to be tested empirically.[17]

Technologically, viewshed analysis assumes perfect reciprocity – all points are equally intervisible regardless of direction. In this study's context, however, visibility from A to B (for instance, master to slave) does not imply visibility from B to A. This is particularly important in analyzing hidden "sites from which one could view but not be viewed" or, in this case, where the desire is to observe without being observed (B to A) as in the panoptic plantation model.[18]

In GIS-based visibility studies, the viewpoint is a static representation even though observation points may represent a vantage based on the height of an adult person radiating outward in three hundred sixty degrees from a rigidly fixed point. Visibility studies can be made more fluid by either (1) generating multiple viewsheds for points along a pre-determined pathway or (2) integrating virtual reality (VR) modeling, which enables full mobility and interaction within the study area.

GIS has been used by archaeologists to calculate line-of sight between two points since the early 1990s.[19] In "Vision, Perception and GIS: Developing Enriched Approaches to the Study of Archaeological Visibility" Stephen Kay and Timothy Sly state that "the purpose of visibility analysis is to explore the visual features across a landscape, where the concept of visibility has both cognitive and perceptual implications." As a tool, viewsheds attempt to explore cognitive past acts. Kay and Sly illustrate how CVA, used in a Cultural Resource Management (CRM) context, aids in understanding the functionality of the beacon system during the English medieval period. In their study, individual locations formed "part of a complex scheme of visual pathways providing a link in a chain." To perform its function, the beacon must be visible at minimum with one other beacon. Applying this analogy to the plantations along the East Branch of the Cooper River, the reverse is important because the functionality of the panopticon is predicated on the principle that at least one point of observation is visible. To understand the cognitive landscape, it is useful to consider the importance of visibility as a vital component of a panoptic system.[20]

Another way to perform a cumulative viewshed analysis is to create a grid of points in a shapefile in ArcGIS as a base of data points to test visibility across the entire landscape, x number of points (x_{max}) at x meters apart. The resulting cumulative viewshed surface represents "for each cell within the landscape, the number of sites with a line of sight from the cell." The viewshed is then reclassified based on the total number of categories (x_c) since the greatest value is x_c rather than x_{max}. With either method, no single point provides a view of the entire landscape and no single point is completely visible from all other points.[21]

Lynsey Bates employs this method in his study of Stewart Castle, an eighteenth century Jamaican sugar plantation. Bates examines the possibility of slave appropriation of space at Stewart Castle. Using cumulative viewshed and anisotropic cost surface analyses, Bates argues that topography, land-use strategies and hierarchies developed on this plantation fail to support the surveillance argument. The planter's and overseer's houses were not at optimal locations for surveillance. Bates's viewshed analysis reveals that the slave settlement was not visible from the overseer's house, which was located near the sugar works, and only half of the slave settlement was visible from the Castle. Bates infers that the Stewart family "may have chosen a location [for their residence] that provided a prominent view of the surrounding area rather than [other plantation structures]." Bates argues that neither the surveillance model nor movement-minimization arguments apply. The position of the Castle Plantation house provided a broader view of the property rather than direct observation of the slave activities. Bates conjectures that without direct supervision, slaves' acquired knowledge of the landscape provided them with the possibility of appropriating space within the plantation.[22]

Data and method

Using ArcGIS 9.3 spatial analysis generic viewshed analysis tool, coupled with other models, I determined how much of the slave settlement landscape along the East Branch of the Cooper River could be viewed from the big houses of area plantations. DEMs for six 7.5 minute USGS quadrants (Cainhoy, Huger, N. Charleston, Kittredge, Bethel, and Cordes), downloaded from the South Carolina Department of Natural Resources GIS database, were mosaicked together with the ArcGIS topo to raster function and converted to ESRI GRID format. The topo to raster function interpolates information using a "drainage enforcement" rule, which assumes that water is the primary force that shaped landscapes and therefore provides a nearly accurate representation of streams and ridges. The resulting map estimates the elevation at the cell level. The mosaic was not perfect as some edge effect errors occurred in the DEM raster. Edge effect errors occur when several individual images or photographs of adjacent areas are merged into a single raster dataset. Sometimes the data at the edge of the individual images are not interpolated properly, which results in either missing or inaccurate data. In addition, there are noted discrepancies between the DEM raster and the USGS contours as recorded by Ferguson and Babson. For this reason, Light Detection and Ranging (LiDAR) imaging would have been preferable over DEM since the topography of the study area is relatively homogenous. Because LIDAR imaging is expensive and not available at this time for Berkeley County, analysis was performed using the DEM raster. A digitized version of the Ferguson/Babson map served as the base layer for the creation of a shapefile for determining observation points, placed at the center of each settlement (Figure 3). Polygons were drawn around each plantation to aid in the location of land plat boundaries. Viewsheds were created with 1:24,000 DEMs with cell resolution of thirty meters, which is very coarse for work at the scale of this analysis. For observation points, two point shapefiles were created. One shapefile contained points located at the center of each big house and the other shapefile contained points located at the center of each slave settlement as identified by Ferguson and Babson. Modifications to the generic viewshed functions were added: (1) Wheatley's CVA to combine individual viewsheds to create a single composite map revealing how often a slave settlement is in-view from multiple big houses and (2) unweighted Higuchi's view-distance classifications to designate the limits of effective vision.

This study focused primarily on the area between one hundred fifty meters and one thousand meters. Viewshed analysis assumed the observer has a strong acuity of vision; however, being able to see and

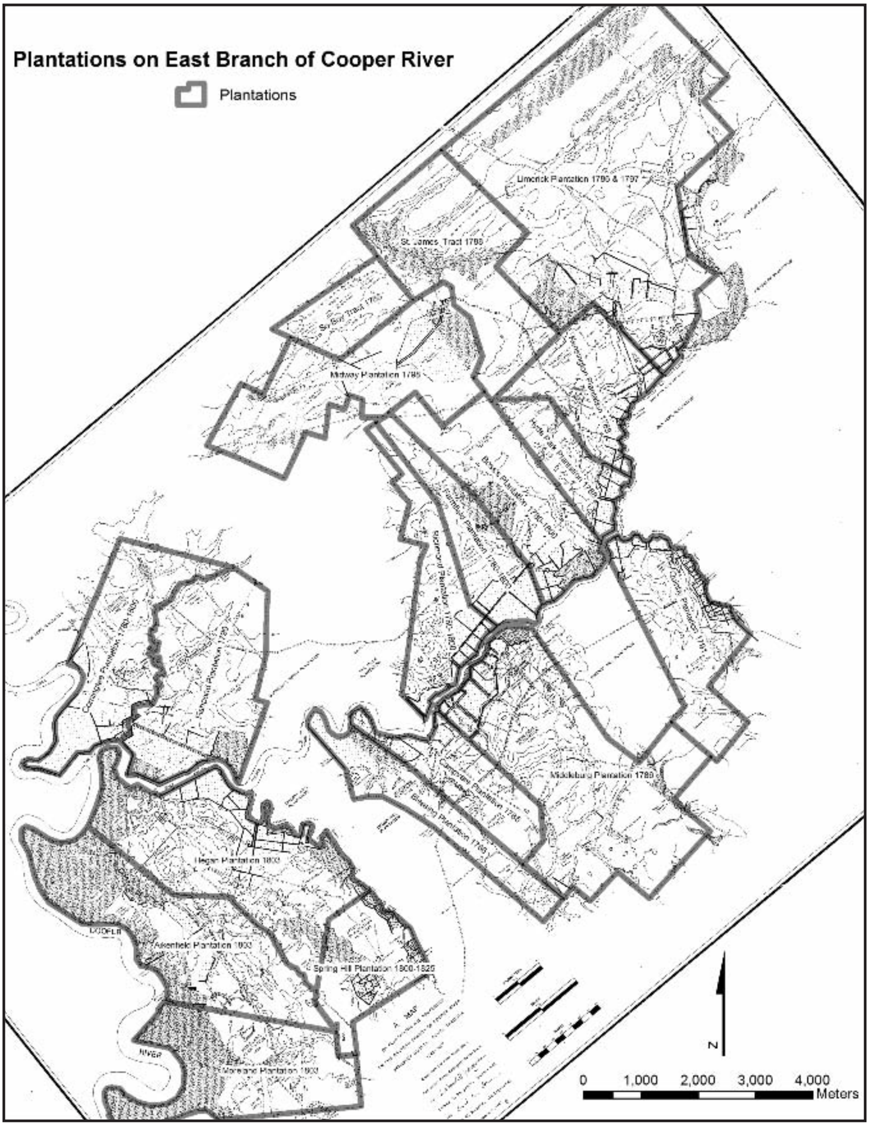

Figure 3. Plantations along East Branch of Cooper River. Outline of plantations superimposed over Ferguson/Babson Composite Map dated 1986. Used by permission.

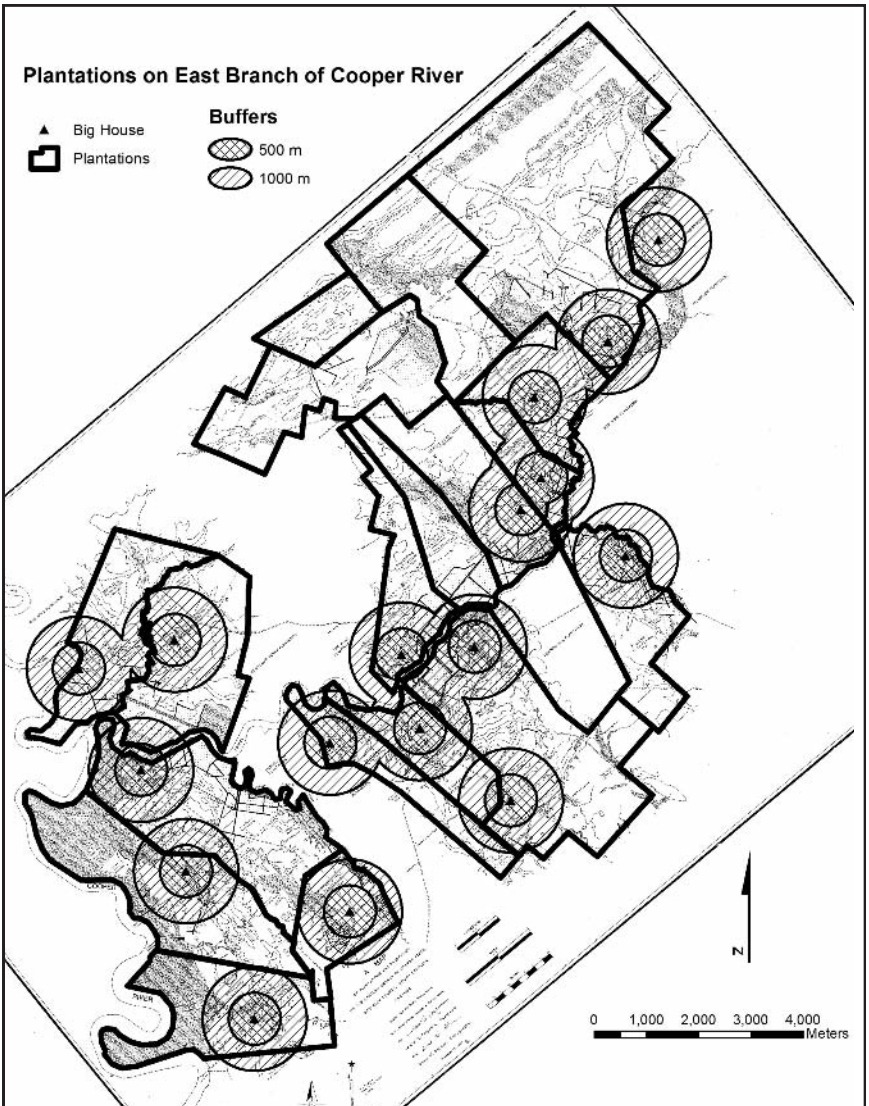

Figure 4. Plantations along East Branch of Cooper River superimposed over Ferguson/Babson Composite Map dated 1986. Buffers were placed around the plantation big houses. The buffers revealed two clusters.

recognition of what is seen are very different. Visual clarity decreases with an increase in distance. Beyond one hundred fifty meters, some degree of prior knowledge of the area is necessary unless a highly visible feature marks the area. Geoffrey Loftus, psychology professor at University of Washington, argues that the average person could see another person's head at a distance of five hundred feet (152.40 meters), although just as a blur. Based on the human tendency to view distances differently, buffers were created at one hundred fifty meters and a thousand meters to represent Higuchi's view-distance classes (Figure 4). For this particular analysis, the buffer distances were not weighted; however, it is recommended that future analysis contain differentiated weightings.[23]

This study proposed to test intervisibility between multiple observer points, therefore, a map was created that assigned each cell a value based on whether a particular cell is visible or not visible. This viewshed analysis was applied to a "barren landscape" without regard to height of the observer, angle of view, vegetation, buildings, or temporal and cyclical changes. In applying CVA to test the panopticon plantation model, it was first necessary to determine if the big houses were positioned strategically to enhance surveillance. Single viewsheds for each plantation big house were created and then combined using map algebra to produce a multiple viewshed. To refine the analysis CVA was performed to test the intervisibility from big house to big house. When a particular cell is visible by only one big house, it returns a value of one; two big houses are represented by a value of two and so on. The purpose of this analysis was to determine if there was any intervisibility among the big houses and if so, how extensive. Due to the low topography of the area, high intervisibility was expected along the river. The settlements along the upper East Branch are typical of this arrangement. Based solely on topography, cartographically all plantations appear to support the panoptic model of surveillance to varying degrees.

Based on the locations of the one thousand meter buffer zones, two potential clusters of intervisibility emerged from the processes described above. The next step was to test the intervisibility of the big houses with slave settlements in the two clusters. First, single viewsheds for each plantation from the viewpoint of the slave settlements within its cluster group were generated to create a surface representing visibility. Next, the viewshed was compared with the big house CVA using the one thousand meter buffer zone.

Results

The panoptic plantation model asserts that the planter's big house and/or the overseer's house were located at points from which the planter or overseer could easily observe agricultural production and life in the slave settlement. Previously cited archaeological and architectural studies assert that planters used a carefully designed plan of physical and psychological dominance to assert control. The location of the big house on high land and tidal rice fields on lower lands along the banks of the river conforms to "a geography of power" that reinforced the social hierarchy of the white minority at the top. The interpretation of the results of this analysis must remain tentative at this point. Additional documentation is needed to complete the Ferguson and Babson map to determine whether or not the connectedness of the plantations maximized control over the entire region. In this study, CVA indicates that plantation layout along the East Branch of the Cooper River supports intervisibility of big houses along the river but only provides limited support for purposes of surveillance and control of the slave settlements. While these results may answer some questions about intervisibility regarding the panoptic plantation model, future studies should refine this methodology by considering additional variables not tested here.

Due to the visual complexity of the CVA results, the maps illustrating the discussion that follows (Figures 5 and 6) show only the single viewshed analysis, in conjunction with the visual acuity buffers discussed above. These viewsheds indicate visibility between the big house and the slave settlements.

Cluster I

Cluster I consists of the big houses of the following plantations: Windsor, Limerick, Kensington, Hyde Park, Boss's, and Quinby. The viewshed analysis of Cluster I reveals that most of the area within the one thousand meter slave settlement buffer zones located along the East Branch are visible from at least one big house with possible limited visibility by as many as five big houses. This is possible because several slave settlements are included in the central settlements that also contain the big house. However, three slave settlements—two at Limerick and one at St. James—are not within the viewshed of any big house. St. James is the only plantation that does not contain a big house. Closer examination of the individual plantations reveals more details.

From the big house at Windsor Plantation (Figure 5a, located just to the east of Limerick), it appears that two, possibly three, other big houses could view some portions of the area within the buffer zone. Since only the location of the big house for this plantation is recorded by Ferguson and Babson, additional information is needed to determine if any slave settlements fall within this zone. One of Limerick's remote slave settlements falls outside of the buffer zone as well. Therefore, one cannot conclusively state

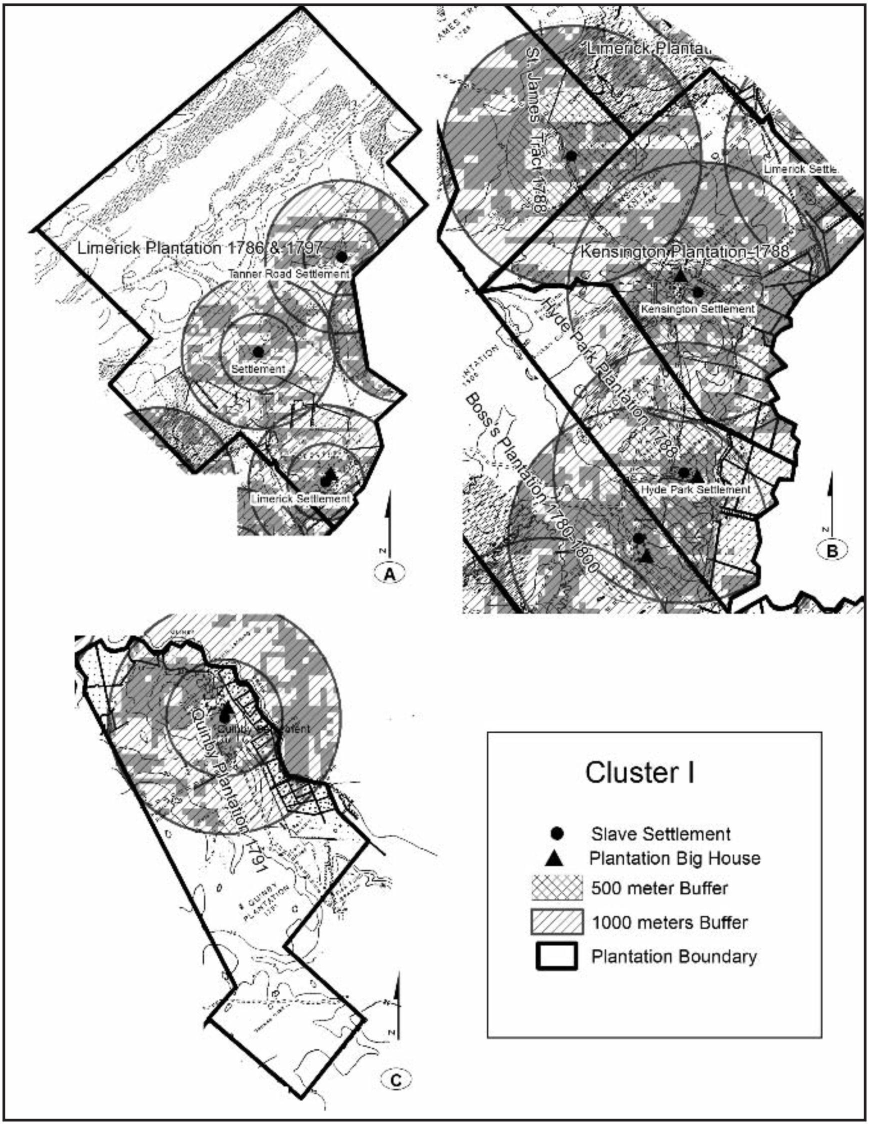

Figure 5. Details of Cluster I. (a) Limerick Plantation (b) Kensington Plantation and Hyde Park Plantation) (c) Quinby Plantation. The gray area represents viewshed from the slave settlements based on DEM for a 1,000m radius.

whether or not Windsor plantation contributes to the overall panoptic plantation model.

Limerick Plantation (Figure 5a) contains three slave settlements, one central settlement and two isolated settlements. The CVA reveals high visibility around the central settlement and the rice fields between the settlement and the river. Additionally, the central settlement maintains intervisibility with another (or possibly two other) big houses in limited areas. What is striking about Limerick is that its two isolated slave settlements do not appear within the buffer zones of any big house. Perhaps the owners believed it was more important to display command of their residential landscape rather than controlling the lives of the enslaved population.

The Kensington Plantation (Figure 5b), containing thirty-five buildings with nineteen slave quarters, served as the administrative site for Kensington, Hyde Park, St. James, and So-Boy plantations. Kensington and Hyde Park are located along the river, while St. James and So-Boy are located further inland. As the administrative location for several plantations, it would be expected that the highest level of intervisibility would occur here. The central slave settlement area surrounding the Kensington Plantation big house is visible not only from Kensington but also possibly by one or two other big houses. So-Boy does not fall within the visibility of any big house and St. James reveals limited visibility within the zone by one or two big houses.

Hyde Park Plantation (Figure 5b), located along the river, presents an interesting interpretation. It appears that the slave quarters located to the southwest along the approach to the big house are not within the viewshed. Additionally, high intervisibility occurs with Boss's Plantation to the north of the big house (one to two other big houses), fields southeast of the big house (one to two other big houses), and along the border (up to three other big houses).

Quinby Plantation (Figure 5c), located on the east side of the East Branch across from Boss's Plantation, appears to fall within this cluster. The areas located close to the river exhibit high intervisibility with other big houses in this cluster yet the central slave settlement exhibits no intervisibility with other big houses. Caution should be taken with this interpretation, as there is no information regarding neighboring plantations on either the north or south sides of Quinby. Quinby's slave settlement is located south of the big house with limited visibility. Perhaps with the addition of information from the adjoining plantations, intervisibility at the slave settlement might increase.

Cluster II

Cluster II consists of the big houses of the following plantations: Middleburg, Richmond, Campvere, and Blessing. All of these plantations are located along the eastern side of the East Branch with the exception of Richmond, which is located on the west side of the East Branch directly across from Middleburg. Cluster II differs from Cluster I in that most of the focus of visibility is toward the river rather than toward the central slave settlements. At Middleburg Plantation (Figure 6b), the central slave settlement is located northeast of the big house. The CVA revealed that only portions of the slave settlement are visible from the big house. Higher levels of intervisibility occur to the west and south of the big house.

Two anomalies appear at Richmond Plantation (on the west side of the branch) and Blessing Plantation (directly across the branch on the east side from Richmond). First, at Richmond Plantation (Figure 6a), high levels of intervisibility occur around the big house yet the slave settlement located to the north is situated in a pocket of no visibility. The area surrounding the slave settlement exhibits visibility by one or two big houses. Second, the slave settlement at Blessing Plantation (Figure 6c) exhibits a similar visibility. The slave settlement is located south of the big house and in a pocket of no visibility. Again, data from adjoining plantations are missing from the Ferguson and Babson map that might account for the low to no intervisibility of these slave settlements. The panoptic plantation model does not appear to apply to these two plantations. Additional research in the future is recommended to determine why the slave settlements are located where they are. The slave settlement at Campvere (figure 6c) exhibits the highest level of visibility. Not only is the entire settlement visible from the big house, but it is also visible from one other big house.

Conclusion

This viewshed analysis serves as a feasibility study to examine the landscape from the viewpoint of the enslaved population at the regional scale. Viewsheds can be simple to produce and could have value throughout the life of a research project. Maps from Cumulative Viewshed Analysis take considerable time to generate; however, this constraint should not prevent future repeatability. This study is a simplified representation of viewshed and intervisibility. One must acknowledge that there could be errors in the method.

Since the Lowcountry landscape is relatively uniformly level and unrestricted, straight line of sight evaluation performed in this analysis is

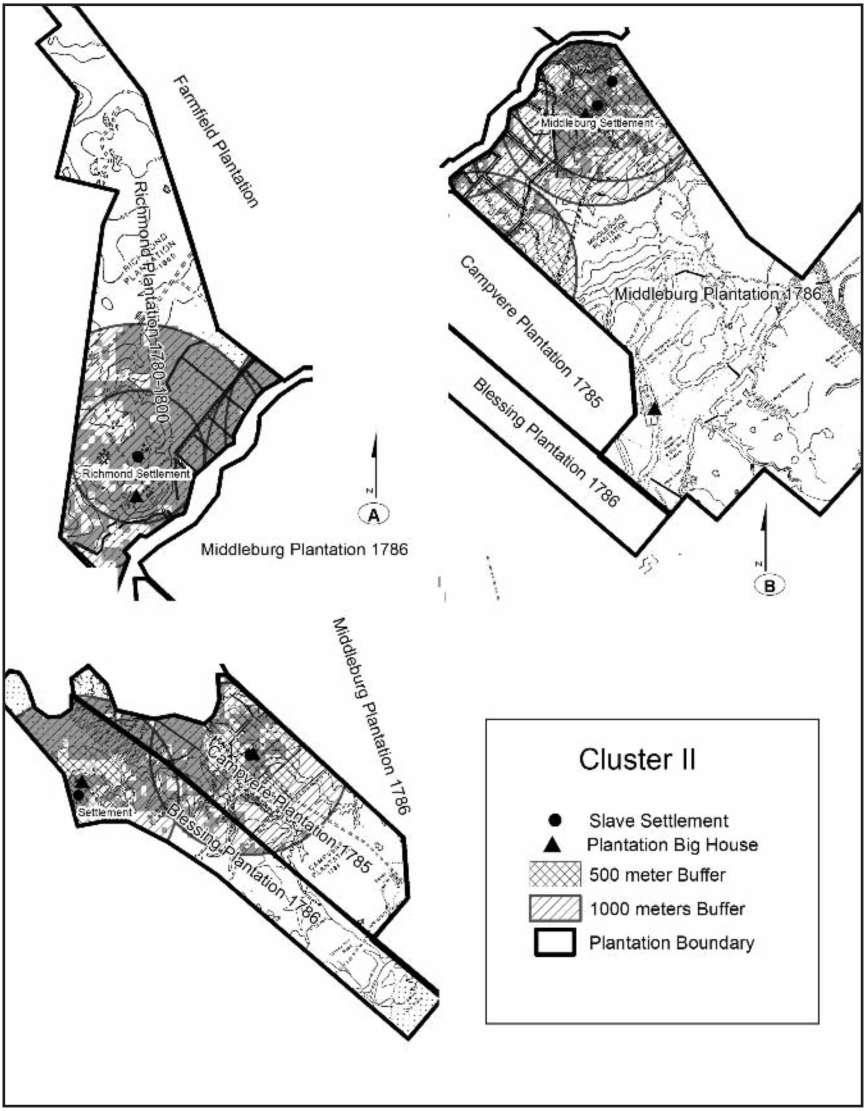

Figure 6. Details of Cluster II. (a) Richmond Plantation (b) Middleburg Plantation (c) Blessing Plantation and Campvere Plantation. The gray area represents area of view-shed from the slave settlements based on DEM for a 1,000m radius.

not sufficient in examining how planters would have expressed their control across the region. A valid critique of this method is that it does not take into account the observer's acuity of vision (which does not affect the present study) and telescopic technologies. Nor does this study take into account vegetation and building obstructions. Other variables not addressed in the current model include: the distance between the fields, slave quarters and planters'/overseers' house, and possible paths the enslaved population may have used to reach the fields and other plantations. Additional evaluations, such as cost distance and cost of travel, are needed to expand the hypothesis of a regional panoptic plantation model. Nevertheless, adding other variables (such as proximity to water and/or fields) and missing data from adjoining plantations may factor in location of slave settlement that will further affect intervisibility. A future direction of this study will be to complete the missing data and conduct more viewshed analyses of the entire region. Due to missing data on the Ferguson and Babson composite map, it is possible that known slave settlements could fall within the viewshed of other big houses. If this viewshed analysis supports, in part, the panoptic plantation model, there should be an archaeological explanation. Perhaps the clustering of plantation central settlements represents additional hegemonic control among the planters themselves. Because Delle and Whitley did not consider the panoptic effects of intervisibility, I argue for an analysis at the expanded regional scale (several plantations as a community or neighborhood) to fully comprehend the effects of visibility from multiple points. Planters could have gained added legitimacy, among each other, by locating their big house within sight of another planter, thereby placing themselves in a better position to exercise surveillance and control over the region. The enslaved population could have monitored those monitoring them if they knew where they would be and could better see them. Additionally, the location of "invisible" settlements could be the result of either holdovers from an earlier colonial settlement pattern or changes in plantation society wherein the master and slave relationship developed sufficiently to create a largely self-disciplined workforce (the "Foucauldian" panopticon).

This paper has offered a method for investigating the panoptic plantation model at an expanded regional scale. Using geostatistical tools, viewshed functions allow for analysis of plantation settlements across a vast landscape. The modified generic viewshed technique presented here does not provide detailed analysis of all the possibilities available, but can be applied to locate areas for future targeted analysis. With this technique, it becomes possible to demonstrate significant relations between settlement patterns and issues of surveillance and control. However, due to the very nature of viewshed analysis one must be aware that vision is privileged over other senses that might have been important to surveillance such as sound (e.g. drums, conversations) or smell (e.g. fire, cooking). Further examination of historical records, maps, and the implementation of GIS analyses will produce answers to questions about surveillance and control on rice plantations along the East Branch of the Cooper River from the viewpoint of the slave settlement.

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