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GIS as an Interpretative Tool for Addressing Risk Management and Cognitive Spatial Dynamics in a Slave Society

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Abstract. GIS used in the context of the archaeological record has the ability to represent some of the *ideas* people may have had about space (i.e., cognitive landscapes). The paper presented here will detail some of the efforts to understand 1) how enslaved Africans and African-Americans envisioned their surroundings during the eighteenth and nineteenth centuries, 2) how they may have conceptualized of task and social spaces, 3) how owners and overseers directly and indirectly manipulated those landscapes, 4) why and how slaves might make the choice to escape, and 5) how cognitive landscapes might be held collectively in a multi-temporal support network. The GIS environment can provide a simulation of these cognitive processes, how they related to risk management and affected decision-making. Ultimately, GIS is beginning to allow the archaeologist to address issues of spatial dynamics, which are beyond the mere location of artifacts, features, and activity areas.

Keywords. GIS, Spatial Analysis, Cognition

1. Introduction

A great deal of literature has evolved in the U.S. regarding the archaeology of slave sites and their contribution to our understanding of the social parameters of material culture, architecture, power and status, religion, gender identities, cultural origins and heritage. Although this literature is vast in scope, there has been a great deal of emphasis from both the positivist and the historic-contextual perspectives. Primary archaeological fieldwork has typically produced positivist or empirical-objectivist interpretations, while post-fieldwork regional or topical syntheses have contributed more to contextual, or somewhat cognitive-idealist approaches (cf. Witcher 1999:15-16).

The form of analysis applied here is essentially what Renfrew (1994) has argued as the basis for cognitive-processualism. Though Renfrew rejects the environmental deterministic stance of much empiric correlative analysis, he also singles out anti-processualist rejection of the scientific method as distinctly "confused, and ultimately unhelpful" (Renfrew 1994:4). An examination of the nature of cognition, not inherent meaning, should be the focus of a cognitive-processual approach. Understanding the ancient mind is to come from mechanistic explanation not from environmentally deterministic correlative explorations or from speculative post-modernist attempts to infer "meaning" from the archaeological record.

2. Mapping, Analysis and Interpretation

The results of our survey and testing project at the Ford Plantation (near Savannah, Georgia) included the identification of eight (8) significant archaeological sites which represent components of three (3) different eighteenth and nineteenth century rice plantations (known as Silk Hope, Cherry Hill and Dublin/Richmond), particularly what might be referred to as the slave "villages" (Figure 1). In our approach to developing a complete archaeology during the project we tried to touch on a wide diversity of issues and create detailed arguments about both internal and cross-site observations. In addition to the compilation of all available historical documents, and traditional archaeological material culture analyses, we envisioned the project as a fully GIS-integrated research project from the outset. This meant that we employed GIS in three primary ways:

GIS as an Information Management Tool - Primary, secondary, and tertiary GIS data sources were compiled, digitized, downloaded and overlaid in the same coordinate system. Managing these different data layers allowed us to coordinate the point locations of artifacts and features with structural remains, ground and aerial photographs, historical maps and descriptions, and above all the more complex analytical and interpretative surfaces.

GIS as a Reconstructive-Analytical Tool - The GIS's ability to interpolate artifact and feature densities, query and correlate datasets, and generally combine or extract data and present it in a spatial overlay with surface landmarks added tremendously to our opportunities for reconstructing and identifying past behaviors, even before the fieldwork was complete.

GIS as a Cognitive-Interpretive Tool - Although, analysis generally presents archaeological and related data in the framework of the mindset and viewpoint of the analyst, we were interested in building an independent framework that represented the cognitive perspective of the people who actually deposited the archaeological material. This required thinking about not just how the slaves used the environment in the past, but how their ideas and behavior were influenced by how they envisioned their environment to be, and how those ideas and behaviors changed over time.

These three approaches are the perspectives taken for nearly all archaeological presentations and literature, which deal with GIS. None of these approaches are mutually exclusive; in fact, GIS papers typically include aspects of more than one. The three ways in which we employed the GIS, in fact, equate quite closely with Verhagen et al.'s (1995:196) hierarchical framework of *representative*, *descriptive*, and *interpretive* and Harris and Lock's (1995:349) characterization of GIS as a tool progressing from inventory, to analysis, to addressing integrated decision-making systems.

I would agree that all GIS analysis falls somewhere within this fuzzy three-tiered framework.

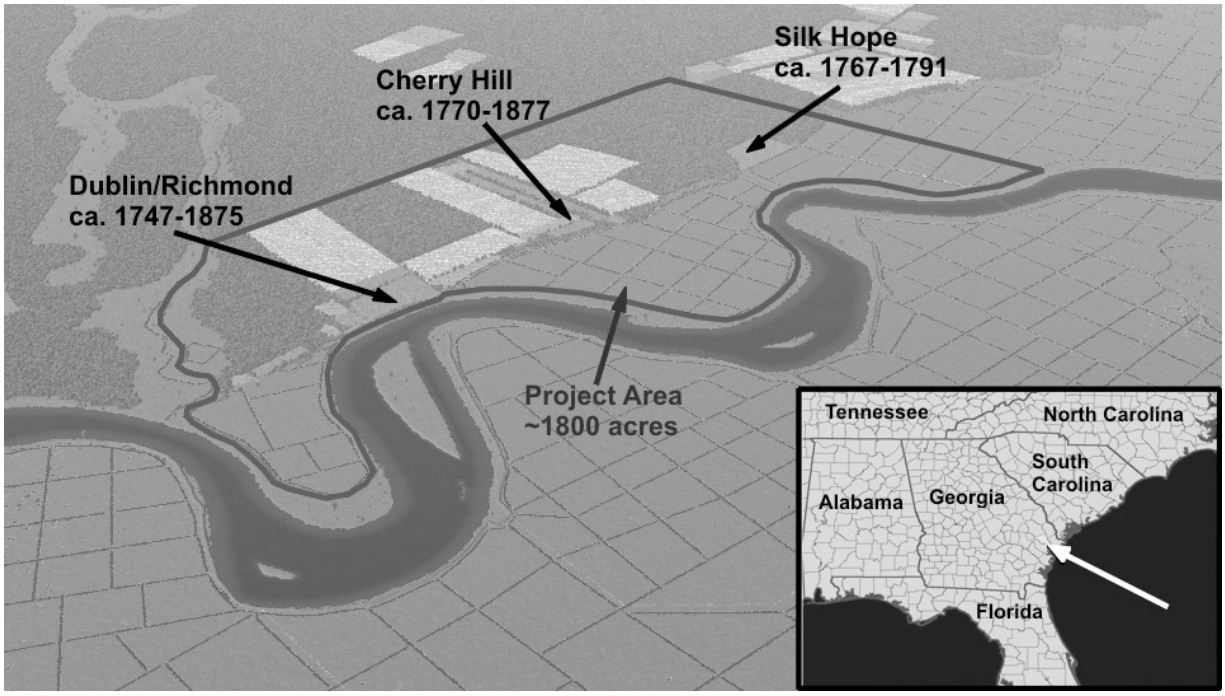

Figure 1. *Project Area Overview and Location.*

In terms of the technology utilized for the GIS mapping, analysis and interpretation, we placed all of our digital data in ArcView 3.2 (ESRI 1999). This was augmented with the Spatial Analyst (version 2.0) and 3D Analyst (version 1.0) extensions. We also utilized the Visual Nature Studio (VNS version 1.1) photorealistic 3D modeling package (3DNature 2001) to create a facsimile of the setting and environment from several different perspectives and multiple time periods. VNS is a technological improvement of World Construction Set (3DNature 1995-2001) with tools for integrating and manipulating GIS data in its native format.

We were able to directly import two-dimensional and three-dimensional shapefiles from ArcView and apply ecosystems built from native vegetation to the appropriate areas overlaid on the digital elevation models. We were also able to import and place three-dimensional buildings and other structures in the exact locations in which they were identified or suspected to be. These models were then rendered with realistic textures, atmospheres and lighting conditions. Granted, this is our interpretation of what the environment may have been like at a single point in time, but it is far more accurate than can be simulated with ArcView's 3D Analyst and goes a long way toward building behavioral interpretations.

3. Cognitive Landscapes and Decision-Making at the Ford Plantation

Though there are many different perspectives which can be taken with regard to cognitive landscapes, Due to space limitations, I will only address three here. The first is a brief examination of the diverse expressions of coerced labor, and how spatial areas may have been internally categorized, externally recognized, and subject to control mechanisms. The second is an interpretation of the use of communal and ritual spaces based on the cumulative viewshed and distance analysis of structures, features, and material culture. The last involves an integration of perceived spatial categories, temporal dimensions of cost-benefit surfaces and risk management in terms of motivations for or against escape.

3.1 Labor and the Landscape

Slave labor activities that took place in the Ford Plantation project area were quite diverse. We can, in fact, consider several types of labor activities. The most ubiquitous labor effort undertaken would have been *coerced labor*. Coerced labor would include all activities which took place in which individual (or groups of) enslaved Africans or African-Americans were not compensated through monetary or other exchange, nor for personal or social survival or enrichment. Thus coerced labor is that which has no perceivable benefit for the laborer, rather engaging in coerced labor may reduce costs for the laborer (such as punishment) at best. Coerced labor could be subdivided into *supervised* and *unsupervised*. Typically, the landowner controlled coerced labor directly or indirectly. Indirect supervision was maintained by proxy when the landowner could not be present (either by a Euro-American overseer or an African-American slave driver).

Spatial areas within which supervised coerced labor took place would have been conceptualized in the minds of the slaves as essentially negative places, since no benefits are present. Many interviews, recordings, and slave narratives strongly express the dislike of and aversion to "the fields" and the fear and loathing of the slave drivers and overseers. Such resources also describe the often innovative and surreptitious efforts by slaves to avoid coerced labor. In our conception of the geographic space of the project area we can digitize these areas and assign a general negative cognitive value to them. All things being equal, they would be considered negative attractors (or repulsors), in the same sense of the term as it is used in complexity research. The locus of labor control for these areas would have, by default, resided with the landowner, overseer or slave driver.

Unsupervised coerced labor relied on the slave (or group of slaves) to complete their assigned tasks without the need for direct control. In the low country of Georgia and South Carolina a system of labor control evolved which relied heavily on unsupervised coerced labor to succeed. Using this method (known as *the task system*) the landowner or overseer assigned a series of tasks to each slave on the basis of a standard unit (the amount of work expected to be complete within a given time frame), and a spatial area within which the work took place. When the assigned tasks were complete, the slave was free to return to their communal or residential areas, regardless of how much time remained in the day. In contrast, the supervised *gang system* relied on a workday where an immediate supervisor assigned and oversaw tasks as they were completed within a fixed period (usually sun up to sun down) and keyed to the area chosen during that day.

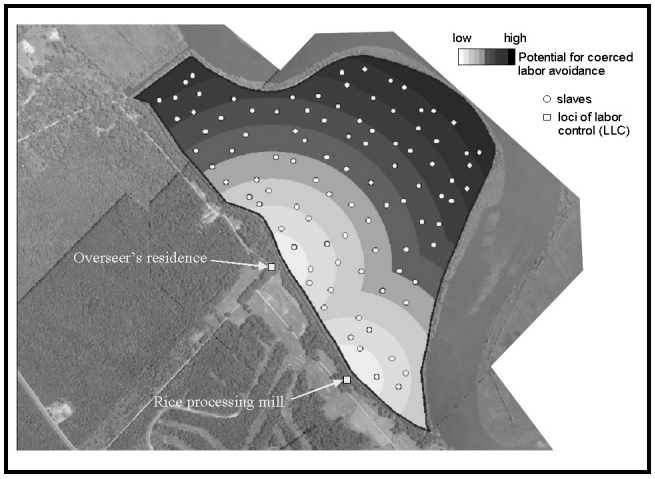

Figure 2. *Potential for Coerced Labor Avoidance at the Cherry Hill Rice Fields (no labor system).*

The task system was designed in response to several problems related to rice agriculture. First, in order to maintain economic success large expanses of wetland had to be drained and transformed into rice fields. The rice fields themselves needed much more time-dependent intensive management than upland crops (such as cotton). The timing and frequency of field flooding, in particular, was extremely important to produce a good harvest, and the rice plantations (at the height of their efficiency) were able to witness two complete harvests per year. This required a large number of slaves. With the ratio of slave to overseer being as much as 30 times that of an upland cotton plantation, such large numbers of slaves would have been difficult to control. Secondly, rice fields could not be worked a little at a time; rather much of the planted acreage had to be managed concurrently. This mandated the distribution of the slaves across a much wider landscape during the workday. Controlling the work habits of individuals spread across such a wide area would not have been easy by a single landowner or overseer.

Given that coerced labor produces little incentive for hard work, the gang system was successful only if punishment was quickly and liberally applied to any individual who was not acceptably working hard. Standards of hard work were set by the landowner, overseer or slave driver according to their own character and motivations. Within the rice fields, punishment could not be quickly applied nor could close observation be maintained without the employment of a large number of slave drivers. Slave drivers, though, were the least motivated to apply punishment to fellow slaves and had the greatest incentive for overlooking work shortfalls. Under the task system the slaves were given a greater degree of control over their own time, with the acceptance that the results of their coerced labor could be inspected at the leisure of the overseer, and punishment could be administered many hours or even days after the fact.

The differences between the gang and task labor systems would have created very different conceptions of the landscape for the individuals involved. The work area polygons should not necessarily be considered uniformly negative across their surface. Cognitive negativity is a function of the coerced labor effort expended. In the gang system, the level of coerced labor is likewise a function of the proximity to and nature of the locus of labor control (the landowner, overseer or slave driver).

If we were to model the potential for coerced labor avoidance across these polygons with respect to the inherent environment, we could simulate this with a combination of cost-distance and viewshed surfaces from the loci of labor control. In this particular environment (the Ford Plantation rice fields) cost and visibility are not essential since the fields are uniformly level and the view is unrestricted. Thus, a straight distance evaluation is sufficient (Figure 2). But in an expanse where differential terrain or vegetation might hinder either cost of travel or visibility, we would expect alterations to a coerced labor avoidance surface. In this example I have placed the primary locus of labor control at the overseer's residence and a secondary control location at the rice mill (the places where a stationary overseer would most likely to be found during the work day).

Without any direct manipulation of the slaves' cognitive landscapes (by the landowner or overseer), coerced labor avoidance is very possible across the rice fields. The potential for avoidance of coerced labor is well known to the overseer, though, and under the gang system close proximity is always maintained between the individual slaves and the locus of that labor control. In effect, hard work is enforced by manipulating the slave's cognitive landscape through mobilizing the loci of labor control, increasing their frequency (by assigning more slave drivers), and minimizing the number and distribution of enslaved individuals across the work area. The resultant effect is that work cannot be easily avoided (Figure 3).

Since this is not possible for economically successful rice agriculture, though, the task system limits the potential for work avoidance in other ways. First, the relative importance of the overseer or slave drivers is reduced since immediate supervision is unnecessary. Thus, a distance surface no longer simulates cognitive negativity. Repulsion is then represented by uniform polygons reflecting the personal involvement of each individual with identified task areas. Second, overall negativity is reduced since immediate punishment is no longer applicable. Although punishment is delayed rather than being entirely averted, the responsibility for avoiding punishment rests much more directly in the hands of the individual slave. Third, the desire to avoid assigned work is minimized, since work is not defined by a period of intensive supervised activity, but a series of tasks which can be completed at the motivation of the slave (within reason).

Though each slave (or work group), under the task system, would operate independently, there would, in effect, be a driving force toward greater group community identity. For example, in order to reduce the costs of coerced labor, there would be incentive to lobby the landowner or overseer for the reduction of the standard task unit. This may perhaps take the form of intentional work slowdowns, but would have to be coordinated between all or most of the enslaved individuals to be successful and to avoid punishment. As a consequence, it might be argued that under the task system a more cohesive labor community, and one that spoke in a much more unified voice, would therefore likely be generated. This is an example of the direct and indirect relationship between cognitive landscapes, labor economics and social identities.

3.2 Communal and Ritual Spaces

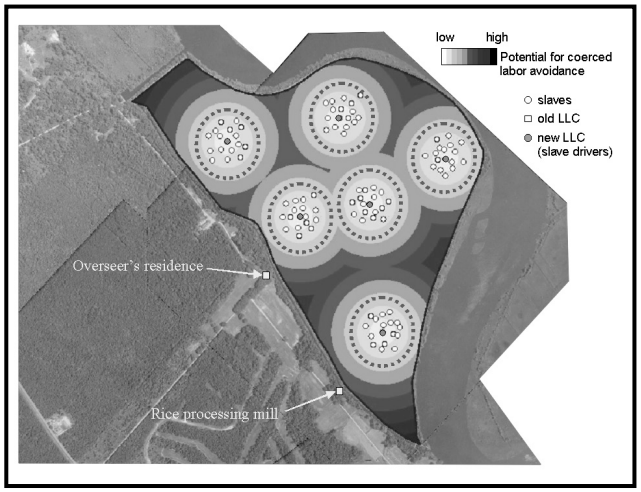

Figure 3. *Potential for Coerced Labor Avoidance at the Cherry Hill Rice Fields (under the gang system).*

Just as slaves would have assigned negative feelings to work or task areas, they would likely also have assigned positive cognitive values toward areas associated with communal or family activities. Through participation in their communities and involvement in ritual activity, slaves may have balanced out some of the negative affects of coerced labor with the positive effects of family interaction and the support of close friends and neighbors. In response to the dehumanizing effects of being forced to labor in the fields, slaves would have re-asserted their own identities by claiming personal, family, and community space and legitimizing that claim through ritual and other cultural activity. Perhaps the most illustrative example of this would be the expression of an African material and religious cultural identity.

The most interesting expression of African ritual activity that we encountered at the Ford Plantation was the remains of a "sacrificial" lamb. This single feature included an entire, unbutchered, and unconsumed young sheep, which was buried behind one of the Cherry Hill slave residences. No other artifacts were found with the remains, and no cutmarks were present on the bones. The lack of butchering and the completeness of the remains strongly argued against consumption of the lamb for subsistence, while the slave context makes the identification of the lamb as a pet highly unlikely. Similarity with remains from other sites and detailed descriptions from the historical literature of animal sacrifices associated with African-American religious ritual, led to our conclusion that the feature is probably an expression of ritual activity. Though, I would stop short of presuming a distinctive "meaning" for the sacrifice, the burial itself does beg the question of; "why that particular location?"

Rituals that involved the sacrifice of animals would have had to take place in areas and under circumstances where the participants would have felt unlikely to encounter punishment or disapproval. They would, as well, have taken place in areas, which to them could be cognitively designated as ritual or communal spaces, and therefore evoked a strong sense of social bonding. These two criteria would suggest an evaluation and classification of landscape characteristics that may be simulated within the GIS.

The initial perception of an area within which it would be unlikely to attract the attention of the landowner can be simulated with a cost-distance (or in this case simple distance) evaluation from the landowner or overseer (or the areas where they are most likely to frequent). An evaluation of the Cherry Hill slave rows with the exponential distance from the overseer's residence was calculated. In addition, a secondary potential exists for the overseer or landowner to be found along the main entrance road (between the slave rows) or the road to the rice mill. Therefore another exponential distance evaluation was calculated with the two roadways as the focus. Areas that provide visual barriers preventing the ritual from being seen would also be preferable. Thus, viewshed analyses from both the overseer's residence and the two roadways were also calculated.

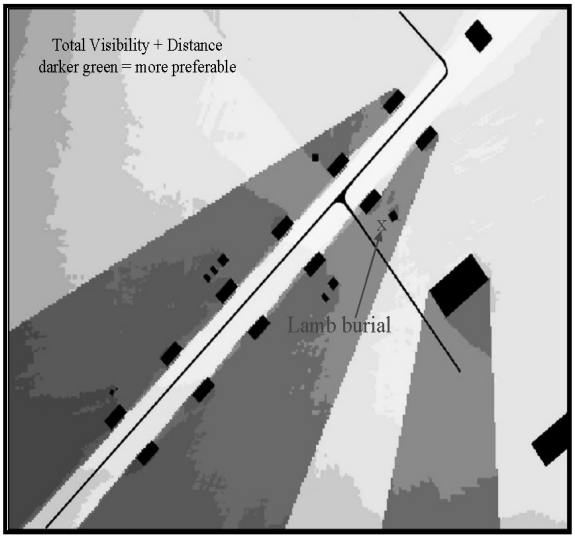

Figure 4. *Combined Distance and Visibility Surfaces.*

The combination of these four surfaces should show areas that may have fit the required criteria for holding such ritual activities (Figure 4). The weighting of each surface though, might be difficult to establish. The initial combined distance and viewshed surfaces were standardized and weighted equally. It might be a valid assumption that to further avoid the disapproval (and punishment) by the overseer, such ritual activity may have occurred during the night or when the overseer was not present. Similarly, the ritual may have been conducted in silence to prevent discovery, and a "soundshed" surface may also have been important. As a result, distance and visibility may have played a somewhat reduced role in establishing ritual activity areas. Another spatial characteristic may have, in fact, determined the location of the lamb

sacrifice to a great degree; proximity to the residence of a religious specialist.

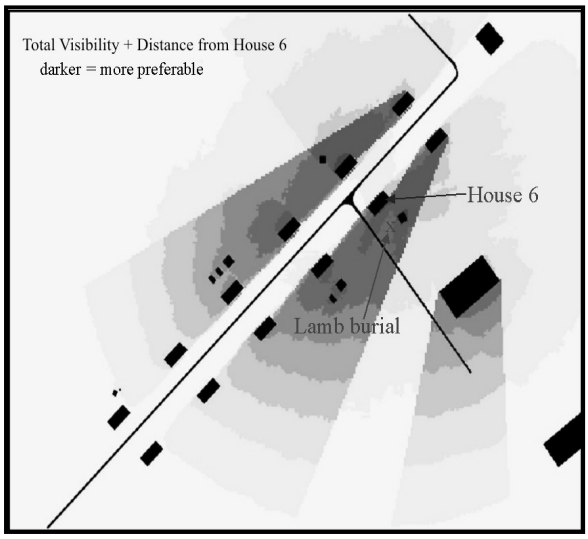

Figure 5. *Combined Distance and Visibility Surfaces (including proximity to House 6).*

There were a series of at least 12 dwellings identified at Cherry Hill, which on the surface, seem to be largely identical. The material remains, however, suggest a subtle distinction. One structure (House 6) was found to have a larger proportion of certain items associated with it. These items were blue beads, mirror glass fragments, a pewter sheep figurine, and a single colonoware vessel (the only one found at the site). All of these items, in other contexts, have been designated as having religious or symbolic connotations. Though the combined viewshed-distance surfaces present an idea of potential African-American ritual spaces at Cherry Hill, inclusion of a distance evaluation linked to House 6, strongly suggests that the proximity to the House 6 residence was a deciding factor in the placement of the specific lamb sacrifice ritual (Figure 5).

3.3 Risk Management and the Threshold of Freedom

The presence and active management of identifiable communal and ritual spaces is another aspect of the cognitive landscapes employed by individual slaves and the slave community as a whole. As they were integrated with the conceptions of labor and other expressions of social identity, these mental maps took shape as a differential surface across which costs and benefits could be internally illustrated. Within the minds of the slaves, as well, we know there resided a conception of some place where they could escape the high costs of coerced labor (and its punishments). This conceptual place would not necessarily have been integrated with their local cognitive landscapes since its relative location might be fuzzy. But, if such a location could be placed in a cognitive landscape, there would have been a great deal of pressure for an enslaved individual to attempt to reach it. The struggle between the desire to escape bondage and the risks of doing so formed a threshold of decision-making important to both the slave and the slaveholder.

As this is expressed in the GIS, there arises a very crucial contextual and temporal characteristic of the escape threshold. To observe this characteristic I created a cumulative cost-benefit simulation of the regional data (keyed to the USGS quadrangle map - an area approximately 10 by 15 km in extent) for different temporal periods (around 1780, 1820, and 1860). The cost-benefit balance reflected just the effects

related to an attempted escape - such as the risks of recapture and punishment, and the cost of travel itself. When mapped individually across the region certain landmarks form the attractors linked to a cognitive evaluation of increasing risks as a function of proximity. Roadways, open fields, railroads, and communities were to be avoided, while dense woodland had preferential characteristics.

The resulting cumulative surfaces were broken out into different temporal periods (two shown here - 1780 and 1860). It should be noted that the cost-benefit surfaces represented here includes all pertinent factors weighted simply and with complete and accurate information. The highlighted areas simulate the spatial knowledge acquired by the enslaved Africans or African-Americans. The earliest period (Figure 6) indicates a time when little information about the surrounding area was available and a cognitive evaluation of the risks of escape would have been built upon a very incomplete spatial dataset.

As time progresses (Figure 7), indirect spatial knowledge increases through access to neighbors and the growth of settlement in the region. Meanwhile direct and indirect visual knowledge stays the same. Overall the risks of recapture begin to skyrocket, making successful escape very difficult. The increased understanding of regional spatial risks would suggest that the thought of escape might decrease unless the costs of coerced labor were to unbalance the situation. More detailed regional knowledge, therefore, would present the slaveholder with the ability to deter escape by making it clear to the enslaved the great risks involved. Avoidance of recapture was extremely limited without the support of neighbors and strangers with more detailed spatial knowledge. The repeated learning experiences of those who went before, and those from other plantations and even other regions, paved the way for the increasing success of every attempted escape.

Ultimately, there evolved a system that evaluated and compiled the spatial experiences of enslaved individuals and actively applied them to the landscape to develop escape corridors and a support system for those attempting escape (this has been dubbed the Underground Railroad). This system would have to be conceptualized as active understanding, management and manipulation of a very complex cumulative cognitive landscape. This would also only be visible through the lens of multi-temporal analysis.

4. Conclusion

In summation, I have attempted to show some insights into the complex cognitive landscapes of bondage. With only the few examples outlined above it is clear that there is a very integral relationship between space, labor control, risk management, and social identity. Understanding this relationship may not necessarily be reliant on the use of GIS and spatial analyses, but it is certainly enhanced by it. Given that we have the ability to model material culture, environmental parameters, and analytical surfaces in both two and three dimensions, with a strong theoretical underpinning the exploration of such models have a valuable contribution to make toward cognitive interpretations. Clearly, though the best potential use of these ideas is within a model of explanation that can incorporate the fuzzy and complex nature

of human reasoning and cultural behavior. Creating the building blocks for this sort of cognitive interpretation are but the first steps on what appears to be a very long road of inquiry.

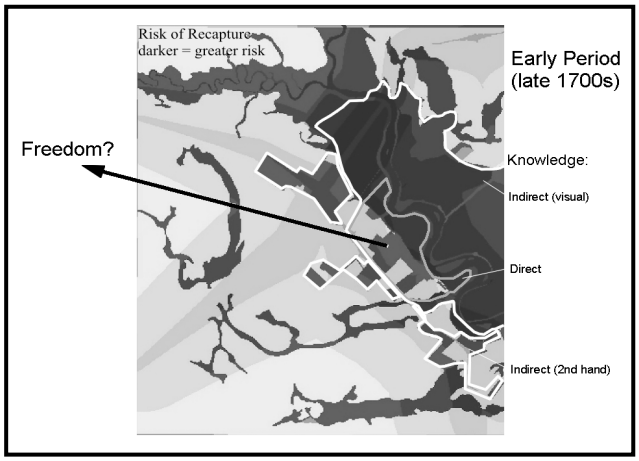

Figure 6. *Cumulative Cost-Benefit Surface (late 1700s).*

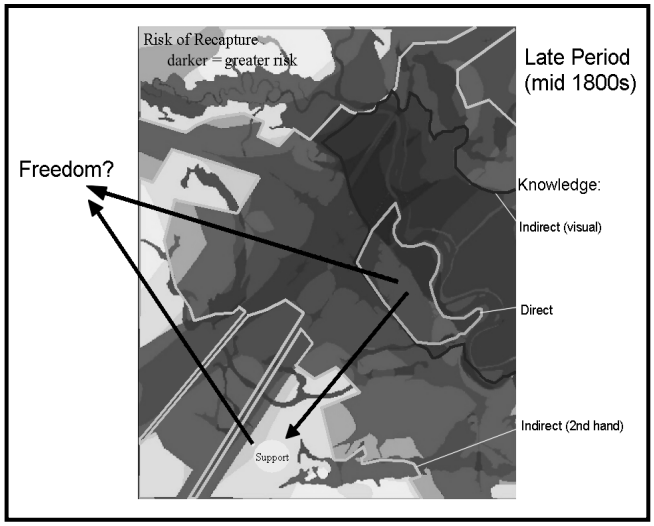

Figure 7. *Cumulative Cost-Benefit Surface (mid 1800s).*

Acknowledgements

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References

HARRIS, T., AND LOCK, G., 1995. Toward an Evaluation of GIS in European Archaeology: The Past, Present and Future of Theory and Applications. In, *Archaeology and Geograph-ic Information Systems: A European Perspective*. G. Lock and Z. Stančič (eds), Taylor and Francis, London, pp.349-366.

RENFREW, C., 1994. Towards a Cognitive Archaeology. In, *The Ancient Mind: Elements of a Cognitive Archaeology*. C. Renfrew and E. Zubrow (eds), Cambridge University Press, Cambridge, pp. 3-12.

VERHAGEN, P., MCGLADE, J., RISCH, R., AND GILI, S., 1995. Some Criteria for Modelling Socio-economic Activities in the Bronze Age of South-East Spain. In, *Archaeology and Geographic Information Systems: A European Perspective*. G. Lock and Z. Stančič (eds), Taylor and Francis, London, pp.187-210.

WITCHER, R., 1999. GIS and Landscapes of Perception. In, *Geographical Information Systems and Landscape Archaeology: The Archaeology of Mediterranean Landscapes 3*. M. Gillings, D. Mattingly and J. van Dalen (eds), Alden Press, Oxford, pp. 13-22.