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A Multiscalar Approach

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THE MANY DIMENSIONS OF HALLY CIRCLES

Patrick Livingood

Those of you who have made it this far will realize that this volume collects scholarship that celebrates and honors David Hally's many contributions to southeastern archaeology. This paper will contribute to this worthy goal by attempting to build upon Hally's work identifying and measuring Mississippian polities. In a 1993 chapter, collected in an unabashed festschrift for Stephen Williams, Hally first published the results of a study looking at the spacing between contemporaneous mound sites (see Figure 10.1) in the southern Appalachians (Hally 1993). He found that secondary mound centers were never more than 22 km from their primary center and that primary centers from different polities were never any closer than 33 km. Hally and his colleagues frequently displayed these mound sites on maps, showing their locations and showing circles of 18 km radius around the primary mound center, indicating the approximate limits of the territory and influence. I have referred to these in print as Hally circles (Livingood 2012).

In previous research I have conducted on Hally circles, I examined the distances between mounds using simulated travel time rather than straight-line distances. This rather mechanical reanalysis has been unexpectedly productive and has opened up many additional questions. This chapter is going to be organized around addressing these three questions:

1. Which variable best explains the underlying distribution of mounds: distance, travel time, or some other measurement?

2. If identified, what does this variable say about the process that created this pattern of mound distribution and polity spacing?
3. And finally, can we say whether the distribution of sites into these clusters was intentional and understood by Mississippian people, or were they epiphenomenal of other behavior and organization?

Travel Time and Hally Circles

Hally's original study used the location of 45 known earthen mound sites in the southern Appalachians that were occupied between A.D. 1000 and 1600 (Figure 10.1). Several archaeologists have speculated over the years that the spacing of mounds observed by David Hally has to do with an underlying process that created polities that are approximately a half-day's travel in radius (Blitz 1999:580). This corresponds well with observations of chiefdom societies around the world that show that such polities are usually limited in their capacity to control territory greater than a half-day's journey from the center. A few years ago, I realized that whether or not the Hally circles correspond to a half-day's travel was an untested and unexplored proposition, one that could be checked using available data.

The details of this work are presented elsewhere (Livingood 2012), but I will summarize the method and results here. The simulation to calculate travel times between mounds permitted both pedestrian travel and canoe travel. For pedestrian travel, the simulation used Tobler's hiking function (Tobler 1993), which calculates walking speed as a function of slope. Tobler's function predicts a speed of 5 km/hr. on a flat surface and slower speeds with increased or decreased slopes. This speed has been confirmed by a few experimental observations (M. Aldenderfer 1998:11–15; Lee 1979) and is widely used in cost distance studies using travel time (e.g., M. S. Aldenderfer 1998; Gorenflo and Bell 1991; Hare 2004; Jennings and Craig 2001; Kantner 1997; Phillips and Leckman 2012; Surface-Evans 2012; White 2012). The simulation also applies an additional penalty for pedestrian travel that crosses bodies of water, and these penalties increase in magnitude with the size of the channel as measured by water flow.

This simulation was different from many others in the cost distance literature in that it also permits canoe travel. Specifically, travel was permitted on waterways with average flows exceeding 100 cubic feet per second. The simulation used a base canoe speed of 4 km/hr. to which the speed of the current would be added or subtracted depending on

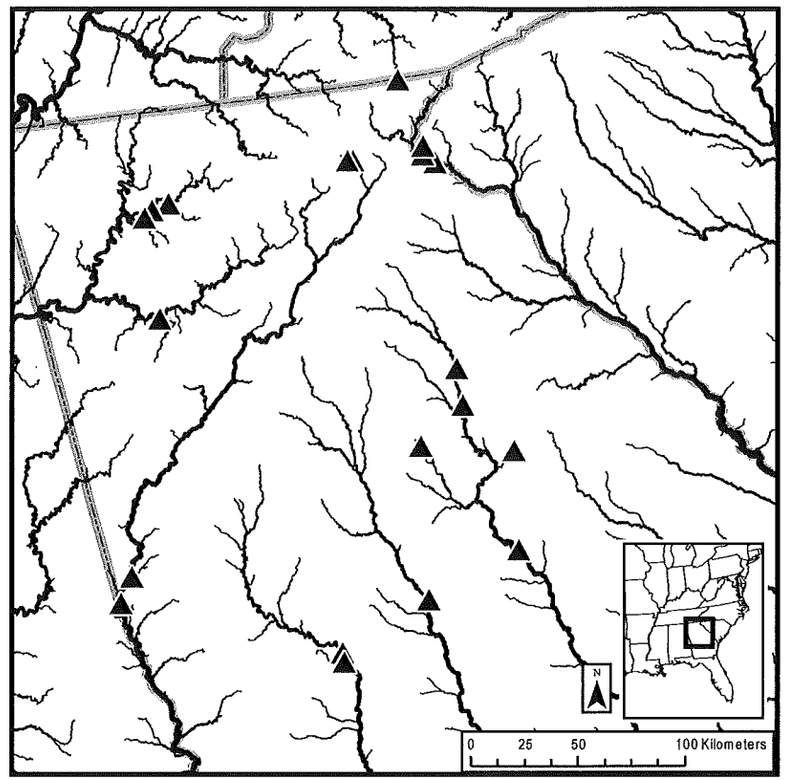

Figure 10.1. Map of all of the mound sites from all periods used in Hally's study.

whether travel was with or against the current. This base speed was derived using a compilation of modern and historic canoe travel accounts from which speed could be calculated. These trips were widely variable in speed, and I suspect any base speed between 3.5 and 5 km/hr. could be defensible. Interestingly, David Hally once shared that he did not think canoe travel was especially significant in this region. Using these parameters, he is absolutely correct; there are very few journeys between mounds for which the optimal trip includes canoe travel. It may be if we simulated travel with the additional costs of moving significant burdens, such as food or material, that canoe travel would be optimal for a larger number of journeys.

The simulation used modern topography data and river channel data provided in the National Hydrography Plus data set (Horizon

Systems Corporation 2006). The hydrography data were constructed using year-round averages of modern rainfall data. Finally, I would have liked to have included penalties to pedestrian travel through swamps and penalties to canoe travels over falls or shoals, but there are no available geographic datasets with this information for a premodern world. Since no commercially available GIS programs have the off-the-shelf capability to calculate least cost pathways using all of these parameters, I chose to write my own path-finding software, which implemented Dijkstra's algorithm (Dijkstra 1959; Surface-Evans and White 2012).

The results are summarized in Figure 10.2, which contrasts the histogram of pairwise distances between mounds as measured by Hally with the pairwise travel times produced by the simulation. As Hally argued, these show a strong modality between mound sites that are part of the same polity and those that are from different polities.

Together these inform us that most secondary centers were less than 4 hours travel from the administrative center of their polity, and all are located less than 5 hours. A single secondary center, Wilbanks (9Ck5), was located 22 km from its administrative center, Etowah (9Br1). That is a trip that would have taken 4.7 hours downstream from 9Ck1 to Br1 and 4.9 hours upstream. On average, contemporaneous mounds belonging to the same polity were located 2.2 hours or 9.9 km from each other. If we exclude the outlier, 9Ck5, these averages are 2.0 hours and 9.0 km.

Mounds from different polities are located at least 26 km or 5.6 hours from each other, and no competing primary centers are closer than 33 km or 7.5 hours distant. Most mounds from competing centers are located a minimum of 8–10 hours from each other.

> Question One: Which variable does the best job of explaining the underlying distribution of mounds: distance, travel time, or some other measurement?

Superficially, the histograms showing pairwise straight-line distance between mounds and pairwise travel time between mounds are similar, but a visual inspection shows that perhaps there is slightly better modality when using travel time. Stronger modes would imply that travel time, rather than distance, was the fundamental variable informing the Mississippian's choices about where to locate mounds.

This can be quantified using Silverman's test (Baxter and Cool 2010; Silverman 1981, 1986) which can quantify the probability that each of these histograms has certain numbers of modes. In short, Silverman's test

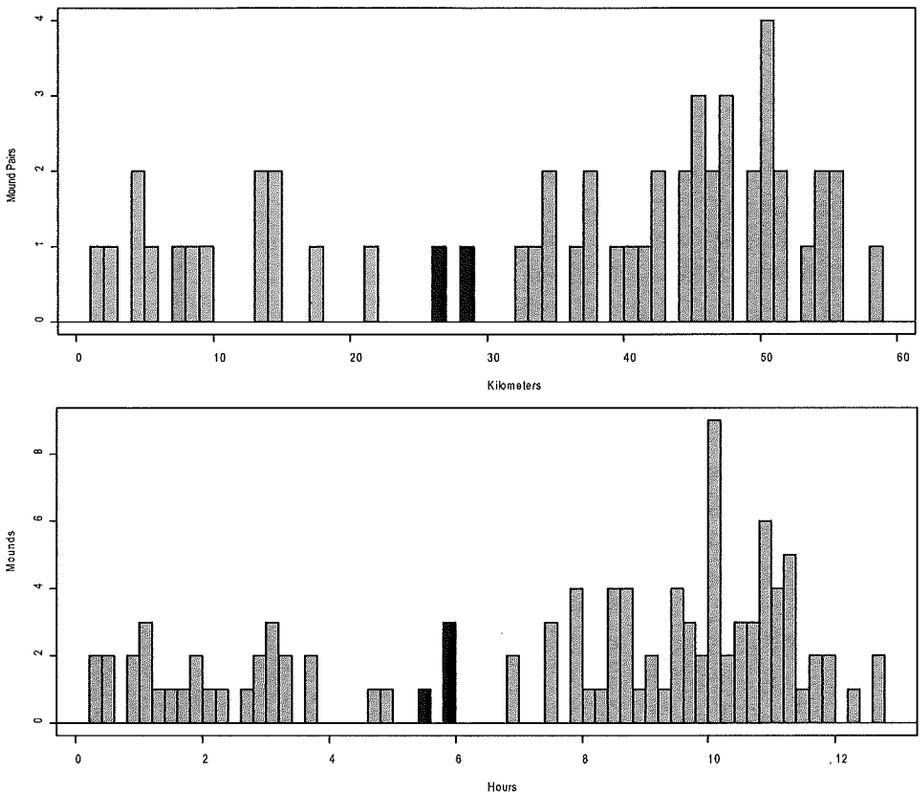

Figure 10.2. Histogram of straight line distances and travel times between mound pairs.

finds very slight support that there is a stronger case for the presence of two modes when using travel time.[1] The paragraphs below supply the details for the statistically inclined.

For pairwise travel time, the Silverman's test of the null hypothesis that there is just a single mode provides an associated probability of $p = .0019$ (at bin width 2.253, or $p = .000071$ with the calibrated version suggested by Hall and York [2001]), which easily meets the traditional standard of statistical significance ($\alpha = .05$). A subsequent test of more than two modes fails to hold ($p = .362$, calibrated $p = .195$, critical bin width = .745), which provides a statistical argument that there are two, but not three modes. In comparison, a Silverman's test on pairwise distance has a $p = .0034$ (calibrated $p = .000165$, critical bin

width = 10.245), which also confirms that the two modes are present but with just slightly less confidence. Phrased another way, we are fairly confident that there is more than one mode in the data using either measurement, with well less than 1 percent chance this is just statistical noise, but there is slightly more confidence when using the time measurement (p = .001/.00007 for time and p = .003/.0001 for distance). The difference between these results is small and not itself statistically significant (Gelman and Stern 2006); however, these provide a small empirical way of scoring these distributions of data and indicates that the histogram of travel time is slightly more strongly bimodal than that of distance.

Another perspective on this question was articulated by geographer Daniel Montello's notion that ultimately travelers base their opinion about the cost of a journey on a concept known as subjective distance (Montello 1997). Subjective distance is itself influenced by three factors: environmental features, travel time, and travel effort. Experimental research shows that environmental features are particularly important, but unfortunately these are nearly impossible to model in a prehistoric archaeological context. For example, modern urban travelers will judge a route to be longer despite its objective distance or duration if there are more turns (Sadalla and Staplin 1980), if there are no visible landmarks they are navigating towards (Nasar, et al. 1985), if there are simply more vistas (Montello 1997; Nasar, et al. 1985), or if they experience greater levels of discomfort, insecurity, or congestion (Brundell-Freij 2006; Li 2003). It is also clear that in many studies cognitive, experiential, and cultural biases distort subjective distance in sometimes surprising ways. Studies have found that people overestimate distances of nearby destinations and underestimate distance to far away destinations (McCormack, et al. 2008), that people overestimate the distances of routes the more familiar they become (Crompton 2006), and that people overestimate costs of travel into a city and underestimate costs of travel out of a city (Lee 1970).

Archaeologists are not able to directly measure environmental features as a way to approximate subjective distance, but we can measure travel time and cost effort. The difference between these two approaches is summarized well by Kantner (2012). Caloric expenditure can be calculated as a unit of effort, and a formula developed by Pandolf (Pandolf, et al. 1977) and colleagues provides a way to incorporate variables such as sex, weight, speed, burden, and slope. This approach has been especially useful to test applications of optimal foraging models because one can compare the cost of a trip to the anticipated caloric return.

However, since it is impossible to directly perceive caloric costs, I would make the argument that in this study, time is the preferable unit for cost distance. As experimental studies have found, travel time is a major, if not the most important, factor on a traveler's evaluation of subjective distance (Burnett 1978; Golledge and Zannaras 1973; MacEachren 1980). One possible reason is that instruments to measure time such as clocks, watches, the movement of the sun, meals, and so forth are more readily available than instruments to measure distance (Montello 1997:302) or caloric expenditure. This is somewhat supported by anecdotes from ethnographic and linguistic studies that show time is used more often than geographic distance as a basis for subjective distance. For example, the basic unit of distance among the twentieth-century Tofa of Siberia is *kösh*, which is the distance one can travel in a day on reindeer-back (Rassadin 1995:23 as cited in Harrison 2007:105). It is approximately 25 km but is impacted by terrain, snowfall, and other factors (Harrison 2007). A traveler among the Malays in the 1870s provides more examples of folk measurement of distance, such as "as far as a gunshot can be heard," "the distance you can travel before your hair dries," "the number of times you chew betel between locations," "the distance covered in a days walk," and for boatmen the number of turns in the river (Bird 1883; Mitra 1910). Note that most of these distances are based on perceivable units of time.

In more modern contexts, many urban planners have found that travel time is the most critical variable in understanding city size and commuting preferences (Hupkes 1982; Kölbl and Helbing 2003; Schafer 2000). As urban travel technologies have improved from foot traffic, to horse traffic, to subways, and finally to cars, the size of the city has naturally increased (Marchetti 1994) but what has remained relatively constant is the amount of time that residents choose to travel (Schafer 2000; see also Joly 2006 and Levinson and Wu 2005 for critical perspectives). As congestion has grown in modern cities, people have been shown to make choices about residence and employment that are most responsive to time over any other possible variable (Zahavi and Ryan 1980), giving rise to the notion of a commuter's travel time budget (Hupkes 1982).

Travel time has also been implicated as the most important variable for the construction of other political entities. Many counties in the U.S. that were created in the early nineteenth century, such as many counties of Kentucky, were made so that all residents were no more than half-a-day's horse ride from a county seat (Ireland 1992). This

was accomplished stipulating centrally located county seats and county boundaries of the appropriate size.

I argue here that travel time, more than caloric cost or straight-line distance, is the best approximation we have of subjective distance as it incorporates two of the factors: travel time and effort. I argue this is the cost most likely to be perceived by the Mississippian traveler and the most likely to be actively incorporated into decisions about routes, actions, and settlement organization.

> Question Two: If identified, what does this variable say about the process that created this pattern of mound distribution and polity spacing?

Time is also valuable in this study because it corresponds with the theoretical expectation. Chiefly polities tend to be no larger than a half-day's travel from the center as documented in numerous locations around the world (Bauer and Covey 2002:847–848; Cohen, et al. 1968:136; Helms 1979:51–53; Johnson 1987; Little 1967:240; Spencer 1990:6–8). One explanation for this is that chiefdoms are, by definition, lacking in bureaucracy, or as Henry Wright puts it, internally specialized administrative units (Wright 1977, 1984). Without this political differentiation, chiefs are inhibited from extensive delegation of authority which impose on them a cost to manage their domain from the center (Spencer 1987, 1990, 1993). One outcome is that when chiefdoms stay within this limit, a chief is free to visit members of their community without having to impose on their hospitality since he or she could return home at the end of the day. It would also permit the rapid response of coercive force, if required. From the perspective of non-elites, individuals or corporate groups wanting integration with a polity would choose to live closer because it would decrease the costs of participation and increase the benefits of communal defense. A family or corporate group desiring autonomy would opt to live more distantly from a potentially meddlesome or threatening chief or the other apparatus of the polity.

This particular study shows that travel time produces slightly stronger modes than straight-line distance. There is also circumstantial evidence that time is in fact the underlying variable most closely approximating subjective distance, which is itself likely the controlling factor in shaping settlement organization. This is what is expected from the anthropological theory described above. As we should recall, the Hally dataset is composed of the distribution of mounds. When we state that mounds from the same polity are no further than a half-a-day's travel, we are really speaking of the separation between primary and secondary administrative centers. The best explanation is that such a spacing

pattern was a way of maximizing the advantages and minimizing the problems resulting from the Mississippian form of leadership and polity integration.

> Question Three: Can we say whether the distribution of sites into these clusters was intentional and understood by Mississippian people or are they epiphenomenal of other behavior and organization?

One of the striking features about the settlement system documented by Hally for the southern Appalachians is its regularity over time and space. There is no evidence that any of the dozens of polities that existed for six centuries exceeded the half-day's-journey-from-the-center extent. There exists the anthropological theory discussed above that this extent has its roots in the political organization of the time that defined territory by the cost of interactions between a chief and the people of the polity. However, there is an open question about whether this process would have been understood in the same way by the Mississippian people of the southern Appalachians. For this, I would argue there are linguistic clues reflecting some of the interests and constraints suggested by the theoretical comparative work that perhaps indicate that Mississippian polities were in fact conscious creations.

One example comes from the Choctaw words for territory. Choctaw is a Muskogean language and has the advantage of being one of the earlier Southeastern languages for which a complete dictionary was compiled (Byington, et al. 1915). Although the descendants of the Mississippians in the southern Appalachians did not speak Choctaw, many spoke other languages in the Muskogean language family. Unfortunately, the early lexicographers for other Muskogean languages, such as Creek did not appear to expend as much effort as Byington in recording words associated with territory and political boundaries. Therefore, Byington's Choctaw dictionary remains the best possible proxy for Mississippian language concerning political territory.

In Choctaw there are several terms and concepts for territory which are combinations of various roots. The primary word for territory that is mentioned by Byington is *apelichika*. A related concept treated by Byington is the term *Miko apelichika afullota*. Byington recorded the definition of this as "the circuit of a king's dominion; a kingdom; a realm; an empire." This phrase is itself composed of three words, and breaking those down we find:

> ***Miko*** = chief/ruler (Byington, et al. 1915:260)
> ***Apelichika*** = territory or precinct. Byington defines this as "the place ruled, whether kingdom, province, town, district, plantation, bishopric,

> diocese, or a single house; or the place ruled by domestic animals; domain; dominion; a dukedom; an empire; a government; a kingdom; a monarchy; a province; a sphere; a tribe" (Byington, et al. 1915:53)
> *Afullota* = to circle a place. Byington defines the noun form as "the circuit; the extent round; a range." The verb form is "to go round at; to take a circuit there or at" (Byington, et al. 1915:13)

In other words, there is a Choctaw phrase that invokes the concept of territory as defined by the circuit or range of a chief. Further, the term *affulota* carries with it connotations related to the shape of a circle. This concept remarkably mirrors the theoretical expectation that chiefly territories are commonly defined by the territory that can be easily traversed by a chief. It also reflects the Southeastern native preference for depicting native territories as circular forms as I will discuss below.

There are numerous questions that one would love to have answered about this word that are simply unresolvable. For starters, we have no idea if this phrase recorded by Byington was even in use during the Mississippian period. Other than Byington's gloss, I am unable to find any documentation about how this word was used and whether a Choctaw speaker would have applied it to the political unit identified by Hally. It is entirely possible, for instance, that this phrase was constructed as a means to translate and communicate a biblical concept to the Choctaw people since Byington was working among the Choctaw in his capacity as a missionary (Swanton 1915:viii). The issue is further complicated because there are several terms that are glossed to indicate territorial concepts. For instance, Byington listed the following Choctaw words as meaning kingdom: *apelichi*, *apelichika*, *minko apelechika afullota*, *minko apelichi*, *minko apeliechika*, *pelichika*, and *yakni*. Most of these are variations on roots of the three words already under discussion. In addition to those, p*elichika* is defined as meaning leader and *yakni* as meaning the earth. The list gets slightly longer when one considers Choctaw terms that are translations of English synonyms of kingdom or territory, such as precinct, province, district, etc.

Still, despite the concerns and complications, I am hopeful that *minko apelechika afullota* has special meaning in this instance. The convergence of these three notions is not inevitable, and they do not have any obvious origins in biblical or nineteenth-century American norms. The fact that these three concepts were joined in this phrase is likely entirely based in Choctaw conceptions about political boundaries. In this instance they conjoined an existing word for territory (*Apelichika*) with the notions of a chief (*Miko*) and action or travel in a circle (*Afullota*). Despite our

manyunanswerable questions, what we can say is that this word is very suggestive and maps neatly to what anthropological theory conceives of a Mississippian polity to be. It informs us that for the historic Choctaw, and perhaps for their ancestors, the notion of a territory defined by the actions and travel of its leader was an accepted one. Certainly a study of the distribution of Mississippian mounds in polities that are ancestral to the Choctaw show the same half-day's-radius polity size construction as seen in the southern Appalachians (Livingood 2010).

This term also calls to mind the maps produced by native informants in the historic Southeast. The best known of these were produced by a Catawba informant around 1721, another by a Chickasaw informant around 1723, and a third and fourth are preserved by French copies of Chickasaw or Alabama maps produced around 1737. These maps are all well documented (Galloway 1998; Waselkov 1989, 1998) and all share a few basic conventions. The most striking of these are that all native territories are represented on the maps with a circle, whereas in the Catawba map of 1721, the European territories of Charlestown and Virginia are represented with rectangles and rectilinear lines. Further, these circles are joined by lines indicating passages for travel or social proximity. The circles-connected-with-lines device is also present on earlier materials such as Powhatan's Mantle (Waselkov 1989), Mississippian shell gorgets (i.e., Phillips and Brown 1978:122.3), and Mississippian pottery (Lafferty 1994), which may indicate this is a convention that has prehistoric antecedents. One observation of the historic maps is that there is a lack of uniformity to the sizes of the circles, both on the same maps and when comparing the scales of different maps; therefore, there is clearly no one-to-one correspondence between the use of circles in these maps and polities-as-a-half-day's-radius. As Galloway (1998) indicates, it is better to think of these as "sociograms" than as geographic maps in a Western sense. In this case the circles on these maps represent spatially discrete grouping of related people at some scale.

Another possible prehistoric map is worth mention here. A possible thirteenth- or fourteenth-century rock art map of the central Mississippi valley has been documented that does not use circles to designate territories, but it does depict settlements in discrete and similarly-sized clusters (Norris and Pauketat 2008).

I argue that when taken as a whole, these data suggest that Hally circles are more than just epiphenomenal. The confluence of archaeological data, anthropological theory, linguistic evidence, and cartographic data makes it likely that at least some Muskogean speakers conceived

of their chiefly territories as rounds. Furthermore, these rounds are the artifacts of the organization of chiefdoms and have at their root the distances that one can travel in a half-day in order to effectively organize a polity. Finally, these processes were probably apparent to and understood by the Mississippians who made the settlement decisions that gave rise to these settlement patterns.

Conclusion

The distribution of mounds first noted by Hally for the southern Appalachians (Hally 1993, 1999, 2006) has been widely commented upon as an important feature of Mississippian regional settlement patterns. This chapter attempts to add several new dimensions to this study

1. The straight-line distance limit to polity size noted by Hally corresponds to a half-day's travel from the mound centers.
2. Travel time actually produces a slightly stronger pattern in the data (greater modality), which is evidence that travel time was the variable underlying decisions about mound spacing.
3. This travel cost corresponds nicely to the pattern found elsewhere around the world where social groups with chiefdom-like organization have polity extents approximating a half-day's travel from the center.
4. The Choctaw, Muskogean speakers, had a term *minko apelechika afullota*, which means the political territory as defined by the circuit of a chief. This corresponds very well to the anthropological theory of how and why these chiefdom polities are sized the way they are and provides circumstantial evidence that they actively understood the political processes of polity formation.

For this we can thank David Hally for bringing such an important pattern to the attention of us all.

Acknowledgments

Most important, I want to thank David Hally for his encouragement and his helpful advice on this project. I also want to thank Leroy Sealy for helping me to understand the Choctaw term *minko apelechika afullota* and for sharing his knowledge about the Choctaw language. I want to give additional thanks to Rick Billy for his helpful ideas about the Choctaw language and to Mary Linn for her advice on researching linguistic data. Finally, I want to thank the editors for shepherding along this very worthy volume.

NOTE

1. The results of the Silverman's test presented in Livingood (2012) contained a calculation error. The results here are correct.

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AFTERWORD

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In 2008, Dave Hally published *King: The Social Archaeology of a Late Mississippian Town in Northwestern Georgia*, the capstone to decades of archaeological excavations and analysis of the King site as well as numerous excavations and surveys in the lower Piedmont. In *King* Hally's goal is to do a paleoethnography, or to reconstruct through archaeological evidence as much as possible about the life and times of the people who once lived at King. To do so Hally uses a social archaeology at a multiscalar analysis that not only fosters an understanding of the King site as a community built of many households but also situates that community within the regional network of which it was a part in the mid to late sixteenth century. *King* is, by all accounts, a masterpiece. *King* and, indeed, the full body of work that Dave Hally has accomplished over his career lays a broad and solid foundation upon which new works and new interpretations can be realized. It should come as no surprise then that Hally has inspired two generations of archaeologists; this book is a product of that inspiration.

Hally's contributions are numerous, but I will concentrate on those that are highlighted in this volume. Hally insists that in addition to historical processes, one must also discover the structural elements that constrain and often times direct human behavior. Like a Braudelian historian, Hally understands historical events such as migrations and interactions to be shaped by structural elements such as polity size and placement across a landscape, divine leadership mythos, gender patterns, ecological parameters, and so on. He also understands such structural patterns to be key to understanding how past human societies worked, and he has spent much of his career discerning those structures for the Mississippian