Chapter 7
Social Theory and History in Behavioral Archaeology: Gender, Social Class, and the Demise of the Early Electric Car

Archaeology today, it is well known, lacks a unified theoretical framework. Two traditional paradigms – culture history, with its diffusionist theory, and new (or processual) archaeology, with its weak amalgam of neoevolutionary, ecological, and systems theory – have long dominated the discipline's social theory, that is, the principles that explain variability and change in human behavior (Schiffer 1988b). Since the early 1960s, however, three additional theoretical frameworks have arisen, in part as reactions to the many shortcomings evident in the conceptual structure of new archaeology. Behavioral (e.g., LaMotta and Schiffer 2001; Reid et al. 1975; Schiffer 1976, 1992, 1995a; Schiffer and Miller 1999a; Skibo et al. 1995), evolutionary (e.g., Dunnell 1978, 1980; Hart and Terrell 2002; Hurt and Rakita 2001; O'Brien 2005; O'Brien and Lyman, 2002, 2003b; Teltser 1995), and postprocessual archaeology (e.g., Hodder 1985; McGuire 1992; Shanks and Tilley 1997) are minority programs whose advocates seek a wider following. In both evolutionary and postprocessual archaeologies, the major products are historical narratives. Behavioral Archaeology, however, strives to generate both historical narratives and general principles.

This chapter enters the arena of dispute with evolutionary and postprocessual archaeologies by presenting a case study in Behavioral Archaeology. The purpose is to showcase a behavioralist approach to building social theory and to constructing historical narratives. In Behavioral Archaeology, there are intimate and mutually reinforcing relationships between science and history.

While evolutionary and postprocessual archaeologists were seeking to establish hegemonies over social theory in archaeology, behavioral archaeologists were creating a sound basis for inference. It had been shown that underlying every inference are law-like statements that, along with other kinds of information, link observations on the archaeological record to behaviors of the past (e.g., Schiffer 1972, 1976). Regrettably, the principles required for behavioral inference were underdeveloped and unsophisticated. Thus, Behavioral Archaeology's highest priority, when it emerged in the early 1970s at the University of Arizona, was to improve inference by promoting a better nomothetic understanding of material culture and of the formation processes – cultural and noncultural – of the archaeological record.

Since the 1970s, countless studies – many experimental and ethnoarchaeological – have furnished a host of basic principles (correlates, c-transforms, and n-transforms). With contributions from innumerable investigators, this component of Behavioral Archaeology's program is clearly coming to fruition: behavioral inference is now on a firmer and ever-improving footing. One unexpected by-product of this success has been the near-exclusive identification of Behavioral Archaeology with formation-process studies, experimentation, and ethnoarchaeology. Indeed, most archaeologists seem unaware that behavioralists also build social theory and craft historical narratives.

Behavioral Archaeology and Social Theory

Although the first sentence of the book *Behavioral Archeology* promises "a work in archeological methodology" (Schiffer 1976:ix), the remainder of that paragraph hints at a greater program, one that can rise, eventually, on a base of sound behavioral inference:

> If it [*Behavioral Archeology*] is consulted in search of ready-made explanations for the more popular issues in archeology—e.g., the adoption of agriculture, development of civilization, and Mousterian variability—the reader will surely be disappointed. If, on the other hand, the reader is concerned to ask these important questions in new ways and to devise more appropriate strategies for answering them, then this book may be of some interest. (Schiffer 1976:ix)

Readers who advanced to the second page of Chap. 1 would have discovered that new archaeology's social theory was a scant improvement over that of culture history:

> We simply have substituted one set of all-purpose causes—population pressure, environmental change and stress, various forms of intercultural contact, and assorted cybernetic processes—for an equally inadequate set of predecessor causes, such as innovation, diffusion, and migration. At the level of explaining behavioral and organizational variability and change, much of the new has not surpassed the old. (Schiffer 1976:2)

According to behavioral archaeologists, new and better social theory would be developed as attention focused on relationships between human behavior and material culture. These relationships were believed to capture the core concern of the discipline and the most distinctive characteristic of human societies. Studies of behavior–artifact interactions in all times and all places would furnish a framework of principles, new to the social and behavioral sciences, for understanding variability and change in human behavior. Indeed, behavioralists tended to eschew the adoption of social theory from outside the discipline, contending that archaeology's unique focus on long-term behavior–artifact interactions was the only sound basis for generating social theory in all of science (Rathje and Schiffer 1982; Reid et al. 1975; Schiffer 1975a).

Just as Galileo's telescope revealed, literally, a new universe of phenomena for astronomers to explain, so too would an emphasis on people–artifact interactions change the phenomenological world of behavioral scientists. By privileging the study of human activities, the nexus of such interactions, archaeologists would show that behavioral science could not be behavioral or scientific unless it also attended to artifacts. Creative descriptions of this previously unperceived reality would supply the key to constructing new social theory.

Efforts to achieve these ambitious goals were properly subordinated to forging the tools required for reconstructing a behavioral past. Even so, the last chapter of *Behavioral Archeology* contained one example of the creation of social theory. Not only was a rudimentary model presented for status-symbol distribution and change, but also the model's implications were elaborated for explaining certain classes of technological change in complex societies having high social mobility. More recent attempts on the part of behavioralists to build social theory can be found in several chapters and papers (e.g., McGuire and Schiffer 1983; Schiffer 1979, 1992, 2000, 2005a; Schiffer and Skibo 1987, 1997; Walker and Schiffer 2006; Zedeño 1997), a monograph (Schiffer 1992), and a textbook (Rathje and Schiffer 1982). A great many other studies, carried out by investigators who do not identify themselves as behavioral archaeologists, also fall within the scope and spirit of the behavioral program and have contributed important new principles. The present chapter obviously cannot present even a small sample of Behavioral Archaeology's social theory. It is convenient to term the latter "behavioral theory" to distinguish it from the products of other programs.

Behavioral Archaeology and History

New archaeologists and behavioral archaeologists, some believe, are hostile to history. With respect to the latter program in particular, this belief is unwarranted. Indeed, of the four original strategies of Behavioral Archaeology, I and IV are idiographic – that is, historical (Reid et al. 1975). In strategy I, for example, the investigator uses "material culture that was made in the past to answer specific questions about past human behavior" (Reid et al. 1975:864). Such questions, which can be descriptive or explanatory, are quintessentially historical.

Behavioral archaeologists argued that archaeology had both nomothetic and idiographic strategies and that the discipline's vitality depended upon their interdependence (Reid et al. 1975:867). To wit,

> Archaeology can enjoy hybrid vigor by nurturing both its historical and behavioral science roots. Archaeology will be history as long as historical questions continue to be asked. Archaeology will be behavioral science as long as the answering of historical *and other* questions leads the archaeologist to invent and test nomothetic statements in domains that have not been appreciably explored by other behavioral scientists. (Schiffer 1975a:844, emphasis in original)

Clearly, even before the publication of *Behavioral Archeology*, behavioralists had resolved the incipient science–history split that threatened to sunder the discipline.

What is more, behavioralists have endeavored to answer historical questions. For example, among Schiffer's works are prehistoric studies in northeastern Arkansas

(Schiffer and House 1975) and southwestern Arizona (McGuire and Schiffer 1982) and research on electrical and electronic technologies (Schiffer 1991, 2005b; Schiffer, Butts, and Grimm 1994; Schiffer et al. 2003). The latter studies have generally been well received by historians of technology, suggesting that the behavioral approach lays a suitable foundation for constructing narratives.

Although doing history is important in Behavioral Archaeology, so far we have failed to specify, in general terms, the character of a specifically behavioral history. A few words on that subject are now appropriate.

As the name implies, a *behavioral* history is one that strives to explain changes in behavior – that is, alterations in concrete activities. This means that the first concern in most studies is to infer, rigorously, the activities of interest.

Activities fundamentally involve the patterned interaction of people and artifacts. There are many kinds of people–artifact relationships in activities. Indeed, the concept of "relationship" is deliberately left broad and open ended in order not to exclude promising avenues of inquiry. To facilitate communication, however, we have identified several fundamental relationships based upon an artifact's contributions to the activity. These are known as techno-, socio-, and ideo-functions (Rathje and Schiffer 1982:65–67; Schiffer 1992:9–12).

A techno-function is a utilitarian function: the containment, manipulation, or alteration of materials. A socio-function involves the communication of information about social phenomena among an activity's participants or between that social unit and others, so as to affect interaction and activity performance. Artifacts with socio-functions also establish socially appropriate settings for carrying out specific activities (for a more detailed discussion of socio-function, see Schiffer 1992:132–133). When an artifact encodes or symbolizes ideas, values, knowledge, and so forth, it is said to be serving an ideo-function; clearly artifacts with ideo-functions also influence social interaction and activity performance.

The artifacts (and people) taking part in specific activities have, by virtue of their material composition and form, various properties that affect their suitability for interacting in specific ways. These activity-specific capabilities are known as performance characteristics (see also Chap. 1; LaMotta and Schiffer 2001; Schiffer and Miller 1999a, Chap. 2; Schiffer and Skibo 1987, 1997; Skibo and Schiffer 2001) and can pertain to techno-, socio-, and ideo-functions. Factors such as initial cost, maintenance cost, and replacement cost play a role in defining activity-specific relationships between people and artifacts and can, in principle, be treated as performance characteristics (Schiffer 2005b).

Many kinds of behavioral histories, faithful above all to people–artifact interactions, are conceivable. One such general approach, outlined here, focuses on the activities in which a specific artifact participated. The first question is, what are the relevant activities? In some cases, the investigator may take an interest in the reference artifact's entire life history/behavioral chain, including processes of material procurement, manufacture, distribution, use, maintenance, and disposal. The activities making up each process can be characterized in terms of their constituent artifacts as well as specific people–artifact interactions. Also asked of each activity is, what are the techno-, socio-, and ideo-functions of the reference artifact and other relevant artifacts? And which performance characteristics enable the artifacts to carry out those functions?

Next, one can turn to the social units of activity performance. How was each group constituted? Group membership may be defined on the basis of specific performance characteristics – for example, strong people or people with certain kinds of knowledge – or particular variables such as age, sex, gender, occupation, wealth, and kin or corporate or residential group membership. Once the composition of the task group is given, one may investigate its activity-specific ideology (i.e., attitudes, values, beliefs).

These basic data serve as a foundation for examining a host of other relationships, especially the dependency relationships that link any of the reference artifact's activities to other activities. *Dependency relationship* refers to the manner in which two activities are coupled to one another through material flows (inputs and outputs). The study of dependency relationships allows one to trace causes and consequences of activity change (Schiffer 1979, 1992, Chap. 4).

Another tack is to compare the reference artifact to other artifacts having similar functions. One could ask, for example, what are the similarities and differences in performance characteristics between the reference artifact and possible alternatives in specific activities?

To illustrate the character of a behavioral history constructed according to the foregoing model, the case of the early electric automobile in the United States is explored. This example is intended to demonstrate that behavioralists can generate deeply contextualized, engaging, and instructive narratives capable of reaching an audience of nonspecialists – even the general public. For present purposes, the story that follows has been highly condensed (from Schiffer, Butts, and Grimm 1994). To keep it uncluttered, neither references nor justifications of inferences are included. Finally, as a further nod to economy of expression, it is left to the reader to imagine how the behavioral narrative that follows would differ from those that might be fashioned by evolutionary archaeologists, postprocessual archaeologists, or historians.

The Narrative: What Happened to the Early Electric Car?

After many decades of experimentation with self-propelled road vehicles, American inventors and entrepreneurs began to bring their creations to market in 1895. A few years later, in 1900, automobiles powered by steam, electricity, and gasoline competed on a more or less equal footing. Many knowledgeable observers believed that each kind of vehicle would find its own "sphere of action" and that all would coexist indefinitely. In the end, though, the gasoline-powered motor car conquered the others with stunning speed and thoroughness. The electric car's market share declined from 28% in 1900 to less than 1% in 1915. By 1920, the electric car as a commercial product was nearly dead.

Why did the electric car, in contrast to the gasoline car, fail to reach middle-class Americans? An appreciation for the performance characteristics of the two kinds of automobiles in relation to the specific activities of specific groups of people (defined by class, gender, occupation, and rural or urban residence) can help us understand why the electric car failed to find more than a minuscule market.

In 1901, commercial interest peaked, with 41 firms selling an amazing variety of electric vehicles. Like most gasoline and steam cars at the turn of the century, electrics were expensive, ranging from $1,000 to $5,000 at a time when a common laborer might earn $500 a year.

During these early years consumers experimented with automobiles, trying them out in various traditional leisure and practical activities. People of means, mostly men, tested gasoline, steam, and electric cars as replacements for horses and bicycles in racing, for horse-drawn carriages and wagons in trips around the town, and between farm and city, and, most importantly, for bicycles and trains in long-distance touring in the country. The performance characteristics of each kind of car were assessed in relation to these activities. Farmers, who sometimes lived far from town and almost universally lacked electricity at home, found quickly that gasoline cars were a better substitute for horse-drawn wagons than electric cars. Similarly, wealthy urban men discovered in short order that the electric car's limited range on one charge of the battery (20–40 miles), long recharging time (6–10 h), and low speed (12–18 mph) made touring difficult. As automobilist Henry Sutphen (1901:197) bluntly asserted, "Electricity is manifestly out of the question for touring."

Although gasoline cars were unreliable, dirty, smelly, hard to start, and expensive to operate, wealthy automobilists turned to them almost exclusively as the activity of touring became the *sine qua non* of automobilism in the first years of the new century. Automobile magazines, written by and for enthusiasts, as well as mass-circulation magazines, glamorized endurance runs and tours, elevating the mostly male adventurers into heroes of the day – people whose activities would be worthy of emulation by members of the middle class.

Touring cars were built rugged for rough country roads, had engines of four or six cylinders that were powerful for the time, and could go fast – already 40–60 mph by 1910. Significantly, the tourist did not have to worry about where to buy gasoline on the road; having a number of mundane uses, it was available at any country store.

Clearly, the design of the gasoline car was dictated by the touring function, its form and performance characteristics tailored to the leisure activities of elite men. At $1,500–$5,000, the open-air touring car was a bit pricey for most middle-class Americans. Even so, sales of touring cars surged, and a few entrepreneurs – Henry Ford most prominently among them – improved their reliability and repairability and brought down their price. In 1908, Ford introduced the Model T at $850. Within a few years, as the Model T's price dropped, the middle class embraced the gasoline-touring car in large numbers.

Although farmers and male automobilists scorned the electric car, it did find some satisfied customers. Women in particular – all well-to-do, of course – immediately took to electric cars because they were clean, quiet, reliable, easy to start, and simple to operate. In addition to these performance characteristics, the closed-coach styles of the increasingly popular coupe and brougham could be driven in rain, snow, and cold weather. Significantly, the electric car's speed and range were adequate for the urban woman's everyday activities, such as running errands and socializing. The regal electric car was a perfect replacement for the horse-drawn carriage for travel in town and could even carry out the carriage's social functions. No longer dependent on carriage drivers, the wealthy woman in her electric car enjoyed unprecedented independence and mobility.

Appreciating that the performance characteristics of the electric car made it the vehicle of choice for getting around town, even some men, such as salesmen and doctors, adopted it for use in their professional activities. To enhance the electric car's appeal to men, manufacturers began to offer a "roadster" body style that mimicked – in looks only – the stereotypical gasoline touring car.

Performance characteristics of electric cars improved greatly between 1900 and 1910. The use-life and energy density (stored power per pound) of batteries advanced almost yearly, and carmakers reduced energy-wasting friction in the drive train. The happy result was that by 1910 electric cars could travel 50–100 miles on a charge. Owing to the low speed limits geared to the pace of horse-drawn vehicles (usually 12 mph or less), an electric car on one charge could cruise the city all day long.

Unfortunately, the recharging of batteries in 1910 could be difficult, because fewer than 10% of city residences were wired. Outside the home a variety of garages, patterned on livery stables, sprang up to charge and care for electric cars and deliver them to their wealthy owners. The usual stabling fee was $25–$40 per month – about what a working-class person earned. Outside of cities, getting a charge was nearly impossible.

Realizing that charging of car batteries could become a significant source of income, in 1909 the larger electric companies joined carmakers in a promotional campaign. They believed that the electric car, a perfected technology, was poised to take off, even though its market share was now less than 5%.

During the electric car's classic age (about 1910–1914), advertising exploded across the pages of newspapers and magazines. Gradually, discussions of mechanical and electrical virtues – aimed mainly at men – took a backseat to the promotion of comfort, convenience, and luxuriousness. In highlighting these performance characteristics, carmakers were targeting women, whom the ads depicted extensively. In electric car ads published in *Literary Digest*, for example, images of women outnumbered images of men in the ratio of three to one, and women were shown more often as drivers, sometimes chauffeuring men. In one fascinating Detroit Electric ad of 1912, a lone woman heads to her electric car carrying a set of golf clubs. Clearly, the all-weather, easy-to-drive electric car made it possible for wealthy women to enjoy, during the day, a liberated lifestyle.

In the evenings, the electric car became the elegant town car, taking elite couples to the opera, concerts, and the theater. An electric coupe or brougham, with its plush upholstery, curtains, and polished brass or silver fixtures, enabled members of America's horsey set to travel around town in a style once reserved for European royalty and to communicate their exalted social position to friends, acquaintances, and onlookers.

Although sales of electric cars accelerated in the early teens – around 6,000 were sold in 1912 by at least 20 manufacturers – their market share continued to decline. That same year Ford alone produced 82,388 Model Ts, which sold for as little as $525 (compared with $850–$5,000 for an electric car).

For the urban elite seeking to replace a horse and carriage for evening travel in town, the electric car was the motor car of choice. After all, who would want to crank-start a gasoline engine while wearing a tuxedo or gown? Beginning in 1912, however, the horsey set had an alternative. In that year Cadillac, which for some years had already been copying the electric car's closed-coach style, brought out a gasoline town car with an electric starter.

In the next few years, sales of Cadillacs and their clones began to cut deeply into the electric car's core market. Electric car sales stagnated at 6,000 in 1913, and in 1914 began to slump. From 1915 to 1920, the electric car faded into obscurity as, one after another, manufacturers of electric cars went out of business.

It would be easy to conclude that the rapid adoption of the electrified gasoline town car killed off the electric car. Although partly true, that explanation does not account for the electric car's failure to be adopted by the middle class. While inexpensive gasoline cars – still crank started – were finding a huge middle-class market, inexpensive electrics (under $1,000) of the mid-teens were being largely shunned by consumers. A prosperous middle-class urban family could have afforded a cheap electric car but instead chose a gasoline car – even though the price of gasoline was rising while that of electricity was falling, and millions of middle-class homes were now wired. The reasons for this choice are fascinating.

Doubtless, both men and women of the middle class longed to own cars, to emulate the activities of the wealthy. For a woman, an electric car was the ideal city car that could give her, during the daytime, a freedom of action impossible with trolleys. And, of course, it was a car designed for feminine tastes that increasingly were being molded by mass-circulation magazines. As *Electric Vehicles* put it in September 1916 (p. 98), "There is hardly a woman living who would not like an electric." The middle-class man, on the other hand, mainly coveted the car that promised to make possible the adventure and excitement of touring. In ads everywhere and on city streets he could see that the real man's car was a gasoline touring car like the Model T. An electric roadster may have looked like a touring car, but everyone knew it did not perform like one.

In very wealthy families, the conflict over cars was easily resolved by buying two. Many of America's elite, like Thomas and Mina Edison and Henry and Clara Ford, owned "his-and-her" automobiles: one a gasoline touring car, the other an electric coupe or brougham.

Middle-class families lacked the wealth to buy and maintain two cars, and so the decision about which one to buy became a struggle. Most likely, the husband was able to convince his wife that a gasoline car could do more than an electric car and was cheaper too, and thus it was the only sensible purchase. A wife unswayed by this argument could always be reminded that the husband was entitled to make the decision because he was the family's breadwinner. At this time, married middle-class women did not work outside the home. In any event, the struggle between the sexes in middle-class families ended with the purchase of a gasoline car. Had such families been wealthier or had middle-class women enjoyed greater economic independence, the electric car in the teens might have found a market of millions.

History and Social Theory: The Electric Car Revisited

Although behavioral archaeologists can and do fashion historical narratives, even those suitable for the general public, idiographic research is also a source of *nomothetic questions* that can orient theory building. This is an example of the interaction and integration of strategy I with strategies II or III (Reid et al. 1975). In this section, the history of the electric car is used as a springboard for developing a new behavioral theory.

All historical narratives achieve plausibility because the writer and the reader hold in common particular theory- or law-like generalizations (Spaulding 1968). These generalizations connect the causative factors enumerated in the narrative to the event or process to be explained. In most historical narratives, however, the principles – which may be little more than folk theory or ideology – are deeply embedded, invisible on the surface. That theories and laws are implicit is an unavoidable consequence of the narrative form; a story constantly interrupted by exegeses of general principles would be choppy and dull. In a scientific context, however, bringing to light the hidden nomothetic apparatus is essential. Such an exercise may lead to generalizations of potentially widespread applicability. Once explicit, these theory- and law-like propositions can be evaluated for their fit with other principles as well as subjected to testing on new historical cases.

The electric car narrative contains much implicit behavioral theory, and so a complete analysis here is out of the question. To make the task manageable, the focus is on the end of the scenario: why middle-class Americans failed to adopt the electric car.

In previous chapters (see also McGuire and Schiffer 1983; Schiffer 1992; Schiffer and Skibo 1987, 1997; Skibo and Schiffer 2001), behavioral theory dealing with the compromises entailed in the process of artifact design has been elaborated. It has been shown that owing to the complex linkages between technical choices and performance characteristics, an artifact's design cannot optimize the values of all behaviorally relevant performance characteristics: some are necessarily achieved at lower levels than others. Thus, each artifact embodies compromises in performance characteristics relating, for example, to activities of manufacture, use, and maintenance. The pattern of compromises in each case is determined by behavioral factors pertaining to lifeway and social organization. For example, "high residential mobility favors use of houses that are easy to build but often difficult to maintain. In contrast, greater settlement longevity shifts the balance in favor of more manufacturing effort, which is repaid by houses that are easier to maintain and last longer" (Schiffer and Skibo 1987:600).

In order to lay a foundation for explaining technological variation and change, the investigator constructs a performance matrix. Such matrices allow one to compare the patterns of compromise in the performance characteristics of two or more artifact types. It is now possible to recognize at least four kinds of performance matrices:

1. An *absolute* matrix lists absolute values for all behaviorally relevant performance characteristics.
2. A *relative* matrix indicates which artifact type scores higher on each performance characteristic.
3. A *threshold* matrix specifies, for each performance characteristic, which artifact types exceed a given threshold value (for an example, see Schiffer 2005b).
4. A *weightings* matrix denotes whether or not a performance characteristic was apparently weighted heavily in the design process (for example, see Schiffer and Skibo 1987:607).

Although absolute matrices contain the most detailed information, relative, threshold, and weightings matrices can still reveal major patterns in compromises.

The patterned technological variation systematized in performance matrices becomes the focus of explanation. That final step is taken when one shows, with correlates and other behavioral theory, how specific "factors of lifeway and social organization *condition the acceptability of particular design compromises*" (Schiffer and Skibo 1987:600, emphasis in original).

Originally devised to facilitate explanation of design compromises effected between activities of manufacture, maintenance, and use, performance matrices can be easily modified to allow close study of compromises in use activities alone – as is appropriate for the electric car case. Extended in this way, performance matrices become the tool of choice for investigating the adoption of artifacts by consumers (see also Schiffer 2005b).

In the extended model (a performance matrix that treats use activities exclusively), artifacts may participate in more than one use activity, and in each activity they may have any number of techno-, socio-, and ideo-functions. In specific cases, one begins by identifying relevant use activities and the functions that the reference artifact performs in each. The investigator then enumerates the performance characteristics relevant to each function in each activity. Finally, one constructs a performance matrix.

The theory underlying the extended model rests on the premise that an artifact's performance characteristics cannot all achieve high values in every use activity. Thus, the activities can vary greatly in the degree to which they are performed effectively. For example, a Swiss army knife can be used for diverse activities, from cutting meat to taking apart a radio or opening a beer bottle. However, compared with the unifunctional artifacts that might be employed instead (e.g., butcher knife, screwdriver, and bottle opener), the Swiss army knife does not allow every activity to be performed at maximum effectiveness. Bottles can be opened reasonably well with a Swiss army knife, but it is much less effective in cutting meat and taking apart radios. It follows that in the set of activities that share a multifunctional artifact, there will be compromises in activity performance. The extended model allows the investigators to visualize patterns in these compromises, to see which activities were favored and which were disadvantaged. The focus of explanation becomes the patterned compromises, which have to be linked, through explicit principles, to factors of lifeway and social organization.

In the case of the Swiss army knife, none of its use activities can be performed in the most effective manner. The only use-related activity decisively favored is transport from one activity area to another. Principles of technological organization (e.g., Nelson 1991) permit us to appreciate that this pattern of activity compromises is expectable when there is high user mobility and limited transport capability. As we attempt to explain the patterned compromises in activity performance brought to light by applications of the extended model, new behavioral principles will also doubtless emerge.

With the extended model now in hand, as well as new ways to construct performance matrices, we can return to the electric automobile. In listing the activities in which automobiles were used during 1910–1914, one must grapple with the problem of scale, taking care to strike an appropriate balance between activities narrowly and generally defined. Three activities of use are recognized for purposes of this analysis: touring, running errands in town, and traveling to social functions in town. Table 7.1 shows a threshold performance matrix that enumerates the performance characteristics believed to be relevant to each activity. It should be noted that although each activity has a distinctive set of performance characteristics, some of the characteristics are behaviorally relevant to more than one activity.

Inspection of the performance matrix (Table 7.1) reveals some remarkably strong patterns in the effects of gasoline and electric cars on each of the three activities. Insofar as touring is concerned, the electric car was, so to speak, a non-starter, as the touring impresarios claimed. On the other hand, the electric car was well suited to running errands and traveling to social functions in town. Clearly, neither kind of car allowed all activities to be performed effectively. A household's choice of one car over the other would have been an unhappy compromise that reflected the differential weighting of activities.

Before discussing the problem of how to treat the differential weighting of activities, one must bring the car users into the foreground by introducing the dimensions of gender and class. Although one can generate gender- and class-based performance matrices that present relevant activities and relevant performance characteristics for each abstractly defined user group, the process is simplified here for the sake of brevity. The strength of association between a specific activity and given gender-class groups (its "loading") is discussed.

Touring in the teens was a socially desirable activity for men. It began as a leisure pursuit for members of the upper class, but by 1910 tens of thousands of Model Ts and other inexpensive gasoline cars were being driven by middle-class men striving to emulate the activities of their wealthier brothers. In short order, the middle-class man's social competence – the ability to interact effectively with other men, especially of his class – was coming to depend on the possession of a car capable of touring.

Running errands in town, especially during the day, was an activity with a very high female loading, regardless of social class. What differed by class were the available transport technologies. Upper-class women could depend on horse-drawn

Table 7.1 A threshold performance matrix for gasoline and electric automobiles, circa 1912[a]

Activity	Performance characteristic	Gasoline	Electric
Touring	Range of 100+ miles (T)	+	−
	Top speed of 40–60 mph (T,S)	+	−
	Ease of fueling, recharging (T)	+	−
	Ruggedness (T)	+	−
	Economy of operation and maintenance (T)	−	−
	Repairability in the country (T)	+	−
	Can indicate owner's membership in the group "tourists" (S)	+	−
	Can indicate owner's wealth (S)	+	+
Running errands in town	Range of 50–100 miles (T)	+	+
	Speed of 12–20 mph (T)	+	+
	Ease of starting (T)	−[b]	+
	Ease of driving (T)	−	+
	All-weather capability (T)	−[c]	+[d]
	Reliability (T)	−	+
	Economy of operation and maintenance (T)	−	−
	Ease of fueling, recharging (T)	+	+[e]
	Can indicate owner's wealth (S)	+	+
	Can indicate owner's social position (S)	+	+
Traveling to social functions in town	Range of 50–100 miles (T)	+	+
	Speed of 12–20 mph (T)	+	+
	Ease of starting (T)	−[b]	+
	Ease of driving (T)	−	+
	All-weather capability (T)	−[c]	+[d]
	Reliability (T)	−	+
	Economy of operation and maintenance (T)	−	−
	Ease of fueling, recharging (T)	+	+[e]
	Cleanliness of operation (T)	−	+
	Quietness of operation (T, S)	−	+
	Can indicate owner's membership in the "horsey set" (S)	−	+
	Can indicate owner's wealth (S)	+	+
	Can indicate owner's affinity for "high culture" (I)	−	+

[a] Entries represent an approximation of how these performance characteristics were judged. A plus (+) indicates that the car exceeds the threshold value of that performance characteristic; a minus (−) indicates that the car falls short of the threshold value. T = techno-function; S = socio-function; I = ideo-function.

[b] After 1912, the pricier gasoline cars had an electric starter.

[c] A few expensive gasoline cars, like the Cadillac, had a closed-coach body style, but the touring car exposed the occupants to the elements.

[d] The electric roadster lacked all-weather capability.

[e] In homes without electricity, recharging of batteries could not have been done economically.

carriages and coachmen or on cabs, while middle-class women had to walk or take the trolley. The electric car was quickly adopted by upper-class women as appropriate for running errands.

Men and women both traveled to evening social functions. Again, however, the electric car – the most suitable technology for the activity – was restricted to America's elite; middle-class Americans took cabs or trolleys.

Upper-class households, by buying two cars – gas and electric – were able to avoid making unhappy compromises in automobile-use activities. Middle-class households in the teens may also have desired two cars, for the same reasons, but they simply could not afford their purchase and maintenance costs. Someone's activities had to be severely compromised, and those activities were mainly women's.

Certainly, there is nothing novel about the generalization that wealthy households can afford more artifacts (e.g., Schiffer et al. 1981). What is new is the recognition, grounded in behavioral theory, that wealth makes it possible to avoid compromises in activity performance caused by the employment of multifunctional artifacts. Wealthy households acquire a plethora of artifacts having very narrow functions that enhance the performance of specific activities. This can be stated more formally as the "Imelda Marcos" hypothesis (a pair of shoes for every occasion)[1]: in a class of sedentary behavioral components (e.g., households, corporate task groups, communities), the members with greater wealth are able to enhance the performance of favored activities by acquiring additional specialized or unifunctional artifacts. This means, for example, that a set of techno-, socio-, and ideo-functions formerly performed by one artifact can be carried out by several. In the present context, "unifunctional" does not mean literally only one function; rather, the term denotes artifacts having a reduced or limited number of functions (relative to the artifacts being replaced).

Other processes in addition to that described by the Imelda Marcos hypothesis can also cause unifunctional artifacts to proliferate in specific activities. For example, as Zipf (1949) long ago hypothesized, a tool kit used at a high rate will differentiate into more specialized tools as artisans seek to reduce their effort per unit of output. Zipf's hypothesis is of value in explaining the expansion of tool kits that can accompany changes in the scale of certain production activities, though it appears to apply mainly to techno-functions. The process described by the Imelda Marcos hypothesis, however, operates independently of rates of activity performance and artifact use and covers all artifact functions. Another process is at work when the constraints of high mobility (which favor multifunctional artifacts) are relaxed. As residential mobility decreases, a behavioral component is apt to acquire more artifacts, including those with narrower functions, for some activities. Although neither of these alternative processes is relevant to the automobile case, one should keep them in mind when offering explanations for other instances of unifunctional-artifact proliferation.

The Imelda Marcos hypothesis, though obviously requiring further refinement and empirical evaluation, is not without interesting implications. A few examples should suffice to illustrate its productivity.

In complex societies without rigid sumptuary rules, especially where there is a high social mobility, the acquisitiveness of wealthy households seemingly lacks limits. Entirely new technologies and industries can arise simply to meet the

[1]Imelda Marcos, wife of the late Philippine leader Ferdinand Marcos, was fond of footgear. Forced out of power by a coup in the mid-1980s, the Marcos family made a hasty exit from Manila. The first visitors to the abandoned presidential palace discovered Imelda's trove of 3,000 pairs of shoes.

insatiable demands of well-to-do consumers (cf. Schiffer 1976, Chap. 12). It is commonplace to attribute such lavish acquisition behaviors to the ceaseless quest for prestige and high social standing, which is fulfilled – but often only temporarily – by artifacts having appropriate social functions. I suggest that the traditional account is, at the very least, incomplete. It is clear that households that acquire new products at high rates garner greater prestige and social standing in certain activities; the artifacts do serve these socio-functions. But does that effect alone explain the acquisition behavior? The Imelda Marcos hypothesis suggests that another cause may be the effort to enhance the performance of favored activities through the acquisition of innumerable artifacts having narrow functions, including techno-functions. Thus, one should not forget that "status items" and "prestige goods" can also carry out important techno-functions. After all, even Imelda Marcos used some of her shoes for walking. This implication of the Imelda Marcos hypothesis resonates with an analytical imperative of Behavioral Archaeology: artifacts must be deeply contextualized in relation to all relevant activities.

The Imelda Marcos hypothesis also has implications for understanding the use of space. To wit, another strategy for enhancing favored activities is to conduct them in larger and sometimes dedicated – that is, unifunctional – spaces. Thus, when wealthy households proliferate unifunctional artifacts, they may also expand and subdivide their dwellings and tofts.

Because the term *artifact* can, for certain purposes, include people (Schiffer 1979; Schiffer and Miller 1999a), the Imelda Marcos hypothesis is seen to have unexpected utility in accounting for the proliferation of specialists – people who carry out, usually with great skill, a limited number of activities. For example, to enhance the performance of certain activities, elite households may add unifunctional members, such as cooks, butlers, maids, chauffeurs, and gardeners. Doubtless the Imelda Marcos hypothesis can be extended to people in other kinds of behavioral components.

The final implication deals with the effects of unifunctional artifacts on activity performance. The addition of unifunctional artifacts can cause an activity to change in predictable ways. In a word, an enhanced activity is apt to become more differentiated and complex. Owing to the additional artifacts and thus more intricate people–artifact interactions, the spatial organization of the activity also changes; as noted already, often more space – even unifunctional space – is needed. New artifacts require new maintenance activities, which may in turn entail new unifunctional maintenance artifacts and dedicated maintenance areas. These altered material flows establish new dependency relationships between the original activity and others, which can contribute to further activity changes in different parts of the behavioral system (Schiffer 1979, 1992, Chap. 4). In addition, as the task group becomes more practiced at using the new artifacts, tacit knowledge and skill will increase along with the activity's techno-science content (Schiffer and Skibo 1987). The activity's ideology will also change, as the task group adopts more appropriate activity-maintaining values and attitudes (Schiffer 1992, Chap. 7). Clearly, activities enhanced by an infusion of unifunctional artifacts will undergo many changes, having implications for our understanding of how behavioral systems alter in response to the allocation of resources to favored activities.

The Imelda Marcos hypothesis helps us understand how very wealthy households solved the car problem and why that solution was unavailable to the middle class. However, an important question remains: Why did middle-class households favor touring over running errands in town? Another way to ask this question is, why was a heavily male-loaded activity favored over a heavily female-loaded activity? The answer, furnished in the narrative above, implicates the structure of middle-class families. In the traditional Euro-American patriarchal family, men decide which activities are favored, and allocate resources accordingly. Middle-class men, captivated by touring, privileged their own leisure activities, and so bought gasoline cars. This commonsense explanation has some appeal, but in a scientific context it should be the beginning, not the end, of inquiry. What desperately needs investigation is how activities come to be differentially weighted by various kinds of behavioral components.

To facilitate investigation of this issue in the future, one can further generalize the Imelda Marcos hypothesis. Its most fundamental component is that the investment of resources in an activity, to enhance its performance, leads to an increase in unifunctional artifacts. In this fully generalized form, the hypothesis can even be applied to a class of behavioral components having the same wealth. Today, for example, there is enormous variation in the acquisition behaviors of middle-class households (e.g., Schiffer et al. 1981). Much of that variation is likely to be in the form of unifunctional artifacts obtained to enhance the performance of favored activities. What needs explanatory attention, then, is the differential enhancement of activities.

By monitoring the proliferation of unifunctional artifacts, the investigator has a powerful tool for assessing a behavioral component's activity priorities. This perspective permits us to raise old questions about our own society in new ways. For example, why do some lower middle-class households invest heavily in the sport, car-repair, and partying activities of adult men, whereas others channel resources disproportionately into enhancing the educational activities of children? Attempting to create the behavioral principles needed to answer such questions, which is obviously beyond the scope of this chapter, can lay a foundation for much fruitful research on the causes of behavioral variation and change.

Summary and Conclusions

Since the 1970s, behavioralists, along with other investigators, have begun to contribute the principles and procedures needed to put archaeological inference on a scientific foundation. Happily, it is becoming possible to describe some characteristics of past societies in behavioral terms.

Inferring past behavior was never viewed by behavioralists as archaeology's final goal. Rather, behavioral inferences provide the basis for generating a view of the past compatible with a particular theoretical stance: the behavioralist premise that the basis of human societies is their complete reliance on complex and intimate relationships between people and artifacts (Schiffer and Miller 1999a). The study of such relationships, in all times and all places, can, behavioralists maintain, lead to the creation of distinctive social theory in archaeology.

Using the case of the early electric car, it was demonstrated that behavioral theory, immature though it remains, facilitates the fashioning of historical narratives that are both richly contextualized and audience friendly. More significantly, a behavioral narrative is centered on the actual activities of past people.

In Behavioral Archaeology, however, historical narratives are not the only or the ultimate product. For behavioralists, history (i.e., strategy I) can be a source of general questions that serve as a starting point for crafting new behavioral theory (in strategies II and III). The electric car study provided an example of strategy interaction as the narrative was dissected to disclose some of its nomothetic underpinnings. This exercise led to the development of an extended model for studying, with performance matrices, the effects of multifuctional artifacts on activities. This behavioral model allows one to understand the patterns of compromise in activity performance occasioned by instances of product acquisition.

These theoretical discussions, prompted by the electric car case, also led to the formulation of the Imelda Marcos hypothesis, which states that in a class of behavioral components (e.g., households), wealthier members can afford to invest in greater numbers of unifunctional artifacts. The performance of favored activities is thereby enhanced because one can avoid the compromises entailed by the use of multifunctional artifacts. The hypothesis was generalized and additional implications derived. The effort to explain why middle-class households in the teens enhanced male-loaded activities (touring) instead of female-loaded activities (running errands in town) foundered for lack of relevant behavioral theory. Development of the appropriate principles is urgently needed to permit replacement of folk theory and modern ideology, which are, regrettably, the nomothetic basis of many archaeological explanations. The behavioralist demands that historical narratives rest, eventually, on a foundation of well-confirmed behavioral principles. As the consideration of the electric car narrative shows, nomothetic strategies of Behavioral Archaeology can serve history not just by improving behavioral inference but also by answering, with credible theories and laws, the general questions raised in specific narratives. This vision of the mutually beneficial relationship between history and behavioral science in archaeology is an uplifting one, for it encourages individuals to pursue the research activities for which they are best suited and it fosters an across-the-board elevation of standards. Clearly, we can now build behavioral science for distinguishing between rigorous historical narratives and just-so stories.

Although improving historical narratives is a good reason for creating sound behavioral theory, it is not the only reason. Archaeology is also a unique behavioral science that, owing to its emphasis on artifacts, has much to contribute to other behavioral sciences. The foundation of archaeology as behavioral science is "the study of relationships between human behavior and material culture" in all times and all places (Reid et al. 1975:864). Thus, the focus of theory building in archaeology is not on culture or on extrasomatic adaptations or even on the archaeological record but on what people actually do (and did) in specific activities. By privileging people–artifact interactions, behavioral archaeologists are able to discern a distinctive order of human phenomena, previously unperceived, that is amenable to nomothetic study. Constructing behavioral theory to explain variation and change in human behavior, conceived as people–artifact interactions, is archaeology's highest scientific calling.