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A cognitive history of material objects: The archaeology of possession, inheritance, and value

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Abstract

Humans have had the same cognitive capacity for at least 50,000 years but it is only in the recent past that this capacity has been put to increasingly complex uses. Starting about 6,000 years ago, population growth and the development of permanent hierarchical leadership was materialized in the emergence of states, cities, and empires. Archaeologists often focus on ancient political leaders to explain and analyze these developments, a process that leaves out the motivations of the vast majority of people who "vote with their feet." A broader perspective incorporates the actions of ordinary individuals who sought opportunities for the creation of increasingly dense social, economic, political and ritual networks in towns and cities. In this talk, I will discuss three aspects of individual actions that can be seen in the archaeological record and the effects of which are still very much with us economically: possession and the use of material goods, inheritance as a mechanism of disposing of goods in a socially-meaningful way, and value as a component of the fluid and dynamic assessments undertaken by individuals as part of daily economic life.

Archaeology and the study of material objects

Although we think of it as being the study of ancient people and artifacts, archaeology can be defined more broadly as the discipline that evaluates the relationship among people, material objects, and space (cf. Reid et al. 1975:864). In the United States, most archaeology is housed within departments of anthropology, providing a complement of cultural and biological perspectives to the study of the ancient past. A disciplinary home in anthropology also provides a framework within which archaeological research contributes to the understanding of present human behavior. The material traces of the past, as recovered through archaeological research, can be used to evaluate the mechanisms by which our ancestors first engaged in the use of the environment for the extraction of food resources and tools, and for the enhancement of social relationships.

Archaeological information is gathered by three different means: excavation, survey, and remote sensing. Excavation is the mode that is most familiar to the public; by digging through layers of accumulated deposits, archaeologists gain detailed information about specific contexts such as living areas and work zones. However,

excavation also is time-consuming and expensive, and is usually undertaken on just a small percentage of an ancient site. Archaeological survey captures information about a larger area through a variety of methods, including the simple walking of the landscape to record the distribution of artifacts and features. Survey methods also include the use of imagery and geophysical techniques of subsurface density mapping to reveal the location of structures and features prior to (or as a substitute for) excavation. Surveys, which often involve statistical techniques that enable archaeologists to target regions with the highest proportions of sites, can be very successful in locating broad patterns of ancient activity across landscapes (e.g., Ford, Clarke, and Raines 2009).

Information about human activities in the past has a strong environmental component, and our colleagues in the physical and biological sciences are important collaborators in the search for ancient human behavioral parameters and practices. Environmental studies include the assessment of climate changes that affected the co-evolution of competitors and prey over the course of millions of years. Because today's landscapes are increasingly the product of modern historical activities such as dams and grazing, these studies enable us to visualize past environments. Environmental studies also are carried out on the small scale, for example through the examination of animal bones found in archaeological sites that reveal not only what people were eating but also about the surrounding environment as revealed through commensals such as mice, rats, and birds. Other environmental studies include the study of pollen cores for information about long-term climate change, of carbonized seed grains that were preserved in cooking and heating fires, and of residues from ancient pottery that show whether vessels held dairy products or fermented grain beverages.

Proxy evidence is an important additional means by which we can discern the development of human behavior. Many of the activities of our earliest ancestors involved perishable materials that decomposed and cannot be found through excavation or any other means of recovery. As a result, archaeologists creatively use durable proxies to understand the timing and extent of particular developments. One important example is fire, which enabled our ancestors to cook food, keep warm, protect themselves from predators, and encourage certain types of plant growth favorable to prey species. The earliest evidence for the use of fire is ephemeral, as the physical traces of small open fires would have quickly dissipated into the surroundings; however, we can use changes in human dentition to suggest when fire as a preparation technique resulted in a reduction of wear and tear on teeth (Wrangham et al. 1999).

Another development that is principally available only through proxy evidence is the development of clothing. Clothing is a daily, often highly symbolic, internalization of prevailing social norms through deliberate individual acts. These deliberate acts also contain the potential for change as individuals incrementally or dramatically materialize changes in styles from place to place or from generation to generation. But trying to find evidence for perishable clothing in the past is literally like looking for a needle in a haystack. Instead of excavating site after site in hopes of finding sewing tools made of bone or antler, we again turn to proxy measures of evaluation. In an

innovative use of mitochondrial DNA sequencing, R. Kittler and colleagues (2003) suggest that the appearance of the human body louse as a distinct, specialized subgroup of lice is a marker of the use of clothing. Their studies indicate that the development of clothing was relatively recent in evolutionary terms, dating to about 40,000 years ago in the Upper Paleolithic period. This is also the time when the archaeological record reveals the first substantial evidence of increased economic activities, including the emergence of complex symbolic systems as demonstrated through rock art, ornaments, and burials of the dead and the diversification of subsistence resources in a process known as the "broad spectrum revolution" (Flannery 1969:77; see also Bar-Yosef 2002; Kuhn and Stiner 2006).

These developments indicate that humans were doing more tasks--and more types of tasks--than in previous eras. Each additional activity brought with it an increase in the number of decisions related to the processing sequence, combined with an increase in the number of potential alternatives to the task at hand. By 40,000 years ago, simple linear sequences were no longer adequate to allow humans to engage with new technologies and new social investments; instead, humans increasingly engaged with a long cognitive heritage of multitasking. Multitasking is more than just the ability to do many things at once: it also involves the ability to adjust the timing and sequence of activities in response to changes in external or internal conditions (Burgess et al. 2000; Salvucci and Taatgen 2008). Through multitasking, individuals can adjust to unplanned or unpredictable external inputs that interrupt the original task flow, requiring reprioritization, rescheduling, and the capacity to remember and reintegrate delayed intentions (Burgess et al. 2000).

The tool-making process was a significant component of our species' development of the multitasking strategy that became progressively more sophisticated over time. On the cognitive level, the initial impetus for reprioritization and task flow adjustment would likely have stemmed from humans' first interactions with tools, a process that dates to at least 1.4 million years ago. Multitasking in this early era involved balancing the differential nature of stone resources compared to perishable edible resources, planning for seasonal availability, and learning from others the strategies for stone procurement and tool-making. Although humans are not the only species that makes and uses tools, the archaeological record supports an interpretation of human tool-making as encompassing distinct aspects.

First, the objects that are present by 1.4 million years ago, in the form of Acheulian handaxes and other bilaterally-symmetrical stone tools, require multiple and variable activities on the part of the makers. A handaxe is made through a succession of blows, but the progression of manufacture involves different levels of force: the initial blows require more force in striking off large flakes while the finishing touches involve a softer percussion; in addition, the individual must keep turning the stone over to ensure that the symmetry of the object is maintained. Human tool-making is distinct from the tool-making patterns of other species because of the social aspect that accompanies learning (Tomasello 1999), a factor that leads to long-term processes of observation, apprenticeship, and "technical virtuosity" (Vidale and Miller 2000).

There appears to be a link in the cognitive apparatus between the making of objects and the development of language, perhaps related to the fact that learning how to make sophisticated objects such as a handaxe would have required processes of learning through observation and communication. Alex Martin's (1998) research on the human brain has shown that information about natural entities (such as animals) are stored in a different physical portion of the brain than information about human-made entities such as tools. Moreover, information about tools is located in proximity to the same neural region that is active during the handling and use of objects. Martin's work suggests that the development of the language process and the capacity to manipulate objects co-evolved, with the result that the ability to make and use tools was a component of our species' behavioral patterns deep in prehistory.

Clearly, our species' interactions with stone was only the beginning of the artifact-making process. Individual decisions about the sequences of tasks affected not only the enaction of activities with material objects, but also affected the process of innovation. Michael Brian Schiffer's (2005) work on technological adoption indicates the many small and incremental steps of decision-making that are involved in the development and use of new technologies. He emphasizes that the adoption of a new technology is not merely a matter of it being better for some utilitarian purpose, but is enveloped in social factors that affect individual perceptions of utility. These "invention cascades" involve many individuals' participation in the steps of making prototypes, replicating successful components, and the use and maintenance of new processes and objects (Schiffer 2005:485). Although his examples focus on modern inventions such as the electric car and the portable radio, Schiffer's archaeologically-derived perspective on technological change can be applied to any time period in which we can discern the development and use of new technologies.

Two examples illustrate the effect of individual cognition and multitasking as seen in the archaeological record. In Bronze Age Greece, Nick Kardulias (2003) has shown that stone tools continued to be used at the domestic level long after the development of metals. His paper, entitled "Stone in an Age of Bronze," examines the rationale for the continuity of older technologies even when metals became available. He notes that stone tools were an essential part of subsistence technologies, being used for a wide range of tasks such as food preparation, and for the processing of materials such as hide, bone, antler, wood, and shell (Kardulias 1992:425). Moreover, the acquisition of raw materials was "embedded" in other subsistence activities such as hunting and herding, whereas metals were associated with the elites (Kardulias 1992:432).

Another example comes from the prehistoric American Southwest, where the invention of pottery was not immediately followed by its universal adoption even though it was superior to basketry for many aspects of storage, cooking, and transport. Patricia Crown and W.H. Wills have written of the combination of environmental constraints and opportunities that were factored into these decisions, proposing that people "maintained a heavy work load in the late Archaic and that scheduling conflicts might have deterred them from adding pottery manufacture to that work load until increased sedentism and greater dependence of cultigens required more frequent use of existing

containers (baskets, bags, pits, and gourds) for storage and food processing" (reported in Crown 2001:252; emph. in original).

The conscious assessment of the physical landscape, and the use of multiple, simultaneous economic strategies is a distinctly human characteristic. With each new invention, whether in the form of stone tools, fire, or clothing, humans had more ways in which to allocate their energy, more need to dovetail some activities with others, and more potential sources of new information. The increased repertoire of energy expenditures was accompanied by increased sophistication of language and culture. Although material and spatial interactions with objects were performed in a social context, the actual creation of objects and utterances was undertaken by individuals who each engaged an autonomous cognitive capacity for the materialization of behavior.

The participatory framework of engagement with the material world proposed here is distinct from many previous archaeological interpretations of the relationship between people, objects, and landscapes. Previous treatments have tended to focus on social divisions and the control of production, as well as the restriction of access that makes some objects more valuable than others for political display and the demonstration of hierarchy (e.g. Arnold 1996; Lesure 1999; Hunt 1997). These perspectives have a theoretical foundation in John Locke's observation that labor is what turns natural resources into property (1980[1690]:28), but with an emphasis on the competition within social groups. For example, Timothy Earle's (2000) treatment of property encompasses a necessarily adversarial component, in which property is a "behavioral mechanism to limit and direct the use of things" (2000:39). While he views property as "integral to all concepts of social institutions--how people are related to resources and to each other" (2000:40), the assignment of rights is often "contested and ambiguous" (2000:41).

Scarcity is a key factor in the development of competition. One source of scarcity is in the natural restrictions on availability (for example, because of the limited distribution of raw materials and other point-specific resources). Another source of scarcity is the restriction placed on production by elites, a factor that is particularly apparent after the development of agriculture and the emergence of permanent political hierarchies. However even in well-developed states and empires, the vast majority of material goods and social activities continued to be selected, utilized, modified, and discarded by individuals acting outside of the gaze of elites. My own emphasis is on the shared common denominator of cognition that underwrite interaction with the material world; like other archaeologists, I focus on energy expenditure as the means by which change is effected in the material record, but with a focus on the ordinary person and ordinary goods. As will be explored below, the individual human relationship with the material world can be evaluated through three aspects: possession, inheritance, and value.

Possession

We can characterize the handling of tools and other human-enhanced natural objects through the rubric of possession. At its most basic, possession is a physical act that begins with proximity and the autonomous body: are you holding the object or not? Are you standing

in that space or not? The here-and-now is clearly implicated in the individual's placement in space and physical proximity to objects. But possession also is conditioned by time and space, in that there are more objects and more aspects of the landscape to which an individual can have a claim other than what is "used" at any given moment. As a result, possession has a social component in which an individual's intent regarding particular objects and spaces is created relative to the recognition--and sometimes renegotiation--of those claims.

The expression of possession across time and space is not limited to humans, of course. Animals also mark territory and objects through physical means such as urine or saliva that serve as an advertisement of claims. Animals also signify their presence both actively (through vocalizations) and passively (through scent). However, possession may be only selectively enforced when a resource is encroached upon, depending on the timing and intensity of the encroachment and whether the encroachment is carried out by conspecifics or by other competitors (see Smith 2007a). And, the range of resources upon which non-humans express territoriality is limited to mates and food, constituting a relatively restricted set of physical entities over which possessive intent is registered.

Starting at least as early as 1.4 million years ago, humans would have had a wide range of resources upon which to make claims including food resources, reproductive opportunities, and resource zones for raw materials such as stone. The outcrops suitable for making stone tools are differentially distributed in space; they also can be differentially distributed in time, for example if there are seasonal constraints such as rain or snow that physically obscure the ground surface. The identification of places in the landscape for <u>potential</u> resource extraction added to the element of enforcement not only of present rights to a resource but future rights that may or may not be actualized by the individual or group. Elements of space and time mean that the acquisition of resources is done through a process of multitasking as individuals moved around the landscape to simultaneously acquire desired resources.

Language, whether expressed in utterances or encoded in symbol systems, is the mechanism by which possession is most commonly articulated among humans. Language encodes past and future, memory and planning, conditional statements and situational accommodation. The use of language to express the conditions of possession through space and time constitutes another way in which the coevolution of language and objects can be surmised. Spoken language, fully operational by 40,000 years ago, was a means by which the subtleties of possession, such as usufruct and temporary access, could be communicated. These forms of possession were much more diverse, and changeable, than could be conveyed by physical markings. In this way as well, language contributed to multitasking by providing a framework for novel circumstances in which people could acquire (permanently or temporarily) desired objects from others.

Among humans, possession is not only a matter of direct acquisition by individuals but also involves social mechanisms such as exchange. Exchange constitutes the transfer of objects, resource-rights, or other possessions from one individual to another. Cognitive elements such as memory, planning, and recognition are implicated in the process of transferring possession between living individuals.

These cognitive elements enable humans to place conditions on the transfer of possession. Cognitive elements also allow for the re-purposing of possessions to suit other contexts, such as the use of the same stone object as a pendant, a plaything, or a tool. The capacity to re-purpose possessions on a temporary or permanent basis is a process that relies on language for the communication of the intended use of an object or space at that moment in time.

Inheritance

Possession is about living people and synchronous time. What happens to the objects and architectural spaces associated with people when they are no longer there? The material goods of the deceased may be burned, buried, broken, and discarded; alternatively they can be curated as untouched heirlooms or kept in use as working implements. But in any case something must be done with them, as their original possessor is no longer present to interact with them. Inheritance also can be of intangibles, such as the inheritance of clients, patrons, titles, and social relationships. Inheritance often is associated with the disposition of possessions after death, but a living person also can transfer possessions in perpetuity if it is something that is perceived as no longer usable by the original owner. In either case, the "inherited" entity then becomes the responsibility of the individual to whom it has been devolved.

The effects of possession and inheritance may have a very long evolutionary trajectory, though this would be difficult to prove. Materially, we know that human object-making included a durable component in the form of stone tools, whereas other species' modifications of the environment generally focus on perishable materials such as sticks or fibers. The immutability and durability of stone objects may have resulted in our early human ancestors viewing at least stone tools, if not all manufactured objects, as having a social component. The process of visible energy expenditure, as well as the process of learning (with its social component discussed by Tomasello, above), may also have encoded stone tools with a distinct "signature" of manufacture that would enable individuals to identify subtle differences even when the finished products were very similar.

There is evidence of purposeful concentration of stone tools starting 1.4 million years ago that appear to reflect non-utilitarian concerns. At sites including Olorgesailie in Kenya and Kalambo Falls in Zimbabwe, there are deposits of hundreds of handaxes that appear to have no obvious signs of use; these have been interpreted as social displays (Klein 2009:95). Because displays such as these are evident even at an early date, then the idea of socially-meaningful acts through the physical handling of objects, and the likelihood that individuals could continue to identify their own handiwork among a pile of discarded tools, provides support for the idea of possession that outlasted the individual maker.

The ideas of inheritance as an intergenerational transfer of possessions can be placed in the broader context of discard and reuse of material objects in the past. In the ancient world, getting rid of things was not as easy as it seems, as there were rarely purpose-built facilities for discard. This is quite different than the modern context, where the placement of objects in a trash bin ensures that

they will be removed to a secure location (such as a landfill) from which they cannot be retrieved. We know from the archaeological record that ancient people did tolerate a very high level of trash in their immediate vicinity, as seen in the appearance of trash right outside the front door both in prehistoric contexts (Halstead, Hodder, and Jones 1978:128) and historic time periods (see, e.g., James Deetz [1977:125] who noted in his study of early Anglo-American trash patterns on the East Coast that seventeenth-century houses were surrounded by a "broadcast sheet of refuse...often at what to us would be an alarmingly short distance from the door."). Cross-cultural studies of trash behavior also show that people are inclined to discard trash in ways that results in a sustained visibility of discards. The archaeological record of a million years ago does not include any sites with preserved living areas, but observations of small-scale hunting and gathering groups of the historic period suggest that a model of visible discards is plausible over the long term.

Ancient people did have some mechanisms for permanent discard. One way to really remove objects from view was through burial along with the deceased. An effect of this practice is that access to the materials is denied to the surviving community, thereby severing the continuity of memory encoded in material objects. A related practice is the deliberate destruction of objects through burning (for organic materials) or smashing (for brittle artifacts such as stone and pottery). These practices have a social effect, with the destruction of objects constituting a performance to impress spectators (Hayden 2009). These practices have an economic effect as well, in that the removal of objects may result in an increase in value for similar objects that remain in circulation (see Hayden 2009). Thus the transfer of objects through the process of inheritance is undertaken as one of a series of deliberate actions within a range of choices available both to the giver and to the recipient.

What effect does inheritance have on the individual who receives possessions? Inheritance often is intertwined with kinship, with the disposition of possessions intended to bridge generations. Inheritance as a recognition of kin-based rights accelerated greatly after the advent of agriculture, when land and the tools of agricultural production represented subsistence and the potential for the production of a tradeable surplus. Gary Hamilton and Chi-Kong Lai (1989:265) have noted that under conditions of equal inheritance there is a frequent division of land with the result that family status is fluid: "The constant rise and fall of family wealth and position and the uncertainty of one's family's status at any one point accentuated the use of material symbols to mark status." Although Hamilton and Lai are speaking specifically of late imperial China in the 18th-19th century, the same effects can be modeled any time that a fixed amount of goods or space are devolved from one generation to the next. Hamilton and Lai's observations show that inheritance is actively utilized not only for the securing of basic needs, but also for social status that in turn constitutes the parameters for individuals' actions relative to material goods and to each other.

But not all bequests are beneficial to the recipient; some constitute a significant social and/or economic burden. In a compelling article entitled "Forgetting Your Dead," Brad Weiss (1997) provides the example from Tanzania of the inheritance of a broken

bicycle, an economically-useless object that could only be made viable through the recipient's commitment of additional resources. In a similar fashion, debts and other forms of obligation also can be inherited. The inheritance of these negative entities means that the deceased is the "winner" in transferring obligations to the recipient who must then forego desires and wants to satisfy the inherited debt (sometimes through significant loss of autonomy, such as debt-bondage). Debts can include social debts as well, for example in cultures where rituals for the dead were to be undertaken by the offspring. Those without their own biological children often adopted someone to perform these rituals; the adopted individual was therefore responsible not only for his immediate beneficiary but for the beneficiary's whole lineage: "through one son the adopter rescues many ancestors" (Goody 1969:63).

Value

It may seem that value should have been placed first in the discussion, because without a perception of value there is no reason for possession and no focus for inheritance. However, I put value last because it is much more nuanced than possession or inheritance. Possession is a simple matter of presence/absence even though there can be gradations and even simultaneous overlap of possession (for example ownership by one individual and usufruct by another). Inheritance similarly focuses on a physical object or defined space and is a matter of presence/absence. While it has a temporal component, inheritance means that objects move forward in time in a unidirectional manner from the original to the subsequent possessor.

By contrast, value is conditioned by dynamic processes of individually-directed and socially-derived changes that can radically, and rapidly, alter an item's perceived worth depending on the context. Value is situational, conditional, and subject to frequent changes because it draws on the individual ability to dynamically interact with both natural and cultural surroundings. Like multitasking, assessing the value of an object requires the individual to engage cognitive capacities of memory and planning along with the ability to adjust to unplanned or unpredictable external inputs.

Value is a much broader concept than the notion of "valuables" which are the objects or places that are highly ranked within a set. Individuals assess value for all possessions on the basis of both idiosyncratic and social inputs. Idiosyncratic aspects include the individual's autonomous body with its own trajectory of age, injury, illness, and accumulation of skill. Social inputs are the result of individual actions codified into norms, in a process very similar to the manner in which language consists of individually-generated utterances within a shared rubric of grammar (for language, see Ahearn 2001). The archaeologist V. Gordon Childe (1951:169) discussed the concept of "socially-approved need" as a collective expression of value, a concept that is echoed in Schiffer's assessment of the invention cascade with its multiple incremental steps of technological adoption.

Given that humans engage with more objects than can be physically held at once, value is the process by which individuals discern which objects and spaces to emphasize at which time. Our species' surfeit of

possessions probably can be traced to our earliest tool-making ancestors who had to evaluate which items to take with them on migratory rounds and which objects could be left behind. Hence, the three realms of possession, inheritance, and value are not a simple evolutionary sequence, although the capacity for very complex value systems probably was only actualized starting 40,000 years ago in the Upper Paleolithic period when there was a dramatic increase in the types of objects made and utilized, such as ornaments, multicomponent tools, and clothing. Humans' capacity for multitasking means that value is constantly recalibrated in the course of accomplishing tasks. Some objects keep their value over the long term, such as a rock that is useful for making tools. But some things depreciate extremely quickly, such as fresh meat in the days before refrigeration. On the occasion of a wild-animal kill or a domestic-animal slaughter, individuals turned fresh meat into social capital through sharing with the expectation of future reciprocity.

Premodern equivalencies would have involved value that was calculated to compress long time scales into single transactions, such as a one-time brideprice, dowry, and death or injury compensation (*wergeld*) representing the calculated future worth of an individual's energy and reproductive potential to a group. Other equivalences of investment and compensation could be renegotiated on a regular basis, such as the compensation to parents and other elders for the long period of infantile development. Calculations of value might also result from the compression of space, such as the negotiation of hunting, fishing, or collecting rights from one individual or group to another in which a whole area was subject to negotiation even if afterwards only a portion was utilized. Time/space/energy dynamics also would have been the basis of negotiations for both tangibles and intangibles that were the result of investments in skill, ranging from manufactured objects to song, ritual, and other performances. Individual cognitive assessments of trade-offs in many different realms enabled people to identify expectations about equivalencies as well as expectations about the fluctuation of equivalences (in some cases, greater supply would depress both desirability and "prices" while in other cases the "price" would be the same regardless of the supply).

Socially-recognized standards provide the parameters within which individuals further refine their concept of situational value, or what something is worth at a given moment. Individuals' cognitive autonomy prompts the deliberate consideration of situational value that may even negate the prevailing socially-constructed value system. Economically we might see a successful hunt only in terms of whether or not an animal was captured, but social considerations might render the simple assumption of "more is better" to be incorrect. For an ancient hunter who had both inlaws and parents to support, two small deer may well have been better than one single large deer that had to be divided, and in which there were elements that could not be easily partitioned. For at least the last 40,000 years and probably earlier, people have been able to place value on intangibles such as risk, for example in hunting when there is both a risk of injury and a calculable probability of failure. The assessment of risk was also inherent in calculating the rate of return for investments of time in agriculture as well as in ritual. Assessments of value regarding both tangible and intangible

factors are undertaken not only on the "facts" of the matter but the social context in which the facts are transmitted.

Exchange is an essential component of the relationship between possession, inheritance, and value. The archaeological record shows that people were transporting raw material over long distances at very early time periods. In the Middle Stone Age era of eastern Africa, multiple sites provide evidence for obsidian (volcanic glass) transported as far as 320 kilometers from the source location (McBrearty and Brooks (2000:514-515). At the Tasmanian site of Kutikina, dated 20,000 years ago, the investigators noted the presence of stone tools made of a meteoritic glass from the Andrew River Valley 25 kilometers away (Feder 2004: 259). In late glacial Europe (14-10,000 years ago), a stone called "chocolate flint" was mined from an area of central Poland but was carried throughout a wide area; it was in such demand that even at a distance of up to 200 kilometers from the source it comprises 90% of the lithic assemblage of some sites (Sulgostowska 2002:13). In part the desirability of materials appears due to their physical properties, such as ease of knapping or durability of sharp edges. However, some materials appear to have moved around because of their distinctive visual aspects such as color or brilliance.

The multitasking aspects of cognition enabled our ancestors to ascertain the value of a particular physical object for the task at hand, whether it was a physical activity such as chopping meat or a social activity such as ritual in which performance was enhanced by particular objects. The ability to multitask also is what enabled our species to establish and negotiate values among disparate entities. Two relevant outcomes of the archaeologically-demonstrated propensity to engage with possession, inheritance, and value can be seen in the trajectory to modern behavior. One of these is the capacity to use standards of value to activate perceived equivalencies in disparate types of possessions. The other relevant outcome is the way in which individual cognitive capacities expressed through multitasking enabled the development of very dense social and physical networks in cities, where there is a high degree of economic, social, political and ritual interdependence expressed in increasing quantities of material culture.

What we've inherited, part 1: The abstraction of value systems in the form of money

The existence of robust exchange patterns tens of thousands of years ago indicates that the capacity to create equivalencies across very disparate categories of items long predated the development of coinage and other standardized forms of money. In moving goods across long distances, exchange systems in prehistory required individuals to calculate equivalencies among tangibles and intangibles. Objects traveled long distances in which transfers were achieved through both direct and "hand-over-hand" or "down-the-line" mechanisms (see Renfrew 1975). Even if individuals went very long distances by themselves, there were still exchanges inherent in the acquisition of long-distance goods because the individual who travels must traverse other peoples' spaces and negotiate for shelter, food, and safe passage. Ancient people also calculated equivalences in time-energy exchanges implicated in the acts of teaching and learning. In the process of apprentice-

ship, beginners often engage in physically taxing chores such as raw material acquisition and transport, as well as preparing and/or cleaning up work areas and other simple, mundane tasks. Apprenticeship is the exchange of energy of unequal kinds, because physical energy expenditure by the apprentice is recompensed in the long-term teaching of skills by the master craftsmaker.

The capacity to calculate the value of incremental investments with long-term payoffs also is evident in the development of agriculture. Starting 10-12,000 years ago, people in many parts of the world began to experiment with the domestication of plants and animals. The initial steps of that process were slow and incremental, consisting of enhancements of the natural environment through cultivation and, much later, through the process of selective breeding of plants and animals through domestication (e.g. Haaland 2007, B. Smith 2001). For individuals engaged in the process of agriculture, it was necessary to accept the phenomenon of daily "sunk costs" in which payoff (harvest) was realized only after weeks or months of energy expenditure. Other intangibles included risk, which was an inherent part of agriculture because energy investments in crops or herds might be completely zeroed out by bad weather or disease before they yielded useful produce. With risk as a constant factor in agricultural dependence, and debts already a heritable concept, we shouldn't be surprised that people today can grasp the exchange of time-space intangibles in which perceptions of future value act as a rationale for sunk costs in the present. A valuation of intangibles and unpredictables would eventually find their platform in activities such as gambling as well as in their more modern configurations of futures contracts and derivatives.

Individuals' perceptions of relative value in manufactured items constitutes another way of talking about value over the long term. Archaeological sites often yield objects that appear similar but have different amounts of time investment. One example comes from the Bronze-Age Indus culture, where red beads were very much in demand; some of these are made of stone representing a very time-consuming process, but some of them are made in the considerably cheaper materials of baked clay or fired steatite with red and white paint (Kenoyer 1998:143). From a distance, it might not be very evident whether an individual had "real" stone beads or not, as all small red beads had the same visual effect. The assessment of the reality of the beads might have been made in the social context of the wearer, just as today artificial diamonds and real diamonds are very similar and the person who sees someone wearing them assesses whether they are "real" not on the basis of actually examining the stones, but by evaluating the other aspects of the person wearing them and whether on the basis of those ancillary attributes the individual is likely to be able to afford the "real thing."

While our most ancient ancestors relied on barter systems, by about 3500 B.C. we have the archaeological evidence of an increasing number of standardized valuation strategies in the form of tokens, seals and sealings, records of account, and finally, money. Although it would seem necessary for facilitating trade among disparate items, the idea of coinage is actually a very recent development. In the Bronze Age, state-level societies in ancient India, Egypt, and Mesopotamia had sophisticated economies of exchange and redistribution but had no coinage as a standard of value or medium of exchange. The

first coinage appears in the middle of the seventh century B.C. in what is now Greece and western Turkey. Because money itself requires the acceptance of an assigned value by individuals who use it (Gilbert 2005, Ingham 1996) it could only have been brought successfully into existence if there was already the capacity to create equivalencies across disparate classes of objects including tangibles and intangibles.

Long before there was money, there were transactions in which equivalencies had to be calculated by all individuals who were party to the exchange. Bill Maurer's (2006) insightful article on the "Anthropology of Money" examines how the relationship between money and people encompasses a variety of variables, with the result that there is more than one equivalency calculated at the time of transactions. Similarly, Emily Gilbert (2005) summarizes work in economics that discusses money as a "process" conditioned by social configurations, in which there is a dynamic interaction among individuals related not only to the value of things, but the value of the units that function as the means of exchange. Although it would seem that humans have to first decide on a monetary mechanism and then decide on the equivalencies of objects to those monetary mechanisms, in practice both the monetary objects and the objects that are being "priced" are subject to constant flux on the part of the individuals participating in the system. In social terms, the form of payment and its timing are nearly as important as the fact of compensation at all.

Trust and risk also are components of the monetary experience (Gilbert 2005), but similarly these aspects were part of the human cognitive approach to objects long before the development of money. Tens of thousands of years' worth of exchanges were conditioned by the same factors of trust and risk that we recognize today whenever new monetary systems are proposed (for example, the development of paper money as a replacement for metal coinage, the dollarization of currencies in Latin America, or the creation of the Euro to supercede national currencies). Through actions with material goods and with other people, each individual constantly assesses the value of particular items in the transaction. The concept of multitasking, which enables people to restart and modify activities in the face of new constraints and opportunities, also is relevant here. The restarting process requires the calibration of the activity in terms of newly-learned information so that value and worth are contingent upon external sources such as the environment and the unforeseen actions of other people: the utility of an umbrella is conditional on the current weather; the utility of a beverage is conditional on the current bodily state of the individual; and the utility of a coupon goes from a specific dollar amount to zero simply on the basis of the passage of time.

What we've inherited, part 2: Cities as the locus of accelerated patterns of possession, inheritance, and value

Urban centers are places where we can see the acceleration of human interactions with objects. Cities were established starting around 6,000 years ago, with the first urban agglomerations appearing in the Near East. Subsequent developments of urbanism developed in Egypt, China, India, and in Mexico and South America, often without any

contacts between regions. These independent origins of urbanism lay in local conditions of population growth and environmental opportunity that often were tied to the growth of political systems such as the state (e.g., Feinman and Marcus 1998; Marcus and Sabloff 2008; Smith 2003). Wherever and whenever they are found, cities tend to be remarkably similar in their layouts and features, with public and private venues, economic activity zones, and organizations of space that reflect the materialization of dense social networks.

The effect of cities on ordinary people is that urban centers both compel and facilitate a greater number of material possessions. When people move into cities, they become distanced from an agricultural subsistence base. Urban spaces per capita tend to be small, with systems of provisioning that replace village-level propensities to house stored food in close proximity to residences. Durable goods also increase: there are more people, and therefore more goods, but there are also more goods per person. Objects are utilized to develop, confirm, and display both private identity and public roles (D. Miller 1985; Schiffer and A. Miller 1999; Smith 2007b). Contemporary observations indicate the process by which the increasing density of social networks in urban areas becomes manifested in a greater number of material objects as migrants engage in patterns of behavior that augment the social ties that they have retained from their original rural settings (e.g., Abu-Lughod 1969). Urban environments' potential for many expressions of socially-useful "weak ties" (Granovetter 1985) further accelerates the process of consumption in urban settings.

Another factor in the demonstrated increase of urban consumption is the potential for the providers of new technologies and novel goods to find enough buyers to make even experimental production worthwhile. The process is analogous to what Chris Anderson describes as the "long tail" to describe the cumulative effect of efficiently marketing items even when there is low demand for any particular object (2004). In the modern context, the delivery mechanism that connects dispersed buyers with uneven demand is the internet, which enables people to find "obscure products you can't get anywhere but online" (Anderson 2004:172). In the premodern period the presence of urban centers as dense networks of people was the mechanism by which the human propensity for the "long tail" was actualized. In other words, urban centers were places of diversity and increased risk-taking in terms of both production and consumption.

Researchers examining early urbanism have long recognized the value to producers of having a ready market for infrequently-produced and infrequently-acquired goods, a point made by V. Gordon Childe in 1950. He noted that the producers of specialized products risked social alienation by having to wander from place to place filling orders; for them, "one result of the Urban Revolution will be to rescue such specialists from nomadism and to guarantee them security in a new social organization" (Childe 1950:8). The consumer side of this equation has been less frequently examined, but urban settings provided advantages to both consumers and producers through the efficiency of delivery, the speed of communication, and the feedback cycle of demand for innovation in the types and styles of manufactured goods. Individual autonomy continued to be expressed (as it always had been) through the possession, inheritance, and valuation of objects and

space, although the phenomenon was accelerated both in frequency and intensity in the urban context.

Conclusions

Possession is a presence-absence phenomenon, inheritance is a presence-absence phenomenon with temporal implications, and value is a highly shifting and situational phenomenon. The human engagement with material culture is neither an exclusively modern development nor the result of a simple accumulation of linear decision-making steps. Instead, cognitive engagement through multitasking has been the process through which our species has developed an increasingly complex array of interactions with material goods and space, a process that can be evaluated through an archaeological perspective. The full capacity for this cognitive fluorescence was evident by about 40,000 years ago, providing the basis upon which today's urbanized and globalized engagements with material culture were developed.

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