

studied the Spearman rank correlation coefficient and they showed that for large samples it approximately follows a normal distribution. In 1953, Hotelling continued his analysis of correlations and obtained expansions of Fisher's  $z$ -transformation of Pearson's product moment correlation. This work remains among the definitive results in this area.

Hotelling wrote on matrix calculations and developed methods that still stand. His work on weighing designs led to a number of combinatorial generalizations. Although Hotelling had a mathematical focus for his research, he was not averse to working on applied problems. The range of his applied papers include results concerning the physical state of protoplasm, duration of pregnancy, causes of birth rate fluctuations, anthropomorphic measures of Southwest Indians, and effects of pregnancy on dental caries.

Harold Hotelling's originality and imagination is seen in both the genius of his research that produced innovative methods that stimulated whole areas of modern statistics and in his prescient leadership in the discipline of statistics. Further details concerning Hotelling, including his complete bibliography, can be found in Olkin *et al.* (1960), in Pfouts (1960), and in three articles appearing as 'Three papers in honor of Harold Hotelling at 65' in *The American Statistician* (14), published in 1960 (pp. 15–25).

See also: Fisher, Ronald A (1890–1962); Multivariate Analysis: Overview; Statistics, History of

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## Household Archaeology

### 1. Introduction: The Emergence of Household Archaeology

Household archaeology emerged in the late 1970s and early 1980s as a late development of social archaeology on both sides of the Atlantic. The aim of household archaeology is to create a context in which a humanized reconstruction of the past may be nurtured, through the study of intrasettlement relations. Such an investigation at the microscale involves the intensive recording of archaeological observations and detailed excavation of an area broad enough to include architectural and other features of the built environment. The criticism of such an effort is that it produces an isolated picture of one part of a social group—perhaps only one household—that does not provide a statistically valid extrapolation to the rest of a settlement, or from one settlement to the regional scale.

Household archaeology developed both as an extension of and a reaction, by both processual ('new') and Marxist-oriented archaeologists to the social evolutionary features of social archaeology. Social archaeology provided data and inferences for explanations of change and variation of past cultural systems, focusing on intersettlement relations, especially in terms of the interaction of political leaders on a

regional basis within the parameters of ecological features such as distance and resource distribution. Marxist-oriented studies added the dimensions of ideology and power relations in production and distribution.

A criticism of the macroscale models of social change has been that, in identifying the longer-term evolutionary trajectory of, for example, resource control, hierarchical social relations, and population growth, and in establishing the general social form of a group, the context of shorter term changes and variability is given a lower priority in explanation. In this way a dehumanization of the past has been created in order to 'write history (or prehistory) large.'

Household archaeology developed in the 1980s and 1990s as the result of a growing interest in intra-settlement relations, but it is a sub-discipline that is neither unified, organized, nor recognized within archaeology. The aims and agendas of the archaeologists who carry out studies that are termed 'household archaeology' are as variable as are the theoretical strands of archaeology itself.

## 2. *Household Archaeology: Archaeology at a Small Scale*

When it was initially developed in the late 1970s the study of households aimed at filling in the most detailed level of settlement pattern and activity analysis, which could then be extrapolated to make more general statements about demographic trends, specialized production, class structures and so on (Flannery and Winter 1976). Later, in the important volumes edited by Wilk and Rathje and Wilk and Ashmore, the importance of households as 'fundamental elements of human society' was emphasized (Ashmore and Wilk 1988, p. 1, Wilk and Rathje 1982). At this time it was suggested that, since households are the level at which social groups articulate directly with economic and ecological processes, their study would offer a chance for archaeologists to examine social adaptation (in a functionalist sense) with direct reference to the empirical details of the archaeological record. It was assumed this would be done within the methodological framework of scientific logical positivism. In other words, household analysis would allow archaeologists to 'bridge the existing 'mid-level theory gap' in archaeology' (Wilk and Rathje 1982, p. 617). Thus household archaeology developed alongside the empirical theory-building in archaeology, known also as middle range research, that lies at the heart of the history of processual archaeology at the end of the twentieth century.

It is clear that household archaeology in the 1980s implied examining and analyzing social change at a microscale as a complement to analyses of social and economic change at a broader scale of regions and

continents. Household archaeology served to provide a richness of detail, but was not an end in itself. The ultimate target was to understand social evolutionary change.

## 3. *Sources of Inspiration for Household Archaeology*

The explicit inspiration for household archaeology comprised the studies of households and multiscalar histories written by historians (including historians of the so-called Annales school) (Braudel 1972), and by anthropologists, especially those interested in historical demography and historical anthropology (Arnould and Netting 1982, Laslett and Wall 1972, Netting et al. 1984), (Hammel and Laslett 1974, p. 76). It is the latter who coined the term 'co-resident domestic group,' as a way to bring together the enormous diversity of the minimal social group—family, household, housefuland to use a term that was not subject to 'cultural bias' and would have value for 'objective scientific analysis.' The "'co-resident domestic group" consists of those who share the same physical space for the purpose of eating, sleeping and taking rest and leisure, growing up, childrearing and procreating' (Hammel and Laslett 1974, p. 76).

Archaeologists envied the historians and social anthropologists their knowledge about the kinship relations and the demographic composition of the members of a domestic group that allowed them to explore the 'co-resident domestic group' in terms of variability in their size and kinship composition, and the cooperative activities of their members. Traditional scientific archaeological methodology puts limitations on the investigation of the social composition of or relations within the domestic group. In view of the dangers inherent in using architectural features or any other archaeological data to identify a 'household' on a prehistoric site, Wilk and Rathje pointed out that it was more productive for archaeologists to investigate questions such as what co-residents of a domestic group (households) do, rather than what their social form is (who lives there and how they are related) (Wilk and Rathje 1982). Thus, for example, it was argued that to understand transformations in the social relations of production in Neolithic Southeast Europe, it was not essential to be able to identify 'households' in the historical and anthropological sense of the term (Tringham 1990, p. 603). It was sufficient to be able to investigate changes in co-residence and the cooperative activities of kin-based co-resident domestic groups.

It is not surprising that the impetus for household archaeology came from archaeologists who had focused on the excavation and interpretation of well-preserved architectural remains. Architecture—more broadly, the built environment—provides the essential

context of co-resident domestic groups. Archaeologists working in prehistoric Mesoamerica led the field (Ashmore and Wilk 1988, Wilk and Rathje 1982). Simultaneous and parallel developments were occurring in the Southwest US with archaeologists working with spectacular Pueblo architecture, such as Grasshopper Pueblo (Ciolek-Torrello 1986), and in Europe and the Near East with archaeologists working in Neolithic architectural contexts (Bogucki 1988, Tringham 1990, Tringham 1991). The Chacmool conference on Household and Community provided a welcome synthesis of the diverse routes to household archaeology in place by 1989 (MacEachern et al. 1989).

#### 4. *Modeling Household Activities in Archaeology*

In modeling the economic and social role of co-resident domestic groups, participants of 'household archaeology' have followed social anthropologists in their models of the domestic mode of production (Chayanov 1966 (reprinted 1986), Netting et al. 1984, Sahlins 1972). These models characterized self-sustaining agriculturists and horticulturists who live in permanent villages and carry out relatively small-scale production. Such studies have emphasized the importance of the function of households as the organizing units of cooperative labor, production, consumption and sharing of resources, the transmission of property and rights from one generation to another, and the creation and maintenance of ties and alliances with other units through marriage and other forms of exchange. These same essential features of social reproduction became the objects of investigation of household archaeology (Ashmore and Wilk 1988, Wilk and Rathje 1982).

The study of 'what households do' has been enriched by the Marxist focus on ideology, power and social inequality. In the domestic mode of production the pattern of domination and inequality between and within different households of a settlement and between different settlements, although temporary and flexible, is thought to comprise a crucial variable in stimulating and enabling larger-scale transformations such as the intensification of production, the increase of the labor supply, and the increase in cultural complexity (Meillassoux 1978).

Inequalities certainly exist, along with innumerable variations, between households and are the result of differences in the cycles of demographic and economic evolution through which households pass—cycles in which they expand, accumulating wealth, power, property, and members, and then contract. Thus, at any one time the households of a settlement will demonstrate differences in membership, the composition of the labor force, and the structure of dominance within the co-resident group and within

the settlement as a whole. They will demonstrate differences in relations with groups outside the village, and, most importantly, differences in access to the products and processes of production. This concept of small-scale social inequality is the basis of a number of archaeological models that use the emerging importance of households as the unit of social reproduction to explain larger social and economic transformations (Rathje and McGuire 1982, Tringham 1990).

These differential patterns of social and economic relations reflecting social inequalities, however, have such a low archaeological visibility that these societies have traditionally been regarded as 'egalitarian.' The difficulty in recognizing inequality in 'egalitarian' societies is due to the fact that it is ephemeral and not cumulative. An additional significant factor, however, is that inequality in such societies is not based on such criteria as the ownership of land and other material property, which are easily definable or easily recognizable in the archaeological data. Control of labor—not land, capital or property ownership—is the crucial variable on which inequality is based in precapitalist self-sustaining societies. Thus, those who control the circulation of labor and its products, control the social reproduction of society. At the scale of the domestic unit or household, this may be an individual within the household, or it may be 'senior' households who control the labor of 'junior' households. It has been argued that inequality at this scale creates tensions in numerous spheres and is a crucial variable in the process of socioeconomic transformation that can be observed in the archaeological record (Tringham 1990, p. 608).

#### 5. *Archaeological Evidence of Household Inequality*

The primary requirement for the examination of the social context of production and economic life at an archaeological site (in other words, of household archaeology) is that a number of domestic architectural units be exposed by excavation. This will enable a comparative view of co-resident domestic groups across the settlement at any one time. This information is enhanced by the provision of such a picture through time. Only when a large number of domestic structures is exposed is it possible to tell whether, for example, all the structures in a given excavated occupation horizon represent residences or parts of residences; whether the differentiated units of co-residence can also be differentiated as units of cooperative production; whether all the domestic structures were occupied at the same time; whether they all became part of the archaeological record at the same time or whether they were destroyed or abandoned at different times, and, finally whether they appear to be in a parallel stage of their use-lives at the

time of destruction or abandonment or whether some seem to have been more recently established than others. The study of archaeological architecture in terms of the use-life of the buildings has greatly enhanced these efforts for the purposes of household archaeology (Tringham 1994). In this way the context and nature of the construction, maintenance, occupation, modification, and abandonment/destruction, and replacement of a residence all become objects of knowledge. Traditionally, they would have comprised elements that were subsumed under the formal features of the building. The investigation of a building through different stages of its use-life, brings to light many important aspects that would otherwise have been ignored; for example, modifications such as the addition or removal of rooms during the cycle of growth and decline of a domestic unit; efforts to prolong the use-life of a building by repairs and renewals; symbolic emphasis placed on particular use-life stages such as re-plastering, the destruction of old houses (for example by fire), or founding of new houses (Tringham 1994).

Inequalities within and between domestic units are manifested archaeologically by the spatial differentiation of the production process (that is, in the production, consumption, and distribution of food and nonfood resources). In each case the pattern of economic activity (and inequality) should have a distinctive appearance, demonstrating differential access to the materials, means, process, and products of production. The expectation is that different households will show differential access not only to the products of exchange with other groups but also to the raw materials, techniques, and equipment for making use of resources, such as food items, minerals, and ceramics. Such a differentiation of economic activity is frequently, but not necessarily, accompanied by specific styles of material elaboration, such as ceramic decoration.

#### 6. *Trends in Household Archaeology*

For many years household archaeology remained marginal to the mainstream of processual (new) archaeology. In his review of Ashmore and Wilk's edited volume on *Household Archaeology in Mesoamerica*, David Freidel noted that for the interest in and impact of 'household archaeology' to be sustained, it would need to be incorporated into a more ambitious theoretical program in archaeology (Freidel 1989). Its incorporation into Marxist models of power and social inequality certainly helped in this respect. The theoretical basis that has contributed most to sustaining interest in household archaeology, however, has been that of feminist anthropology and theories of social practice (Bourdieu 1977, Moore 1988). A common theme of these diverse post-structural theories has been their development beyond

neo-Marxian models of power and labor control to models of how ideologies of gender, class, labor, production, identity, etc., are constructed, maintained and transformed. They focus on domestic arenas and the contexts of daily practice as being the most significant places where these negotiations between social agents take place. During the later 1990s these models have also come to characterize the many faces of post-processual archaeology, one of which is an archaeology of households that has transformed into an archaeology of gendered places (Tringham 1994).

In the archaeology of gendered places, the archaeological record is not only analyzed and observed at a microscale, but also interpreted at a microscale. It challenges the search for the universal category of 'kin-based co-residential domestic group' and embraces the richness of the diversity of the social context of domestic action that has been forefronted in social anthropology for many years (Moore 1988). It lifts the household domain out of its previous position of 'assumed general knowledge' and as marginal to the 'great events' of history. It provides a richly-based, multiscalar theoretical framework to consider the role of the labor of players in prehistory: women, men and children (Tringham 1991).

The theoretical basis of feminist anthropology and social practice theory obviously creates some serious epistemological challenges to the scientific logical positivist methodology that characterizes mainstream processual (new) archaeology. It is as difficult to identify 'gender' in archaeological architecture as it is to find 'households' and 'families.' Responses to this challenge have been articulated in many publications (Hodder 1999, Wylie 1992). They are based in a celebration of the ambiguity of archaeological data, a critical awareness of the scientific process of inference, and a richly researched utilization of sources for interpretation—ethnography, history, art and literature. Above all in the post-processual epistemological framework, archaeology is identified as an interpretive discipline rather than a hypothetico-deductive search for true (pre)history. Thus in order to think about the prehistoric construction and practice of gender ideologies and dominance relations within or between households, a researcher may interpret the archaeological data and their meaning in many ways. It is not required to identify gender or 'domestic unit' in the archaeological record.

The database for an archaeology of gendered places remains especially but not exclusively in the record of the built environment. Along with the nature of household archaeology itself, however, the excavation and interpretation of archaeological architecture has changed. According to post-processual concepts, the built environment can be thought of as both a passive container that has a use-life and reflects social action and as an 'active' arena or medium for and symbolic expression of social actions. Thus social actions, practices, negotiations, and dominance ideologies of

whoever passes through a building are constrained and channeled by the materiality of that building. (Tringham 1994). In practice this has led to the necessity of retrieving a highly detailed microstratigraphic record of the traces of human activity, in which the sequence of every depositional event is recorded and interpreted. It is time-consuming, expensive, but immensely rewarding (Hodder 1999, Tringham 1994).

Along similar lines, household archaeology in the late 1990s has embraced the ambiguities recognized by practice theory anthropologists about kinship categories, including 'family' and 'household.' In their view, it is the meaning and cultural value ascribed to a relationship that are significant rather than some set of biological ties (Gillespie 2000). The enactment of kinship often involves the negotiation of identity and the identification of relationships through particular places on the landscape—buildings and sets of material culture (Joyce 2000).

At the beginning of the twenty-first century, 'what households do' is still a focus of household archaeology, but the 'doing' is far more complex than physical action. Moreover, a 'co-resident domestic group' is no longer a faceless economic category, but comprises the complex life-histories of many people as well as buildings and places. Finally, household analysis is no longer a step along the ultimate goal of understanding social evolutionary change. It plays an essential role in the creation of a multiscalar history that considers such questions as how—in practice—was a sense of place created; how was social memory about this group maintained; what were the myths about garbage; what would the walls of a house say if only they could speak (Tringham 2000).

*See also:* Ancestors, Anthropology of; Anthropology, History of; Ethnoarchaeology; Family and Kinship, History of; Gender, Feminism, and Sexuality in Archaeological Studies; Historical Demography; Horticultural Societies; Kinship in Anthropology; Marxist Archaeology

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