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TIME ALLOCATION: A TOOL FOR THE STUDY OF CULTURAL BEHAVIOR

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Time allocation studies diffuse rapidly among anthropologists as the problems they treat require an accurate, detailed technique for observing and recording human behavior in context (74, 152). Time-allocation (henceforth TA) techniques are well established in other social science disciplines as well as in engineering and management science (48, 161, 218, 228). Sociologists have relied heavily on self-kept time diaries on relatively large samples to build up time-budget data. Anthropologists who have explored the technique tend to rely more often on observation. TA studies provide a tool with which to examine a multitude of questions. TA measures the behavioral "output" of decisions, preferences, and attitudes. It provides a measure of role performance. It measures the rates at which goods are produced. TA provides primary data on many kinds of social interaction and provides the basis for defining social groups by behavior. TA can provide important data in studies of attitudes, values, cultural style, and emotions. Any kind of behavior with an observable environmental effect can be observed using TA techniques, including speaking, working, repose, leisure, etc. TA is useful in many kinds of comparative studies: cross-cultural, interethnic cross-sectional, and longitudinal (see 100). It provides a basis for describing and analyzing intracultural variation—even individual variation—seasonal, diurnal, ecological, and other kinds of variation. Because it is replicable, the TA approach allows ethnographers to achieve the same reliability as empirical techniques in the other natural sciences.

TA provides for a microscopically detailed behavioral record from which to construct higher order cultural units (115) including social units, ethnic units, modes of production, and evolutionary stages. The observational rules implied

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by TA techniques allow the ethnographer to trace any statement based upon them back to a unique set of observations of individual behavior and even permits the *ex post facto* reconstruction of the phenomenology of the moment of observation. This is so because TA techniques conserve the time-honored anthropological tradition of participant observation and description of unique events together with the context and the standpoint of the observer. TA studies are supplementary to other ethnographic approaches and may add new information in unexpected ways.

People in every society allocate time as a resource, choosing among alternative pursuits such as working, resting, sleeping, praying, playing, fighting, or making love. This is so no matter how a person conceptualizes these activities. Western industrial society has commoditized time such that it can be "saved," "spent," "wasted," "bought," "sold," "divided," "shared," and "used up." These expressions are characteristic of a system in which "time is money." From a certain point of view, our concept of time does not exist in other societies. In her manual for overseas technical assistance, Margaret Mead (200) wrote that

> Greeks "pass" the time; they do not save or accumulate or use it. And they are intent on passing the time, not on budgeting it. . . . The clock is not the master of the Greek. . . . It is distasteful to Greeks to organize their activities according to external limits: they are therefore either early or late. . . . To introduce an awareness of time into a meal is particularly abhorrent to Greeks . . . (pp. 90–91).

The capitalist mode of production may be the cultural root of current interest in TA techniques. True or not, this does not invalidate the concept of the time budget as applied to societies which do not share this view of time. Budgeting is not a consequence of the mode of production. Rather it is the result of the fact that when a person is doing one thing he is restricted as to what else he can do simultaneously.

TA studies take the convenient units used in Western time measurement and apply them as a matrix to the study of behavior. All overt behavior—that which has an observable environmental effect—can be located within the framework of unitized time measured in seconds, hours, days, years. Behavior generally has an observable beginning and an end, as opposed to the plans, thoughts, or attitudes which motivate it. The analysis of TA has two major aspects which make it observer oriented (115, 116). One is the use of Western time units already referred to. The other is the necessity for *coding* or labeling behavior as an example of a general class of phenomena. This implies that some behavior is comparable to some other behavior. "Cooking," for example, may be coded the same whether it is done in an earth oven with heated stones or in a microwave oven. All that is needed is a definition such as, "the use of heat in preparing food for consumption." Coding, like unitizing, implies reducing behavior to a

common denominator, providing a basis for comparisons of the same individuals over time, across individuals, communities, and entire social groups.

Recent advances in TA techniques have simplified and reduced the labor cost of generating data and greatly increased the scope and reliability of TA studies (152). Since the unit of analysis in most TA studies is the individual actor, TA studies provide for a detailed analysis of individual variation and a comparison of the performance of social units such as households, villages, or social categories such as lineages or sodalities. This paper will review some of the achievements of time-allocation studies to date; it will focus more on method and technique, but it will also discuss the substantive results of leading studies to show the possibilities in the technique. Since the techniques, options, and trade-offs involved in TA studies have not been reviewed extensively in the literature (157, 202, 202a, 211, 257, 262, 265, 287, 288), I will conclude this essay by discussing the technique from the point of view of an ethnographer contemplating use of the technique.

It is useful to distinguish time *allocation* studies from a closely related kind of study that can be termed "time frame" analysis. Time frames are convenient sampling frames to observe a particular aspect of behavior in its natural context. It is an important tool for selecting and standardizing observations in experimental studies where laboratory controls are not possible. Time frames need not take into account all the behavior of a particular group of actors, but they may focus on a range of activities relevant to the study. TA studies, in contrast, attempt to be comprehensive in recording the entire array of activities in which individuals engage in order to understand the trade-offs between different possible allocations of time. TA studies may also be aimed at specific populations or segments. The broadest kinds of time study, those adapted to the widest variety of uses, are those which sample from the behavior stream of entire communities, throughout the day (or at least the waking day), over a substantial period of time, say, a year. Community-wide samples, unlike those focusing on particular statuses or roles, can show the complementarity of roles and the importance of cooperation in production. This paper is primarily concerned with TA analysis, but the distinction between time frame and TA is sometimes narrow, because the same data collected for the latter also permits the former mode of analysis.

By providing a complete record of time use by a given population, TA data allow investigators to test different hypotheses concerning behavior. Various authors have pointed out that TA analysis does not permit drawing conclusions about how time might be spent, only about how it is spent. By presenting, in greater or lesser detail, the array of alternative activities in which people engage, however, it is possible to show how a change in time spent on one activity will require a change in time used in some other activity. To determine how people might change under certain circumstances, the investigator can

design quasi-experimental research using naturally occurring variation to show how changes in some activities influence allocation of time to other activities (315).

Anthropologists have estimated TA, using a variety of methods, since the early days of detailed ethnographic studies in the 1920s. As part of their general descriptive aims, many ethnographers provided detailed information on the "annual round" of activities, and sometimes on the "daily round" as well. Malinowski (191) with his concern for the "native's point of view" provided a "Chart of Time Reckoning" in *Coral Gardens and Their Magic*. In this chart he presents the various criteria by which Trobrianders mark the events of the yearly round as well as corresponding indicators of seasons on the European calendar. Evans-Pritchard's study of the Nuer refers to "oecological time" (76) as that relating to different subsistence activities and perceived as cyclical as distinguished from "structural time" which measures the passage of individuals and kin groups through stages of development and which is perceived as linear and progressive (pp. 94–95).

Later studies began to concern themselves with the use of time in greater detail, perhaps because they were more concerned with questions of culture change. In his restudy of Tepotzlan, Oscar Lewis (182) provided a detailed record of time use by following the members of a five-member Tepotzteco family for four days. Dividing each day into half-hour periods, Lewis recorded the activities of each family member, presenting them side by side in columns. Lewis's main objective was to present "typical" daily activities to the reader, the division of labor by sex and age, and the family as an integrated economic unit. His sample is limited, of course, by its small size, the short duration, and by the fact that the household head was wealthier and older than the average. Lewis also took specific note of time spent in agricultural activities and compared the yields per unit labor of valley-bottom plow agriculture with hillside hoe agriculture for equivalent size plots. This interest in the marginal productivity of subsistence labor as measured in time spent marks an important step in the anthropological study of economics (cf 246, 272). Other influential studies conducted in Latin America followed Lewis in reporting time allocation data based on small household samples (88, 291).

Another landmark study was Audrey Richards' (253) evaluation of Bemba labor costs designed to answer the question perennially asked by colonists: "If they are hungry, why don't they work harder?" Richards observed activities for 18 Bemba couples and 3 single men over 18 in September, and for 10 more days (with different subjects) in January 1934. She used broad categories of work, leisure, foot travel, beer drinking, and others, giving hourly values only for male tasks such as "piling branches, 4 hours." She recorded female activities more informally and concluded that in many cases, they were too exhausted from other tasks to prepare meals, even when food was available. She esti-

mated food intake from household observations and suggested that caloric intake was below what was necessary to sustain higher work output levels (see also 60, 84, 102).

The technical limitations of these early TA studies meant that the results could not be generalized to the broader communities from which the samples were drawn nor to other communities or ethnic groups. Of course, anthropologists—unlike other social scientists—are able to intuitively judge how typical any case may be because of their long-term and intimate contact with the people they study. The confidence that impressions collected over a long period of close observations *must* be valid may lead some ethnographers to claim too much for their results; nevertheless, many anthropologists have more than intuition to back up their impressions. For example, many economists observe that underemployment in the Peruvian Andes is extremely high, troubling themselves over how to put all those idle peasants to work developing the country. Stephen Brush (29), with an ethnographer's eye for the texture of Andean culture, pointed out aspects of the productive system overlooked in economic surveys, such as the seasonality of agricultural activities and the necessity for posting watch over fields approaching harvest. Working backwards from mean household productivity levels, and the labor requirements for each crop, Brush shows that employment levels in one Andean community approach 98% of the theoretical limit (255 days per year).

Participant observers have a variety of ways for estimating how people spend time, even when they do not employ a specific technique for doing so. One reason is that the observer lives with and interacts over time with the subjects of the study. Another reason why the accuracy of many informal reports of time allocation is probably high is that the rate at which people work and perform other activities is highly constrained by the technology they use. For example, individual variation in the time it takes to hand-till a field of a given area is probably much lower than the difference between mechanized and hand tillage.

Nevertheless, the unsystematic perceptions of even the most intuitive and sensitive ethnographer may be biased, and one can scarcely expect other social scientists to accept nonreplicable findings. It would be comforting if the small samples used in some early ethnographic observations of TA had generated a higher quality or finer grain of data, but this in fact did not occur. Continuous observations of even a few individuals can yield enormous numbers of observations, even over shorter periods of time. Lewis, for example, recorded behavior in half-hour units, omitting a great deal of behavior. Malinowski refers only to gross behavioral categories such as "garden work," and actor types such as "young men." Like Lewis, Richards reports observations of specific individuals, but apparently lumps together domestic work, child care, true idleness, and many other categories.

Studies of time allocation in anthropology generally reflect the strong idiographic bias of the discipline. Fine-grained, highly detailed behavior descriptions have long been an ideal in anthropology (201). Many anthropologists are schooled to believe that "everything is relevant" and no detail should be overlooked. Looking at such descriptions, however, has convinced me of two things: (*a*) the size of the actual descriptive vocabulary is fairly small (that is, coding or reduction is present), and (*b*) the entire corpus of data is rarely considered in analysis. The situation is rather like that of the child who wants to go to an ice-cream parlor featuring 28 flavors but who generally chooses chocolate or vanilla. Still the appeal of conserving all that detail is tremendous to the average ethnographer. The desire to capture "everything" helps to explain the popularity of photography and tape recording among ethnographers. But the vast accumulation of data stored in field notebooks, on magnetic tape, and on celluloid has only rarely been subjected to complete analysis. If one dollar were to be contributed to a special fund for each hour of untranscribed tape and each roll of unanalyzed film, there would be a rich source of funds for future anthropologists.

The validity of early TA studies was severely limited by the small sample size and limited periods of observation. Charles Erasmus (74) broke new ground in 1948 when he and his wife surveyed TA among the Mayo of Sonora in Mexico. They visited a sample of 32 households (200 individuals) at different hours on different days for a three-month period, accumulating a total of 5000 observations. The difference in Erasmus' approach was that he did not seek to observe the continuous flow of behavior in a single individual over a period of time. Rather he made "instantaneous" or "spot checks" of behavior of any number of people in a given "scene." It is as if he resorted to a still camera rather than a movie camera. The results were coded and hand-sorted into three categories: "household activities," "economic activities," and "leisure." The measure of labor intensity was the ratio of a particular activity to all activities expressed as a percentage for males and females. The aim was to resolve the perennial problem of who works harder than whom. Erasmus compared his Mayo survey to data generated among workers in Washington, D.C., finding that Mayo men and women work about as much as Americans. It is unfortunate that Erasmus's technique was largely ignored by anthropologists for 20 years. In 1975, Allen Johnson presented a fully modern approach to behavior-stream sampling in TA studies (152), setting a standard which stimulated and guided many other investigators.

These are but a few among hundreds of anthropological field studies which attempted to look comprehensively at time budgets. Few went much beyond Malinowski in examining the yearly round of activities and the division of labor by sex and age (the exceptions were 88, 246, 272, 291). In addition to these, there is a long tradition of viewing time in emic perspective. Evans-Pritchard's

study of the Nuer, for example, devotes a long chapter to their conception of time and its relationship to their world-view and kinship system. There is great value in tying such studies to observations of actual time use, but very few ethnologists have done so (but see 60a). Studies dealing with non-Western concepts of time are beyond the scope of this review.

While anthropologists cherish the goal of describing culture holistically and relating the ethnographic microcosm to the broad sweep of historical trends, their reach typically exceeds their grasp. Recent advances in the techniques of TA surveys combined with electronic data processing and descriptive statistics promise to raise TA studies to a new plateau of validity and reliability (157). The next section of this essay presents some general goals of TA research as organized around classes of research problems. The last section will deal with methododological and technical questions.

Most anthropologists are interested in cultural "performances" or behavior. All performances occur in measureable time. It follows that TA can be used to record any cultural performance, even if it is an informant's account of one. Anthropologists have examined cultural performances at the level of individuals, dyads, small groups, domestic groups, kinship and work groups, residential and other communities, regions, nations, and continents. At each level there are unique problems of sampling from the behavior stream. Most anthropologists have been more concerned with the content of their generalizations than with the method used to arrive at them, hence the neglect of sampling methods.

THE USES OF TA STUDY FOR ANTHROPOLOGISTS

One of the most pervasive theories in the history of anthropology has been the role of "leisure time" in social evolution. Perhaps the most popular general theory to have been espoused is the notion that cultural evolution since the pleistocene has been a steady movement away from the drudgery of subsistence labor toward a stage in which human labor is all but completely replaced by machines. A related theory holds that the rise of civilization is a consequence of the increased availability of "leisure." Many of the trappings of civilization (science and mathematics, literacy, craft specialization, and others) are commonly thought to be products of the mind. It follows that without free time away from the drudgery of productive labor, civilization cannot emerge. Consider Steward's characterization of the formative era in his outline of the birth of civilization (284): "Increasingly efficient farming released considerable labor for the satisfaction of socially derived needs; that is craft production of finer goods and construction of religious edifices for the theocracy made rapid progress during each period."

There are a number of testable notions implicit in these theories to which TA

data can be applied. One such notion is that hunter-gatherers lead hard lives of constant struggle, always on the brink of starvation. Beginning in the 1960s, a series of studies of actual TA among hunters showed that hunting and gathering did not soak up very much time.

In 1964, Richard Lee spent four weeks collecting TA data at a !Kung San camp near a water hole. Between July 6 and August 2, he kept track of the work and leisure activities of the residents and visitors in a seminomadic population fluctuating around 31 people. Lee monitored activities from the camp; thus he could observe camp activities directly. For activities away from camp, Lee observed the departure and arrival times, the objects which people left and returned with such as tools, foods, etc, and he interviewed people concerning what they had done. Activities measured in person days were coded as one of the following: gathering, hunting, in camp, visiting. Subcodes specified the product gathered, the type of hunt, and the type of "in camp" activity. Subsisting primarily on wild foods collected or hunted surrounding the camp, Lee found that this group of !Kung could meet their food requirements with an average of 2.4 hours work per food producer per day, even in a year of relatively poor rainfall (175, 176). Although based on a small, nonrandom sample, Lee's data suggest that !Kung men and women work no more than most adults in industrial societies. Combining subsistence, tool manufacture and maintenance, and housework yields a total of 44.5 hours per week for men and 40.1 for women. Most of their toolkit is manufactured by the !Kung from locally available materials. Lee suggests that even the few manufactured items they utilize do not differ substantially in efficiency from stone-age tools. Thus, he concludes, the !Kung data may be relevant for understanding how hard paleolithic people worked (177). Draper's more complete and better designed study (65) yielded similar TA estimates for another group of !Kung foragers.

Studies among other foraging groups gave comparable results (16, 18, 19, 85, 108–110, 125, 126, 133, 145, 148, 151, 176, 178, 194, 197, 236, 278, 289, 290, 292, 293, 296, 300, 320, 321, 324). Marshall Sahlins was so taken with this finding that he began to refer to foraging peoples as "the original affluent society" (270). If it is so, as the evidence now indicates, that technologically simple hunter-gatherers had abundant "leisure time," that is time away from basic survival activities, it follows that leisure time is not a sufficient condition for the development of civilization. Indeed, a number of authors now suggest that as subsistence systems intensified with the addition of new tools and techniques, the time spent on subsistence per food producer increased rather than decreased (118).

Other TA studies focus more narrowly on the impact of particular items of technology. Some investigators (36, 37, 272, 277, 297) focus on the efficacy of stone tools in terms of the time required to cut down trees. Townsend (297) conducted experiments comparing the efficiency of cutting down trees with

stone and steel axes. He recruited his subjects from the Heve people of New Guinea who were familiar with the use of both tool types at the time of Townsend's study. He found that the efficiency of cutting down trees with steel is about 4.4 times greater than with stone. Carneiro estimated an advantage ratio of 8–9:1 of steel tools over stone, based on his experimental work among the Yanomamo of Venezuela. These studies do not take into account the cost of manufacturing and maintaining stone axes, on the one hand, and of exchange for steel axes on the other.

In a series of studies since 1975, a number of ethnologists evaluated the question of whether the availability of animal protein was limiting on the size, density, and permanence of settlements in the Amazon basin (15, 99, 117). Many recent studies use TA techniques to evaluate output/input ratios (grams protein per hour of hunting time) in a number of native Amazonian villages (15, 16, 18, 19, 38, 43, 66, 125, 132, 133, 143, 144, 153, 156, 172, 183, 184, 188, 189, 236, 269, 312, 315, 326). A smaller subset have applied optimal diet models to a related question (110, 125, 320). The broader issue is whether the natural environment exploited by a given technology imposes limits on basic features of culture such as settlement pattern. TA is a major adjunct to ecological studies in general because they rely on models of optimization, and time is one of the few items which all organisms may be assumed to optimize (51).

Hames's (109) comparison of hunting technologies among South American tropical forest hunters makes particularly good use of the approach presented by Johnson (152). Hames did random spot checks over 216 days in a Ye'kwana-Yanomamo village to estimate the time spent hunting by men from each ethnic group. He followed up the spot-checks whenever hunting was reported to determine how much game was bagged. The Ye'kwana hunted primarily with the shotgun, while the Yanomamo used bows and arrows. The Ye'kwana produced more than four times as much meat per hour of hunting as the Yanomamo in the same village. Yost & Kelley (326) carried out a similar study among the Waorani of eastern Ecuador. They collected data on hunting over the period of nearly one year, partly by self-reports from Waorani hunters and partly from survey and interview data. They established the hour the hunter(s) left and returned to the village and estimated the amount of game bagged. Their results also suggest the superior efficiency of the shotgun over native weapons—here, blowgun and the spear—although the latter used in combination were almost as effective.

It is noteworthy that most of the studies just cited do not count the time spent producing tools as part of the time "cost" of the superior technology. Were this to be counted in, the cost would rise sharply. Of course, industrialized tools are not manufactured locally in New Guinea or Amazonia. Items such as shotguns and steel axes must be obtained in exchange with outsiders. One way of

accounting for the cost of these goods is to estimate the time spent producing whatever is exchanged for them. Gross & Underwood (102) and Aspelin (8) have done so in studies among South American Indian groups by estimating time spent in wage labor, craft production for the market, and so on.

The cost of trade goods may be masked further by government and private largesse in which little or nothing is asked in exchange for axes, knives, and guns. However, a "price" may be exacted in the form of denial of access to resources, and control over movement exercized by outsiders is possible. In their study of four Brazilian Indian villages, Gross et al (101) showed how groups with longer and more intensive contacts with Brazilians had more circumscribed access to resources. As a result, the return to subsistence labor per hour invested was generally lower, and these groups were more likely to resort to subsistence labor and to seek access to industrial technology thereby offsetting the decline in productivity per unit labor.

Development is one of the central issues of our time, and anthropologists who typically work less developed regions are active in analyzing problems of social and economic development, sometimes in the context of assistance programs sponsored by governments or international organizations. Development often implies changing habits and lifeways. Often no suitable baseline exists against which to examine deviations from so-called traditional lifeways. TA studies have been used to assess the benefit that would be derived from labor-saving devices. For example, Hemmings-Gapiha estimated TA among female villagers in Upper Volta to determine the savings that would result from installation of solar-powered grain mill and water pump (130; see also 1, 11, 29–31, 33, 44, 52, 57, 78–81, 87, 122, 123, 146, 162, 181, 199, 253, 299, 306, 309).

In this vein, another major use of TA studies concerns the accurate estimation of the work involved in caring for children, preparing food, keeping house, washing clothes, and other chores generally referred to as "domestic" (1, 4, 11, 17, 20, 21, 32, 47, 77, 80, 95, 98, 128, 130, 159, 163, 171, 193, 225, 248, 302, 307, 327). Because these tasks often are not classified as "work" they may remain invisible. Thus the contribution of women to the provisioning and reproduction of society is often ignored, since it is overwhelmingly women who perform domestic labor. Even some comprehensive TA studies may be biased because time spent "minding" small children may be classified as idleness, not work, unless the subject is actively "manding" the child (316).

TA has proved to be a valuable tool in the study of domestic groups, reproductive behavior, and production, including the economic value of children (14, 23, 27, 30–33, 58, 79, 97, 119, 209, 212, 220, 222, 224). The study of the factors which lead to high fertility in less developed countries is a major topic in demography and increasingly in anthropology. One factor which has been identified as leading to increased fertility is the contribution

to household income contributed by immature children. This can be calculated by measuring the value in goods and other income remaining after the "cost" of raising children has been deducted (27, 212, 222). Boulier, for example, in a study in the rural Philippines, suggests that the net marginal gain of children is positive, providing thereby an incentive to increased fertility. Some studies suggest that parents invest more in children after they enter the work force than before (102, 202).

Another major issue in anthropology to which TA studies have applicability is the notion of the "domestic mode of production," a phrase coined by Marshall Sahlins (271) following a suggestion by A. V. Chayanov (42), a Soviet economist. Chayanov suggested that the peasant family suppressed its production below a culturally prescribed limit and that the productivity of the domestic unit was regulated by the ratio of food producers to nonproducers in the household. Thus as children matured and began to participate in production, the rate of production per producer would fall off. The theory has an important place in Marxist theory which predicts that precapitalist producers in general produce for use not for exchange. Without going into the matter in detail, it is interesting to note that much of the debate has made use of a proxy for labor intensity, either productivity per worker or area cultivated per worker (42, 75, 181, 271). While, one would expect these variables to be related to labor intensity, there are other variables such as soil fertility, technology, crop varieties, and the like which could confound this relationship, especially if good land is unevenly distributed. This measure also fails to consider other forms of labor such as domestic labor (209).

Until the 1960s few investigators questioned that the driving force behind intensification was technological change which in turn drove productivity per capita and population growth. Ester Boserup (26) challenged this assumption, suggesting the contrary: new technologies and intensification were the consequences, not causes of population growth. In support of her position, Boserup began to document what is now widely accepted, that extensive horticulture (swidden, bush-fallow, etc) is more productive per unit labor than more intensive forms. The relative productivity of swidden and other extensive forms of horticulture was the focus of a number of studies dating from the 1930s (35, 44, 45, 89, 91, 250, 251, 267, 304, 305). These studies tended to show that, in relatively undegraded environments with low population densities, people in the humid tropics could maintain high levels of productivity per unit labor, often higher than in more intensive nonmechanized regimes. These findings run counter to a once popular notion that modern agriculture is less labor intensive. David Pimentel (241, 242) and G. Leach (173) extended these studies to the level of energy input/output analysis. As fossil energy is applied to agriculture, the number of cultivators required drops, but the productivity per unit energy invested may actually fall (241). The notion that industrial-style

agriculture is more productive per unit labor is still current, but to my knowledge, no one has evaluated the total labor input required for modern agricultural infrastructure, marketing, and distribution.

Similar questions have been raised concerning industrial technology as well. Several social scientists have asked whether modern technology in general meant less time spent working. In these studies, it is difficult to disaggregate the effect of a single item of technology. Hence, many studies have attempted to evaluate the overall rate of work for workers of a given class. Perhaps the most comprehensive comparative study of the problem yet attempted by an anthropologist is found in Minge-Kalman's study entitled, "Does Labor Time Decrease with Industrialization?" (211). Her study, based on 15 time-allocation studies from many societies, suggests that in industrial societies work outside the home decreases while work inside the home increases for an overall net increase. Minge-Kalman believes the changes are the result of increased cost in time of rearing children in industrial society and the fact that education deprives the household of the labor of children during their early years. These costs are borne largely by the family, not by the state or capital (210–212).

From a methodological point of view, Minge-Kalman's contribution is her suggestion that the issue cannot be studied without attention to both "productive" and "reproductive" (or domestic) labor. Since the latter is difficult to measure by conventional means, TA data are essential for resolving questions of this sort. Her study is a major contribution to a renewed debate concerning the role of the household in the global economy of a society.

Munroe et al conducted more highly controlled spot observations in four societies, including two horticultural groups in Kenya, a highland group in Peru, and a middle-class urban-industrial sample in the U.S. (221). They suggest that the relationship between techno-economic level and total productive labor time is not direct (as suggested in the Sahlins model), but rather curvilinear (see 154, 155). In this view, labor inputs rise from a moderate level among hunters and extensive horticulturalists to high levels among intensive agriculturalists, then fall to a moderate level in industrialized societies. They further suggest that this may be so because horticultural groups have to work not only at subsistence activities but also at numerous chores involved with the upkeep of their goods and equipment.

The foregoing discussion has focused mainly on traditional anthropological questions. Typically, anthropological research has been driven by questions concerning the evolution of societies and has been based on direct observation by ethnographers themselves in communities. Systematic TA studies conducted by sociologists have mainly been concerned with contemporary industrial societies and have been based largely on self-reported time diaries. Early studies in the U.S. were conducted by Lundberg and Sorokin & Berger (190,

281). During the mid-1960s social scientists from 12 different countries carried out a collaborative time-allocation study on large samples of their populations under the auspices of the European Centre for Coordination of Research and Documentation in the Social Sciences (287, 288). The Multinational Time Budget Research Project was an outstanding example of international cooperation in science. The primary objectives of the study were to compare the urbanization and industrialization processes in the countries, to develop methods and standards for time-budget surveys, to establish a multinational data bank for future research, and to promote cooperation and standardization of techniques across national borders (287, 288). These studies initiated or contributed to a tradition of time-budget study in many different countries including Belgium (129, 149), Canada (71, 72, 120, 121), Czechoslovakia (138), Denmark (169), Finland (230, 280), France (17, 46, 103, 180, 227), the Federal Republic of Germany (113, 208, 301), Greece (237), Hungary (5, 6, 140, 141), Italy (147), Japan (119, 223), Norway (98, 186, 187, 229, 232, 233), Poland (235, 243, 322), the Soviet Union (238–240, 247, 268, 283), Sweden (135), Switzerland (104, 210), the United Kingdom (49, 50, 92, 96), and the United States (39–41, 55, 111, 190, 254–264, 281). While a number of individual country studies appeared, there have been remarkably few true cross-national comparisons of time allocation. The studies were based in the main on diaries filled out by interviewers for a previous 24-hour period in the life of the interviewee. This "retrospective" technique presents the problem of relying on the informant's memory of what he/she was doing, when, and for how long (see Bernard et al, this volume).

Sociologists are as concerned with leisure as a topic as anthropologists, not so much as a factor in the development of civilization but as a presumed product of living in an advanced industrial age (12, 71, 72, 90, 96, 97, 113, 121, 137, 138, 190, 254, 258, 260, 261, 264, 286, 319, 325). Some writers suggest that the dilemma of our age is how to find fulfillment outside of traditional work. Many TA studies were designed to describe uses of leisure time as an aid to better design of public facilities or to design work schedules around peoples' needs and preferences (17, 319), while others focussed on the media, particularly broadcasting (137, 223, 258, 260, 261). Other studies focus on hospitals and other social service institutions, including both the caregivers and the receivers (61, 83, 329), and schools (168, 192). TA has been used in studies of housing (7, 203) and of consumption (54, 59, 174) and in the discussion of public policy in general (3, 127, 204, 207).

Linder (185) suggests that the increasing scarcity of time is a central paradox of modern life. In the familiar formalist paradigm, Linder refers to an optimum which can be reached when it is impossible to increase satisfaction by reallocating the amount of time spent on various activities. In a growing economy, the yield per unit time spent working increases. Thus,

> the time allocation which has represented equilibrium at our previous level of income is disrupted. The yield on time devoted to other activities must also be raised . . . We claim that the yield in time in all other activities is brought into parity with the yield on working time. In other words, economic growth entails a general increase in the scarcity of time (185, pp. 6–7).

Translated into practical terms, this means that the "Harried Leisure Class" finds itself locked into an undending spiral in which time for work, consumption, family, and social affairs becomes increasingly scarce; people find themselves tyrranized by the clock; family life is hectic and stressful.

One of the theoretically most interesting applications of TA in sociological writing is social accounting theory (13, 103, 160). The principal theoretical thrust comes from Gary Becker, who has suggested analyzing such institutions as the family as if they were "firms" in the business of producing "goods" like happiness, stability, sexual satisfaction, and so on. Since many of factors of this productive system cannot be estimated in monetary terms, time allocation is a natural unit for the measurement of cost factors. Juster and others have extended this concept to the evaluation of "well-being" in society. By deriving a coefficient of value from the preferences expressed by members of a given society and multiplying them by the amount of time spent at different activities, it is possible to estimate the extent to which people succeed in doing what they hold dear in life. This measure is unique in that it is not based on material possessions or income but rather on the extent to which people spend time doing what they really like and want to do, i.e. a process-based measure. Anthropologists will recognize in this approach a classic example of the application of formal economic calculus to behavior. Chapin (40) devised a "game" in which informants expressed their time-use preferences by gluing stamps, representing units of time, into spaces on a sheet representing alternative activities. Chapin then compared the actual time use patterns to the preferences expressed by informants.

Many other TA studies were done in industrial countries without the theoretical concerns just outlined. Many of these studies are subsidies to the formation of public policy and therefore deal with specific populations whose behavior is poorly understood, such as the aged (93, 129, 139, 164). The behavior of children, while frequently alluded to in anthropological studies, is not always observed systematically. TA studies permit more detailed analysis and comparison of children's behavior and exploration of the role of socialization, task assignment, and the effects other features of the child's environment have on the child's development. These same studies permit a closer look than previously possible at children's contribution to the household. A large number of studies deal with children (24, 25, 27, 33, 52, 62, 64, 65, 220, 222, 274, 279, 316), interaction among children (226, 266), and parental care and socialization of children (10, 34, 53, 94, 131, 165–167, 170, 171,

179, 205, 210, 212, 213, 219, 224, 244, 245, 285, 310). Draper (64), for example, examined aspects of child socialization among the !Kung San using randomly sampled time frames. She suggests that variation of behavior between boys and girls could not be explained entirely in terms of gender socialization.

TA studies, which include observation of all activities, are useful not only because they remove any bias toward particular age/sex categories, but also show the place of previously ignored activities in the totality of domestic and extradomestic activities. TA data make it possible to evaluate assertions of the complementarity of female vs male labor. The selection of the household as sampling unit (see 101, 152) further insures that otherwise "invisible" activities will turn up on activity protocols. The literature on TA shows a strong emphasis on women's activities, sex roles, and domestic labor. The division of labor according to sex and changes in the distribution of sex roles is a natural topic for TA studies (1, 11, 17, 21, 47, 52, 63, 73, 80, 82, 98, 105, 130, 146, 159, 163, 217, 252, 263, 302, 323). This shows an interesting convergence of social, theoretical, and methodological issues.

As investigators became aware of the struggle for women's equality, they became aware of hidden biases in social research. One of these was to assume that female production occurred when women worked "outside the home" and that the domestic sphere was separate from the male-dominated spheres of production, exchange, politics, etc. Even in studies based on participant observation when domestic activities unfolded "right under the noses" of ethnographers, the productive (and "reproductive") labor of women and children went unnoticed and undocumented. Another problem arose when investigators attempted to estimate the importance of unpaid household labor (47, 69, 95, 163, 252, 308). Work outside the home could be estimated in terms of the amounts produced or the exchange value of the goods produced, but household labor involving childcare, preparation of meals, and housekeeping often has no market value or even a tangible product. Using time spent on these activities provided a convenient standard of comparison for all work, regardless of where it takes place and how it was evaluated.

Another area in which TA studies have a wide range of applications is in the study of human nutrition (202). Behavioral, ecological, and cultural aspects of nutrition occupy a central place in studies by anthropologists. The quality of a diet is not a simple function of the availability of nutrients in the environment but also depends on activity patterns, intrahousehold distribution, the social valuation of different foods, etc. Different activities expend caloric energy at different rates. For example, an average-sized European male chopping wood with an axe spends about 8 kilocalories (kcal) per minute, while the same male sitting at a desk writing expends 3.2 kcal/min (68, 70). Estimates of caloric expenditure rely on accurate estimates of time allocation. For example, an error

of one hour in an estimate of time chopping wood, could result in an error equivalent to 300 kcal in the energy expended by the subject. Estimating metabolic rates in the field is so complex that, under most circumstances, only a few individuals can be tested in trials of short duration.

Thus energy balance studies in natural settings must accurately estimate the time spent doing an activity (112, 134, 196, 215, 231, 234). In fact, the accuracy of time allocation estimates may be more critical than the estimation of rates of calorie expenditure. Field estimates of metabolic rates (caloric expenditure) generally rely on the technique of indirect calorimetry (IC). IC employs a device to collect samples of exhaled air from the lungs of the subject, requiring that the subject breathe through a tube and wear a cumbersome backpack (68). After the unit is calibrated and the subject has been selected and trained and allowed to become accustomed to the unit, samples must be extracted and analyzed on the spot for CO_2 content. Montgomery & Johnson (215) conducted one such exercise among the Machiguenga of Peru. They obtained rates of caloric expenditures for a number of Machiguenga subjects, then "plugged" these values into estimates of time expenditure made by the random spot-check technique (152). This is one of the most reliable energy balance studies yet conducted because the investigators were able to estimate TA more comprehensively than in most cases (66, 294, 295). Flowers (85) investigated seasonal variation in diet and nutrition among South American horticulturalists.

Gross & Underwood (102) observed activities involved in sisal production in Northeastern Brazil. By timing output rates for harvesting and decorticating sisal over short trials, they estimated total time spent by monitoring daily output for selected work teams. They used these values to estimate individual calorie expenditure rates by comparing the sisal work to other tasks for which rates have been calculated. They estimated the remaining caloric requirements of individuals by still cruder methods. The results were sufficiently accurate to permit prediction of caloric deficits in households whose income was highly dependent on the labor of sisal workers (102).

One aspect of this study that should be stressed is the technique used for estimating time spent on sisal production. Unlike some activities such as hunting or fishing, harvesting has a fixed rhythm with a small number of highly repetitive body movements. Output per unit of time for any given worker or team is fairly constant. Thus, by knowing how much sisal had actually been produced, one could accurately estimate the amount of time the harvesting and decorticating team had spent. Of course, the output rates had to be estimated through direct observation for each production team sampled, but once this was done, a great deal of information about work time could be estimated simply by finding out the daily production of the harvesting teams. This approach can probably be adapted to other uses whenever output is fairly constant over time.

This condition is met in many kinds of activity, such as food processing, factory assembly-line work, tool making, house construction, and others. In this way, the estimation of time allocation can be pushed into the recent and even prehistoric past, using material residues as a measure of output, and from that estimating TA.

The accurate recording of activity patterns has other uses in nutritional studies. In many societies, food may be consumed at various hours, and the very notion of a "meal" in Western terms may not exist. D. Werner reports (personal communication) that in his TA study of the Mekranoti of Central Brazil, he rarely observed the Western equivalent of a "meal." More often they ate alone, or while out walking, or in the gardens. Accurate measures of consumption may therefore depend on sampling from the total behavior stream. The same is true concerning the allocation of foodstuffs within households and other commensal units. It is well known that foodstuffs are not allocated equally among children in some societies (202). TA sampling can help to reveal the patterns not only of differential allocation of food but also of child labor, female labor, and so on.

TA techniques are also useful to reveal visiting patterns and interhousehold sharing patterns which may be relevant to nutrition or health but overlooked in studies that do not survey the entire behavior stream. Other exchange and productive activities which affect the food supply may also turn up in TA studies. To the extent that time spent in the household (as opposed to working outside the home) impacts on child nutrition and the general quality of child care, time spent by women away from home may have negative consequences on children's nutritional status. Kumar (170) suggests that children who are sent with elder siblings to work in the fields have lower nutritional status which is not offset by the increased household income provided by the mother. TA studies can document that presence or absence of siblings, friends, or babysitters in the household as factors in the quality of care provided to infants and toddlers.

TA studies also provide a vehicle or opportunity for investigating specific aspects of behavior. For example, in some studies there may be an interest in determining the amount and quality of foods captured and consumed. In some of the studies dealing with protein capture in Amazonia (101, 108–110, 236, 315) the investigators flagged all instances in which subjects were reported as "out hunting." They made a practice of returning to the hunter's household in all or some such cases to determine where the hunter went, the species and quantity of the catch, and the time elapsed on the hunt. These observations allowed the observers to make accurate estimates of the productivity of hunting, fishing, and other activities.

Social interaction can be studied in conjunction with TA observations by including information on interaction in the observation protocols. In other

words, in addition to the activity codes for individuals, the observer can code for other persons in the environment of the target subject. Using this approach, the investigator can examine social networks using actual encounters as the indicator of a relationship. In other words, TA studies provide a concrete record of encounters which can supplement informants' statements concerning the nature and quality of relationships. Relatively few TA studies deal in depth with interaction, perhaps because it is difficult to define operationally (107, 226). There are many advantages to combining the study of activities with the study of social interaction (206, 273, 311) in the study of kinship, modes of production, household organization, socialization, social influence (253a), class relations, and status differences (214, 273, 275, 314) and others. The use of the TA framework in the study of interaction will probably expand.

Observations of TA can be linked to many other observational approaches and ethnographic questions. The basic notion of an accurate representative record of events from the behavior stream of a defined population can be tied to many other pursuits. In examples given above, the observers collected data on game bagged, or on social interaction, in addition to the particular activity of the moment. In other studies the investigators used the average amount of time spent on garden activities together with average garden yields to determine the productivity of garden labor (86, 101). Thus individual or global rates of production of different goods can be estimated by using the TA technique. Incidentally, once the time required to produce certain goods is known, information on productive yields—of many kinds of goods, industrial or agricultural, tangible of intangible—can be used to estimate TA for larger population segments. For example, global production statistics for a given region can be used to estimate the size of the population involved in the production of specific crops. TA data may also be used to examine how people utilize space. By determining the location of target individuals at given times, it is possible to determine how people move through space and to correlate different activity patterns or status differences with their movements (40). Transportation engineers have developed their own version of TA studies to analyze the pattern of movement of people through space and to optimize the design of transportion systems (9).

TA studies not only are adaptable to different uses, but they may also provide the observer with unexpected opportunities for observation. Extensive TA studies require that the observer be on hand at different hours of the day to record the activities of a representative sample of people. For example, Madeline Lattman Ritter (personal communication) spent one year in a Kanela Indian village making random spot checks on 24 households per week at randomly chosen hours. The Kanela live in mud and brick houses arranged in a large circle with the doors facing the center. After several weeks of this, the villagers began to take her sudden arrivals in stride. Finally, after several months one villager took her aside and drew a circle in the dust on the ground: "Other

anthropologists come and visit just a few houses," pointing to a few locations on the circumference. "We like you," the villager said, "because you visit all the houses." making a sweeping gesture to the entire circumference. Ritter feels that the technique helped to establish her impartiality in a village prone to factionalism and gave her access to information she might otherwise have missed.

METHOD AND TECHNIQUE IN TIME ALLOCATION STUDIES

It is a truism in anthropology that research design and field techniques must be modified to fit each individual research situation. The principal determinants of field technique are the problem to be addressed by the study and the restrictions imposed by time, resources, and the situation itself. Many, perhaps all, of the problems encountered in designing successful TA research are met by most ethnographers. The most salient of them concern sampling, coding, and access. For convenience, the problems will be divided into the following rubrics: sampling universe, sample units, observation interval, sample duration, sample frequency, codebook, coding rules, direct vs indirect observation, privacy, and ethics.

The first issue to be resolved is the definition of the *sampling universe,* that is, the boundaries of the human group within which observations are to be made. This will depend on the problem to be examined. Most anthropological studies are aimed at a particular social group, e.g. a community or class, and this unit can serve as the sampling universe. Often an arbitrary decision must be made, e.g. the selection of a particular community within which to focus observations, as for example, the choice of Jackson, Michigan, in the 1965 13-nation study (288). The choice of sampling universe may be more critical in a TA study than in other approaches because explicit boundaries must be established. Thus, a study of a particular community may deliberately exclude behavior occurring beyond a physical boundary or groups living beyond this boundary. If the objective of the study is to reveal the contrast between two groups (e.g. social classes), however, the universe must be defined to contain substantial numbers of each group.

Closely related is the issue of the *sampling unit.* This defines the subject(s) whose behavior will be recorded in a given moment or interval. Many, perhaps most, TA studies choose the household or domestic unit as the sampling unit. Households are particularly convenient sampling units because they are often comparable culturally. It is relatively easy to observe behavior directly in a household or to use a single informant to report on the activities of household members. By choosing the household, the complementarity and coordination of roles can be observed (20). Using the household as the observational unit has drawbacks as well, primarily that of excluding individuals who do not reside in

households, such as boarding school students, or Xavante boy initiates who live in a separate hut (195). In other cases, the composition of the household fluctuates. When the Mekranoti are on extended treks, their matrilocal household structure gives way to one based on men's societies and friendship (312, 313). The choice of the sampling unit has important consequences for the efficiency of data gathering. If the units are small, scattered, and inaccessible, the time spent per individual in observation is high. Consolidating sampling units (or visiting adjacent units serially) can reduce the time cost per observation by reducing travel time among them.

In studies where a few households will be observed continuously, the selection is crucial and households must be carefully screened for representativeness. Even so, the investment of time in continuous observation is so great as to make adequate sampling difficult. In broader surveys based on random sampling, the household unit can serve as a convenient way of insuring that every individual has an equal chance of being observed at any given moment in time. Of course, the selection of the household as the sampling unit does not restrict observation to what goes on inside the household. An observer can visit a household and ascertain that some of its members are off working, others in school, etc. Thus the selection of a particular sampling unit might result in certain behavioral sequences being observed by report rather than directly. A way around this would be the selection of an individual rather than a social unit as the sampling unit. Nevertheless, unless the observer is able to keep an individual continuously in view, it would be necessary to rely partly on reported rather than directly observed behavior. Focal individual observation is particularly useful for studies dealing with interaction. Primatologists interested in interaction may use a focal individual and all other individuals who interact with him/her over a specified period as the primary sampling unit (2). This is a viable technique for observation of humans as well with the reservation that the behavior of individuals with which the focal individual does not interact will not be recorded.

The *observation interval* determines whether behavior will be recorded instantaneously, in fixed intervals (FI), or as continuous events. A number of anthropologists have done such studies by sitting in households watching the behavior of all those who occupy a certain space and recording it on a log. In continuous TA recording, the observer must be free to spend long hours sitting, watching, and recording. This can be facilitated by using microprocesser-based devices on which events are tagged with actor identification, time of event, and duration. The length of the observation interval is limited by the patience of the observer and the observed. Film, tape, and videotape may also be used in such situations with obvious limitations (56, 158). The length of the observed sequence may also depend on battery charge and the capacity of the storage media. Very few continuous observations go on for more than a few days (182,

202). Continuous observation presents another problem: behavior itself is continuous. It is the observer who breaks it up into discrete chunks and labels them. An observer who claims to be recording "natural breaks" in behavior is merely relying on unstated operational rules. For example, continuous observation of a cook peeling potatoes might break the behavior at each knife stroke, at each potato peeled, at each potful of peeled potatoes filled, or at dinnertime! Thus, while time-frame and TA studies would seem to be ideal for anthropologists who crave highly detailed contextualized data, in practice, the volume of data and the necessity to code data make it difficult to achieve.

FI sequences ranging from 5 minutes to an hour or more are used by many observers, particularly in the time-frame mode. The selection of the beginning time may be random (157) or otherwise set to insure representativeness. FI sequences present the same problem as continuous observation even when the intervals chosen are short. Typically, investigators who use this technique have carefully worked-out code books and achieve interobserver reliability through thorough training and rehearsal.

Spot checks of behavior get around this problem by taking "snapshot-like" recordings of behavior. The preferred approach in recent spot-check studies is to select the moment of the observation at random and to arrive on the scene unannounced (74, 105, 152, 265). In many cases, the observer attempts to get a clear view of what is going on by avoiding interacting with the actors until after notes are taken. Even if the actor stops what he/she is doing, the observer can often deduce what was going on from the paraphernalia. A person with a knife in hand and a plateful of peeled potatoes next to him on a counter and a sack of unpeeled potatoes sitting next to him can safely be coded as peeling potatoes, even if he looks up and stops peeling when the observer arrives. If the sample is small enough and the sample density is high enough, the subjects eventually learn that the observer does not expect them to "drop everything" when the observer arrives. As a last resort, the observer can ask the actor what was happening before he/she arrived (20, 101). It is probably impossible to avoid "contaminating" the observer's code book with actor's perceptions. Suppose an observer arrives at a subject's home to find the latter waving a long stick in the air. Unless the observer can specifically recognize the movements, the same behavior might be coded as "sword play," "karate," or "orchestra conducting."

The *sample duration* is the period over which observations are made. In anthropological investigations, particularly of communities depending on subsistence production, this is typically a period of one year. Behavior observations may therefore keep the ethnographer continuously in the field for up to one year in order not to miss some significant seasonal variant. As in all field studies, there is a trade-off between the density of data collection and the time available for other things, including vacations for the investigator.

An investigator who relies on a randomizing procedure to schedule observations may begin to feel like a prisoner to the technique. Random spot checks may also miss completely some unique but highly significant behavior such as a rarely celebrated festival. Of course, if the behavior is rare, it should not be recorded frequently in a statistical profile of behavior. There is nothing to prevent an ethnographer from describing a significant event even if rolling the dice does not require a TA visit. It is desirable to join a TA survey to a more intensive form of data analysis such as content analysis, event analysis, life histories, or analysis of ritual because it helps to set particular events in the light of other activities in which people engage.

Sampling frequency is the number of times per week (day, month) that observations are made. In continuous observation, this point is moot, since observations presumably go on all day long. In FI and spot checks, the frequency of observations is an important issue. The frequency depends on the time available to the investigator in the field and the complexity of the analysis to be performed. If, for example, the study is aimed at showing aspects of developmental change in the behavior of children in 2-year age cohorts, it might be necessary to increase the sampling frequency to insure a sufficient number of observations of children in each cohort. If, however, the study does not require such fine distinctions, for example, dividing the population into adults (>15 yr) and juveniles (<15 yr), a smaller number of observations may be adequate. The other limitation on sampling frequency is overall sample adequacy. Mundel (218) provides a convenient table for estimating the sample size necessary to draw conclusions with a probable margin of error of 5% or less. *Sample density* in TA studies is an expression of the sample frequency per unit sampled population. The higher the density, the greater the chance of an activity being observed.

One fallacy about the spot-check technique is that it is very time consuming. Random spot checks are in fact very economical of observer time. Consider a hypothetical example in which an investigator wishes to conduct TA studies in a village of 1500 people with 200 households. What are the trade-offs between spot checks on the one hand and continuous observation on the other? An observer visiting seven randomly selected households per week to make spot checks, spending an average of 20 minutes per visit (including travel time), would generate 2730 person-observations over one year. Each villager would, on average, be observed about two times. The total investigator time spent would be about 121 hours over one year. Suppose that instead of spot checks, the investigator decides to use continuous observations. He selects ten households as representative of the village and spends about 12 hours in each one, writing down what people do. He finds he records about ten activities for each hour of observation, thus generating about 1200 person observations using the

same total number of hours as in the spot checks. In this example, only 75 people in the village would be observed at all, but each of them would be recorded an average of 16 times.

The two techniques differ in many respects. Continuous recording that requires the commitment of entire days is quite different than the commitment of a few hours per week. The quality of the observations would also be quite different. Assuming the household residents became adjusted to the observer's presence, to the point of ignoring him/her, continuous observation might provide more of a sense of "texture" than spot checks. If the observer required more detailed information about specific individuals, say, leaders or shamans, FI or continuous observations might be mandatory. In any case, while not yet attempted, investigators might want to combine some of the various techniques to realize the benefits of each. In terms of sampling validity and level of detail, however, there is little question that random spot checks is the method of choice in TA studies.

In ethnographic studies, the investigator often develops a personal relationship with a number of people who serve as subjects, informants, and guides. In most situations, the ethnographer conducts a census of the study community to gauge its dimensions and variability. A census is nearly always necessary in TA studies no matter which technique is selected. Of course it is possible to observe anonymous actors as well, but then the ethnographer loses much of the context which makes the behavior meaningful and interpretable. Having a census available facilitates the sampling strategy. Without a census, for example, it would be difficult to select a household for continuous observation by any other criterion than convenience. As for spot checks, a census would allow the observer(s) to prepare code sheets prior to the spot check, making the observation far more efficient (see below).

In most cases, a code book should be written prior to commencing TA observations. The code book lists all of the categories of behavior that are expected to occur in the units under observation. It is convenient, but not mandatory, to list behavior under primary codes, sub codes, and sub-sub codes as in the following example (see 101, 313):

Garden Labor (G)
- B = Burning
- C = Cutting down
- F = Fencing
- P = Planting
- S = Soil Preparation
- W = Weeding
- H = Harvesting
- X = Other.

This code book was prepared for swidden horticulturalists and is inappropriate for industrial agricultural systems where burning of fields is not practiced and many sequences not included here are found such as plowing, fertilizing, spraying insecticide, etc. A code book reflects the objectives of the study, generally making finer distinctions within categories of particular importance. Anyone can look at any code book and find "flaws": categories which are lumped where they could be split and categories which appear to be ambiguous.

In some instances, fairly crude categories of behavior are perfectly usable for studies where finer distinctions are not necessary. For example, in the study cited above, children's play was a single subcategory of the primary category "Idle." In another study (226) work is lumped into a few broad categories while play is subdivided as follows:

Play (II)
- A = Rule Games
- B = Interactive Role Play
- C = Joint construction or special construction
- D = Play requiring going outside the community.

In the first study, the primary focus was on the subsistence and environmental relations and the subjects were all residents of four different villages. In the latter example, the study was aimed at isolating "natural indicators of cognitive development" among children (226).

In order to permit cross-cultural comparisons, it is desirable for investigators to standardize their coding of behavior into a set of broad descriptive categories of behavior. This would make the results of different investigators collected for different purposes usable for comparative purposes. It should be stressed that adoption of such a standard scheme does not prevent an investigator from using any sub-categories that are analytically useful. In the example cited above, for example, the distinction between work and play was not so important as differentiating between the cognitive requirements of behavior. Thus, the analysis might well lump "work" with "play" activities while leaving the distinction intact for the purposes of other analysts.

Coding decisions may sometimes be difficult, as in the example of coding joint behavior. In some studies, the observer also coded for any secondary activities, such as when a woman was holding a baby and stirring a cooking pot simultaneously (101, 313). Which of these categories is primary? Suppose a person is ironing clothes while listening to the radio. Is he working or "idle"? The solution that conserves a maximum of detail is to record both behaviors but to adopt a convention about which code takes preference. Gross et al (101) agreed that subsistence labor should be coded as primary and anything else as secondary. But the latter was recorded and can easily be retrieved.

As an etic technique focused on behavior, it would seem obvious that the source of data must be observations by an ethnographer or field assistant of actual behavior as it unfolds. This is impossible in most settings because people move about, they do some things in private when observation is impossible, and because they "emit" behavior 24 hours a day. Even using a "focal individual" as the sampling unit presents problems when that individual lies down to sleep or goes off with a partner to have sex. Standards of privacy vary greatly from one society to another and ethnographers must obey them for ethical and practical reasons. Thus, most TA studies involving direct observation were done during daylight hours among people willing to allow casual visitors at almost any daylight hour. The spatial arrangement of villages in a nucleated pattern with houses with open windows and doors has also facilitated some of these studies. Hames conducted his observations (105, 107) from the center of a Yanomamo village that permitted a continuous view of all the households. He was thus able to make an unusually large number of observations with minimal effort.

In study sites where most domestic activities are directly observable, the observer stops by at exactly the predetermined time and, as quickly as possible, notes (mentally if possible) what everyone was doing at the moment he or she arrived. Ideally, at least some household members are home. This data could then be recorded on a code sheet. The observer then asked about household members not present. If it was learned they were nearby, Hames (105) would go out and look for missing persons, but only if they were in the village. Most observers, however, simply asked household members present what the missing person was doing at the moment. Gross et al cross-checked some of these reports by going back to the households of some persons who had been missing during the day and found that the reports were fairly accurate within a certain tolerance. When wives said their husbands were out hunting, the husbands, asked later, usually reported the same thing. It was impossible, of course, to determine whether at the precise moment of the visit the hunter was engaged in stalking, butchering, resting, or other subsidiary activity. Thus, even those TA studies based on direct observation had to make some use of informants' reports of what they or other people were doing.

Urban settlements in the developed world usually have closed-off homes and apartments designed to maximize privacy, security, and (where necessary) to minimize heat loss. Middle and upper-class people in many such societies have a developed sense of privacy which is not compatible with visits from observers. With a few exceptions (20), most TA studies in these situations rely entirely on information supplied by the actors themselves in self-kept logs. In others, one subject—typically a housewife—was asked to keep a diary of her own and her family's activities. In other studies, the data were recorded by

interviewers who asked the respondents to describe their activities for a given period, usually the day before.

Self-report diaries raise a number of knotty problems for the analysis of TA data and its comparison with other studies. One of them concerns the way in which diaries are constructed. Some diaries are prestructured with intervals ranging from 10 to 30 minutes to be filled in. This approach tends to lead the informant to omit short episodes of easily forgetten behavior and also the beginning and ending times of behavior. Such diaries typically ask the informant, "What were you mainly doing between X and Y o'clock?" In other formats, the diary has no time intervals built in, and the informant determines how many activities will be entered, recording the beginning and ending times of each. In such diaries, the latitude given to the informant is greater. It may lead some to supply great detail (for example, "peeled potatoes, sliced potatoes, washed potatoes, fried potatoes, drained potatoes" etc. rather than simply, "prepared fried potatoes"), while others may give few or no details (such as "did housework"). Berk & Berk (20) are probably representative of other researchers who use a diary method; they state candidly that they allowed the actors to determine where one activity left off and another began. There is a need for additional technical studies showing the consequences of one or the other approach (187, 202a).

In retrospective TA surveys, the problem of accuracy is doubled since the further question of accurate recollection arises. In another paper in this volume (22), Bernard et al review studies on the accuracy of informant recall. They state, starkly, "on average, about half of what informants report is probably inaccurate in some way." Many TA studies are based exclusively or mainly on informant recall over a period of 24 hours or more. Perhaps a more intractable problem is the degree to which informants accurately and truthfully report on their own behavior. In some cases, the informant may forget what he or she did during the day, especially if he/she waits to record it. Where behavior is self-reported in diaries, there are many possible distortions which enter, including the informant's view of how he/she ought to be behaving in the eyes of the researcher, or what activities should not be reported. Where informants have identified their own behavior in self-kept records there is little way to know how consistent the various self-observers were in their definitions of behavior. Finally, there is no guarantee that informants have measured carefully the time their activities take.

Since most of the existing time allocation studies were done in societies where closed doors and privacy were important, the majority relies on informants' accounts of what they were doing. The lack of control studies makes it impossible to determine the extent to which self-reports constitute a valid etic record of behavior or an "ethnochronology" reflecting cultural biases and perceived observer preferences so heavily as to be of little use in estimating

actual time allocation. Some anthropologists feel that the informants' view of how they spend time is as important as time allocation itself, but "ethnochronology" cannot be interpreted without knowledge of how much time people really do spend on an activity. The heavy dependence of all types of TA observation on self-reported activities makes it essential that studies be done to determine the extent and nature of informant error in self reports of TA. There are, as yet, relatively few technical studies weighing the advantages and disadvantages of different approaches to time study (28, 67, 150, 157, 187, 229, 298, 319, 330; for further references see 216, 303, 328).

One source of error is undoubtedly "self-consciousness." Most people are unused to keeping careful records of how they use time, and they are subject to all kinds of unconscious bias when they do so. Indeed, virtually everyone has personal experience in constructing defenses regarding time use. It is possible that one source of error is a lack of the instantaneous or "snapshot" quality in self reports. It is one thing to state what one was doing between 1:00 and 1:30 P.M. and quite another to be surprised at precisely 1:22 P.M. and asked what one is doing. One way of reducing error may be to find ways of notifying a subject at a precise moment to record what he or she is doing. Mundel (218) reports on a management study where all the subjects had telephones on their desks. The investigator arranged for each subject's telephone to be rung in a distinctive way at randomly chosen times. The subjects were instructed to record briefly what they were doing on a code sheet each time they heard the ring. It might also be possible to survey people by telephone at random times in populations where telephones are common. It is possible to utilize the telephone and/or paging devices to notify subjects in a TA study to record their activities (48, 195a).

Whenever activities are highly repetitive, as in certain kinds of industrial and agricultural work, the investigator can take shortcuts in estimating TA. While hunting and fishing, for example, involve irregular bursts of activity interspersed with periods of relative inactivity, chores like weeding crops or assembly-line work have a fixed rhythm with a small number of highly repetitive body movements. Output per unit time for any given worker may be constant. Thus, by knowing how much crop or product was produced, one could estimate the total amount of time spent producing it. Similar conditions are met in activities like food processing, house construction, walking, and others. In this way, an observer can use a measure of goods produced as a proxy for time allocation. This approach may also permit estimation of TA for events which took place in the past, even prehistorically, provided a contemporary baseline can be established for making estimates.

In summary, there are a number of lines of investigation which require exploration in order to achieve a high level of confidence in TA surveys. It seems likely that different techniques will be necessary in different cultural

contexts. For example, where people are not literate, self-reports are difficult. Different housing arrangements also set limits on observation. The reticence of people to report on certain subjects is also a factor. It appears that most studies underreport such activities as sex and elimination.

It is understandable that discussion of these measures should give rise to concerns about ethical practice—and well it might. As we have seen, an accurate record of human behavior, generalizable to entire populations, could be a potent weapon for social control and therefore liable to misuse, but it is no more potent than many other sorts of data which anthropologists regularly collect. The objectives and methods of TA studies are consistent with many time-honored anthropological approaches including tape-recording, photography, film and video, use of key informants, depth interviews, projective testing, anthropometric measurements, blood and feces examinations, food intake studies, and so on. All of these techniques are potentially invasions of privacy and liable to misuse. TA measurements might *appear* more invasive than other techniques, so the practitioner will need to be especially sensitive to ethical concerns, such as protection of informant identities. It may be reassuring to the subjects of TA studies if they can see how data are recorded and have it demonstrated that the information gathered about individuals per se has little meaning unless compared with data gathered about many other individuals.

ANALYSIS OF TA DATA

The following notes refer mainly to TA data generated through the random spot-check technique, although they may also have some relevance for other techniques as well. The advent of electronic data processing put far greater power at the disposal of anthropologists interested in TA techniques. As shown above, TA data can be coded directly in the field and entered directly via terminal, punchcard, or even mark-sensed forms. Ideally, TA data will be entered as a series of observations bearing the date, time of day, individual identity number, observation unit (e.g. household) identifying number, activity codes and subcodes, secondary activity codes, plus any additional information such as whether the activity was directly observed or reported upon, whether the activity was cooperative or not, and so on. In some studies, certain activity reports triggered a return visit to gather addititional information. For data processing each individual TA observation can be combined with data concerning the individual observed (sex, age, occupation, etc), or this data can be maintained as a separate data base and combined with the TA files.

Once the data has been coded and entered, analysis can begin. Most TA studies have involved simple cross-tabulations of activities with actors of particular attributes, e.g. males/females, children/adults, etc. Because of the way the data are stored, the files can be used to describe a wide variety of time use features. For example, given samples of sufficient size, it is possible to

provide "breakdowns" of data on a seasonal basis, by day of the week, by hour of the day, by age, by sex, by social status (such as kin group, provided this is recorded in the census), by location, by activity class, in short by any two features which have been recorded either in the census or in the corpus of TA data. The data can be tabulated as a raw number of observations or as a percentage of observations. The data can also be reported in terms of hours per day, per week, or per year. This is done by converting the ratio of observations into hours in accordance with the number of hours actually observed.

For example, in Johnson's study of Machiguenga time allocation (152), he recorded 815 separate observations of married females. Of these visits, 130 were coded as "manufacture" (primarily making cotton cloth) or 15.9% of the total observations. Since his observations covered daylight hours only (between 6:00 A.M. and 7:00 P.M.) the percentages translates to just over 2 hours per day (14.5 hr/wk). Thus, even without knowing when each weaving session began or ended, it is possible to estimate how much time was spent weaving by the Machiguenga married women during Johnson's study period.

Some writers suggest it is not possible to recover the "texture" of daily life using randomly sampled spot checks (202). While it is not possible to retrieve the actual duration of behavioral episodes using spot checks, it is quite simple to learn what the primary activities of particular status categories are at given hours of the day. Thus it would be possible to know whether children nap primarily in the morning or primarily in the afternoon, or how much hunting goes on in late afternoon. Again, even where specific observations are not made concerning cooperative behavior, it would be possible, for example, to determine what individuals from the same sampling units are doing at the same time of day or what different age/sex/status categories are involved in at the same time. TA data is quite usable in studying the relative complementarity of roles between different classes of individuals.

In some cases, the number of observations made varied over time. Gross and associates (101) found that fieldworkers were not able to conduct a uniform number of visits each week because of travel, illness, and other exigencies. There was a danger that activities observed during some periods would be over- or under-represented in the sample because of the uneven distribution of observations. In order to minimize this problem, these investigators used a raw percentage value for each month of observation, then calculated a mean annual value based upon the 12 equally weighted months. In a few cases, they found that the number of observations for a particular month was too low to permit a valid estimate of time allocation. Values were interpolated for such months by averaging the values for the two adjacent months. Thus, if September's data was missing for one group, the average of August and October's values was inserted for that month. This procedure may artifically smooth out a jagged curve, especially for activities with sharp peaks such as harvesting annual

crops. However, over a year's time it probably does not create major distortions in TA. Of course, when the number of observations is uniform, this procedure need not be resorted to.

The study just described involved four separate field investigations among as many different Brazilian Indian groups. After analysis began the question arose of how to compare different months to each other. The solution was not to use the same absolute calendar month as the basis for comparison. Rather, each community studied was assumed to have "begun" on the day the first swiddens were burned over. In this way, the variation in scheduling in the various communities was smoothed out somewhat and comparisons could be made between, say, the harvest in each community which occurred in different calendar months. Of course, for other less similar communities, comparisons between specific seasonal periods could not be made so easily, but other comparisons could be drawn, for example in the length of the harvest seasons. In this case, one could arbitrarily define harvest as a period in which greater than a specified percent of adult working time was spent harvesting.

Social scientists are rightly concerned with how people think in their studies of attitudes, symbols, values, and representations. A social science that does not account for human thought is undesirable, but this emphasis has sometimes been at the expense of attention to behavior. In part, this can be attributed to the lack of adequate tools for constructing valid samples from the behavior stream. The studies discussed exemplify ways of redressing the imbalance. Time allocation techniques comprise a valuable tool for recording and analyzing human behavior in a natural context. The power and usefulness of TA techniques have been demonstrated in village level studies and national and international samples. There are still many problems to be solved to achieve maximum efficiency, accuracy, and comparability of data sets. At this point, the social science world has yet to take full advantage of the tool provided by TA analysis. Of course, the results will be no better than the kinds of questions we ask, but if we can formulate them, TA studies provide a major way of basing our generalizations in observations of actual human behavior.

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Literature Cited

1. Acharya, M., Bennett, L. 1981. *Rural Women of Nepal,* Vol. 2: *Field Studies: An Aggregate Analysis of 8 Village Studies*. Kathmandu, Nepal: Cent. Econ. Dev. Adm. Tribhuvan Univ.
2. Altman, J. 1974. Observational study of behavior: Sampling methods. *Behavior* 48:1–41
3. Anderson, J. 1971. Space-time budgets and activity studies in urban geography and planning. *Environ. Plann.* 3(4):353–68
4. Anderson, R. 1974. *Leisure: An Inappropriate Concept for Women?* Canberra: Aust. Gov. Print. Off.
5. Andorka, R., Falussy, B. 1981. The way of life of the Hungarian society as reflected by the time budget survey of 1976–77. *Acta Oecon.* 15(3–4):243–73
6. Andorka, R., Falussy, B. 1982. The way of life of the Hungarian society on the basis of the time budget survey of 1976–77. *Soc. Indic. Res.* 26(3–4):243–73
7. Andrews, H. F., Breslauer, H. J. 1976. *Cooperative Housing Study*. Toronto: Cent. Urban Community Stud., Univ. Toronto
8. Aspelin, P. 1975. *External Articulation and Domestic Production: The Artifact Trade of the Maimande of Northwestern Mato Grosso, Brazil*. Cornell Univ.: Latin Am. Stud. Thesis Ser. No. 58
9. Banjo, G., Brown, P. J. B. 1982. *Patterns of Time Budget Expenditure in Nigeria*. Washington DC: Natl. Acad. Sci., Natl. Res. Counc. Transp. Res. Rec. No. 879, pp. 1–9
10. Barry, H., Child, I. L., Bacon, M. K. 1959. Relation of child training to subsistence economy. *Am. Anthropol.* 61:51–63
11. Baumann, H. 1928. The division of work according to sex in African hoe culture. *Africa* 1:289–319
12. Baxter, M. 1977. *A Research Study into Recreation Activity Substitution in Scotland*. Edinburgh: T.R.R.U.
13. Becker, G. S. 1965. A theory of the allocation of time. *Econ. J.* 75:493–517
14. Becker, G. S. 1981. *A Treatise on the Family*. Cambridge, Mass: Harvard Univ. Press
15. Beckerman, S. 1979. The abundance of protein in Amazonia: A reply to Gross. *Am. Anthropol.* 81(3): 533–60
16. Behrens, C. 1981. Time allocation and meat procurement among the Shipibo Indians of eastern Peru. *Hum. Ecol.* 9(2):189–220
17. Berenstein-Wavre, J. 1974. *Meneagere Aujourd'hui: Resultat d'une Enquete sur le Budget-Temps Menage de 1300 Femmes de Suisse Romande*. Lausanne: Diffusion Payot
18. Bergman, R. W. 1974. *Shipibo subsistence in the Upper Amazon rainforest*. PhD thesis. Univ. Wisconsin, Madison
19. Bergman, R. W. 1980. *Amazon Economics: The Simplicity of Shipibo Wealth*. Ann Arbor: Dellplain Latin Am. Stud. Vol. 6
20. Berk, R. A., Berk, S. F. 1979. *Labor and Leisure at Home: Content and Organization of the Household Day*. Beverly Hills, Calif: Sage
21. Berk, S. F., ed. 1980. *Women and Household Labor*. Beverly Hills, Calif: Sage
22. Bernard, H. R., Killworth, P., Kronenfeld, D., Sailer, L. 1984. The problem of informant accuracy: The validity of retrospective data. *Ann. Rev. Anthropol.* 13:495–517
23. Blau, D. M. 1981. Investments in child nutrition and women's allocation of time in developing countries. *Popul. Index* 47(3):473
24. Blurton-Jones, N. G. 1972. *Ethological Studies of Child Behavior*. Cambridge: Cambridge Univ. Press
25. Blurton-Jones, N. G., Konner, M. 1973. Sex differences in behavior of London and Bushman children. In *Comparative Ecology and Behavior of the Primates*, ed. R. P. Michael, J. H. Crook, pp. 689–750. New York: Academic
26. Boserup, E. 1965. *The Conditions of Agricultural Growth: Economics of Agrarian Change*. New York: Aldine
27. Boulier, B. I. 1976. *Children and Household Economic Activity in Laguna, Philippines*. Quezon City: Inst. Econ. Dev. Res. Sch. Econ., Univ. Philippines
28. Branch, K. 1977. *Time utilization studies: Some methodological issues*. MS thesis. Grad. Sch. Educ., Harvard Univ.
29. Brush, S. B. 1977. The myth of the idle peasant: Employment in a subsistence economy. In Peasant Livelihood, ed. R. Halperin, J. Dow, pp. 60–78. New York: St. Martin's
30. Butz, W. P., DaVanzo, J. 1978. *The Malaysian Family Life Survey: Summary Report*. Santa Monica, Calif: Rand Corp.
31. Butz, W. P., Da Vanzo, J., Fernandez, D. Z., Jones, R., Spoelstra, N. 1978. *The Malaysian Family Life Survey: Appendix A, Questionnaires and Interviewer Instructions*. Santa Monica, Calif: Rand Corp.
32. Cain, M. T. 1977. *Household Time Budgets*. Bangladesh Inst. Dev. Studies VFS Methodol. Rep. No. 1
33. Cain, M. T. 1977. The economic activi-

ties of children in a village in Bangladesh. *Popul. Dev. Rev.* 3:201–27
34. Caldwell, B. M., Herskes, L. 1963. Mother-infant interaction in monomatic and polymatic families. *Am. J. Orthopsychiatry* 33:653–64
34a. Carlstein, T. 1982. *Time Resources, Society and Ecology: On the Capacity for Human Interaction in Time and Space.* Vol. 1: *Preindustrial Societies.* London: Allen & Unwin
35. Carneiro, R. L. 1961. Slash-and-burn cultivation among the Kuikuru and its implications for cultural development in the Amazon Basin. In *The Evolution of Horticultural Systems,* ed. J. Wilbert. *Antropologica* (Caracas), Suppl. 2
36. Carneiro, R. L. 1979. Forest clearance among the Yanomamo: Observations and implications. *Antropologica* (Caracas) 52:39–76
37. Carneiro, R. L. 1979. Tree felling with the stone ax: An experiment carried out among the Yanomamo Indians of southern Venezuela. In *Ethnoarcheology,* ed. C. Kramer, pp. 21–58. New York: Columbia Univ. Press
38. Chagnon, N., Hames, R. 1979. Protein deficiency and tribal warfare in Amazonia: New data. *Science* 203:910–13
39. Chapin, F. S. Jr. 1966. *Household Activity Systems.* Chapel Hill, NC: Univ. North Carolina, Cent. Urban Reg. Stud., Inst. Res. Soc. Sci.
40. Chapin, F. S. Jr. 1974. *Human Activity Patterns in the City: Things People Do in Time and Space.* New York: Wiley
41. Chapin, F. S. Jr., Foerster, J. F. 1975. Teenager activity patterns in low-income communities. See Ref. 206, pp. 90–119
42. Chayanov, A. V. 1966. *The Theory of Peasant Economy,* ed. and transl. D. Thorner, B. Kerbley, R. E. F. Smith. Homewood, Ill: Irwin
43. Chodkiewicz, J. L. 1979. *Gasoline and Proteins.* Unpublished manuscript
44. Clark, C., Haswell, H. 1968. *The Economics of Subsistence Agriculture.* London: Macmillan
45. Conklin, H. 1957. *Hanunoo Agriculture: A Report on an Integrated System of Shifting Agriculture in the Philippines.* Rome: FAO. 2 Vols.
46. Coronio, G. 1977. *Loisir.* Paris: Cent. Recherche d'Urbanisme
47. Coverman, S. 1983. Gender, domestic labor time and wage inequality. Am. Sociol. Rev. 48(5):623–36
48. Csikszentmihalyi, M., Larson, R., Prescott, S. 1977. The ecology of adolescent activity and experience. *J. Youth Adolesc.* 6:281–94
49. Cullen, I. G. 1975. The redistribution effect of time and space. See Ref. 206, pp. 120–36
50. Cullen, I. G., Godson, V. 1972. *Networks of Urban Activities: The Structure of Activity Patterns.* London: Joint Unit for Plann. Res. Paper No. 1
51. Curio, E. 1983. Time-energy budgets and optimization. *Experientia* 39(1):25–34
52. Dauber, R., Cain, M. L., eds. 1981. *Women and Technological Change in Developing Countries.* AAAS Selected Symp. No. 53. Boulder, Colo: Westview
53. DaVanzo, J., Lee, D. L. P. 1983. The compatibility of child care with market and nonmarket activities: Preliminary evidence from Malaysia. In *Women and Poverty in the 3rd World,* ed. M. Buvinic, M. A. Lycette, W. P. McGreevy
54. Dean, E. 1963. *Economic analysis and African response to price.* PhD thesis. Columbia Univ., New York, N.Y.
55. DeGrazia, S. 1962. *Of Time, Work and Leisure.* New York: Twentieth Century Fund
56. DeHavenon, A. L., Harris, M. 1976. *Hierarchical behavior in domestic groups: A videotape analysis.* Columbia Univ., N.Y. Unpublished manuscript
57. DeSmet, R. E., Huysecom-Wolter, C. 1972. *L'emploi de Temps du Paysan dans un Village Zande du Nord-Est du Zaire.* Brussels: Editions Cemubac
58. DeTray, T. 1983. Children's work activities in Malaysia. *Popul. Dev. Rev.* 9(3):437–56
59. DeVany, A. 1970. Time in the budget of the consumer
60. Dewey, K. G. 1981. Nutritional consequences of the transformation from subsistence to commercial agriculture in Tabasco, Mexico. *Hum. Ecol.* 9(2):151–88
60a. Diamond, S. G., Schein, M. 1966. *The Waste Collectors.* New York: Columbia Univ. Dep. Anthropol.
61. Dobb, B., Poletti, R. 1977. *Vivre a l'Hopital: La Structuration de Temps Chez le Malade Hospitalize.* Paris: Centurion
62. Draper, P. 1972. *!Kung Bushman childhood.* PhD thesis. Harvard Univ., Cambridge, Mass.
63. Draper, P. 1975. !Kung women: Contrasts in sexual egalitarianism in the foraging and sedentary contexts. In *Towards an Anthropology of Women,* ed. R. Reiter, pp. 77–109. New York: Monthly Rev. Press
64. Draper, P. 1975. Cultural pressure on sex difference. *Am. Ethnol.* 2:600–16
65. Draper, P. 1977. Social and economic constraints on child life among the !Kung. In *Kalahari Hunter Gatherers,*

ed. R. B. Lee, I. DeVore. Cambridge, Mass: Harvard Univ. Press
66. Dufour, D. 1983. Nutrition in the northwest Amazon: Household dietary intake and time-energy expenditure. In *Adaptive Responses of Native Amazonians*, ed. R. B. Hames, W. T. Vickers. New York: Academic
67. Dunbar, R. I. M. 1975. Some aspects of research design and their implications in the observational study of behavior. *Behavior* 58(1–2):78–98
68. Durnin, J., Passmore, C. 1967. *Energy, Work and Leisure*. London: Heinemann
69. Edmond, W., Fleming, S. 1975. *All Work and No Pay: Women, Housework and the Wages Due*. London: Power of Women Collective and Falling Wall Press
70. Edmundson, W. 1977. Individual variations in work output per unit energy intake in east Java. *Ecol. Food Nutr.* 6:147–51
71. Elliott, D. H., Cosper, R. 1982. The time budget study of tavern going: A validation. *J. Stud. Alcohol* 43(3):397–403
72. Elliott, D. H., Harvey, A. S., Procos, D. 1976. An overview of the Halifax time-budget study. *Soc. Leisure* 3:1–78
73. Ember, C. R. 1983. The relative decline in women's contribution to agriculture with intensification. *Am. Anthropol.* 85:285–304
74. Erasmus, C. J. 1955. Work patterns in a Mayo village. *Am. Anthropol.* 57(2): 322–33
75. Evans, M. 1974. A note on the measurement of Sahlins' social profile of domestic production. *Am. Ethnol.* 1:269–79
76. Evans-Pritchard, E. E. 1940. *The Nuer: A Description of the Modes of Livelihood of Political Institutions of a Nilotic People*. Oxford: Clarendon
77. Evenson, R. F. 1978. *Time Allocation in Rural Philippine Households*. New Haven, Conn: Yale Univ. Econ. Growth Cent., Pap. No. 266
78. Evenson, R. F. 1981. Food policy and the new home economics. *Food Policy* 3:180–83
79. Evenson, R. F., Popkin, B., Quizon, B. K. 1978. *Nutrition, Work and Demographic Behavior in Rural Philippine Households: A Synopsis of Several Household Studies*. New Haven, Conn: Yale Econ. Growth Cent.
80. Farouk, A. 1979. *Time Use of Rural Women: a Six-Village Survey in Bangladesh*
81. Fei, H-T., Chang, C-I. 1945. *Earthbound China: Study of Rural Economy in Yunnan*, ed. P. Cooper, M. Park. Chicago Univ: Chicago Press. Rev. ed.
82. Figueiredo, M. 1983. *A comparative study of the socio-economic role of women heads of households in two black fishing communities on the Atlantic Coast*. Presented at Latin Am. Stud. Assoc.
83. Files, L. A. 1981. The human services management task—A time allocation study. *Public Adm. Rev.* 41(6):686–92
84. Fleuret, P., Fleuret, A. 1983. Socioeconomic determinants of child nutrition in Taita, Kenya. *Cult. Agric.* 19(8):16–20
85. Flowers, N. M. 1983. Seasonal factors in subsistence, nutrition, and child growth in a central Brazilian Indian community. See Ref. 66
86. Flowers, N. M., Gross, D. R., Ritter, M. L., Werner, D. W. 1982. Variation in swidden practices in four central Brazilian Indian societies. *Hum. Ecol.* 10(2):203–18
87. Fortmann, L. 1981. *The Plight of the Invisible Farmer: Effect of National Agricultural Policy*. See Ref. 52
88. Foster, G. M. 1948. *Empire's Children: The People of Tzintzuntzan*. Smithsonian Institution, Inst. Soc. Anthropol. Publ. No. 6
89. Fox, R. H. 1953. *A study of the energy expenditure of Africans engaged in various rural tasks*. PhD thesis. London Univ., London, England
90. Frederiksen, V. 1977. *Ungdom, Uddannelse og Fritid*. Kbenhavn: Munksgaard
91. Freeman, D. (1955) 1970. *Report on the Iban*. New York: Humanities Press. London Sch. Econ. Monogr. Soc. Anthropol., No. 41
92. Gershuny, J. I., Thomas, G. S. 1980. *Changing Patterns of Time Use: Data Preparation and Some Preliminary Results*, U.K., 1961–1974/75
93. Ghez, G., Becker, G. S. 1975. *The Allocation of Time and Goods over the Life Cycle*. New York: Natl. Bur. Econ. Res., Columbia Univ. Press
94. Goldberg, R. J. 1977. *Maternal time use and preschool performance*. PhD thesis. Univ. Minn., Minneapolis
95. Goldschmidt, C. L. 1982. *Unpaid Work in the Household: A Review of Economic Evaluation Methods*. Geneva: Int. Labour Off.
96. Gowling, E., Higginson, K. R. 1976. *Leisure in Merseyside*. Liverpool: Bus. Res. Cent., Dep. Manage. Stud., Liverpool Polytechnic
97. Gronau, R. 1977. Leisure, home production, and work—The theory of the allocation of time revisited. *J. Polit. Econ.* 85:1099–1124
98. Gronmo, S., Lingsom, S. 1983. House-

hold work and sexual equality—Changing time use patterns in the 1970's. Tudsskrift for Samfunns-forskning. *Norwegian J. Soc. Res.* 24(5):415–40
99. Gross, D. R. 1975. Protein capture and cultural development in the Amazon Basin. *Am. Anthropol.* 77:526–49
100. Gross, D. R. 1984 Ecosystems and methodological problems in ecological anthropology. In *The Ecosystem Concept in Anthropology*, ed. E. Moran. Boulder, Colo: Westview
101. Gross, D. R., Eiten, G., Flowers, N. M., Leoi, F. M., Ritter, M. L., Werner, D. W. 1979. Ecology and acculturation among native peoples of central Brazil. *Science* 206:1043–50
102. Gross, D. R., Underwood, B. A. 1971. Technological change and caloric costs: Sisal agriculture in Northeastern Brazil. *Am. Anthropol.* 73:725–40
103. Grossin, W. 1974. *Les Temps de la Vie Quotidienne*. Le Haye: Mouton
104. Haffter, A. Minder, B. 1974. *Arbeitsbeanspruchung und Sociale Stellung der Bauerin*. Tancon: Swiss Fed. Res. St. Farm Manage. Agric. Eng.
105. Hames, R. B. 1978. *A behavioral account of the division of labor among the Ye'kwana of southern Venezuela*. PhD thesis. Univ. Calif., Santa Barbara
106. Deleted in proof
107. Hames, R. B. 1979. Relatedness and interaction among the Ye'kwana: A preliminary analysis. In *Evolutionary Biology and Human Behavior*, ed. N. A. Chagnon, W. Irons
108. Hames, R. B. 1980. Game depletion and hunting zone rotation among the Ye'kwana and Yanomamo of Amazonas, Venezuela. *Work. Pap. South Am. Indians*, Vol. 2, ed. R. Hames
109. Hames, R. B. 1979. A comparison of the efficiencies of the shotgun and the bow in neotropical forest hunting. *Hum. Ecol.* 7(3):219–52
110. Hames, R. B., Vickers, W. 1982. Optimal foraging theory as a model to explain variability in Amazonian hunting. *Am. Ethnol.* 9(2):358–78
111. Hammer, P. G., Chapin, F. S. 1972. *Human Time Allocation: A Case Study of Washington, D.C.* Chapel Hill: Univ. North Carolina. Cent. Urban and Regional Studies
112. Hampton, I. 1960. Energy expenditure and caloric intake of an undergraduate expedition. *Nutrition* 14:174–88
113. Hanke, H. 1979. Freizeit in der DDR
114. Harako, R. 1976. The Mbuti as hunters: A study of ecological anthropology of the Mbuti Pygmies. *Kyoto Univ. Afr. Stud.* 10:39–99
115. Harris, M. 1964. *The Nature of Cultural Things*. New York: Random House
116. Harris, M. 1968. *The Rise of Anthropological Theory*. New York: Crowell
117. Harris, M. 1974. *Cows, Pigs, Wars and Witches: The Riddles of Culture*. New York: Random House
118. Harris, M. 1975. *Culture, People and Nature: An Introduction to General Anthropology*. New York: Crowell. 2nd ed.
119. Hart, G. 1977. *Patterns of household labor allocation in a Japanese village*. Presented at Agric. Dev. Counc. Workshop, Singapore
120. Harvey, A. S. 1978. *Discretionary Time Activities in Context*. Halifax: Inst. Public Aff., Dalhousie Univ.
121. Harvey, A. S., Clark, S. 1975. *Descriptive Analysis of Halifax Time-Budget Data: Technical Memorandum*. Halifax, N.S: Regional and Urban Studies Centre, Dalhousie Univ.
122. Haswell, M. R. 1953. *Economics of Agriculture in a Savannah Village: Reports on Three Years' Study in a Generieri Village*. Gambia: Colonial Res. Stud.
123. Haswell, M. R. 1963. *The Changing Pattern of Economic Activity in a Gambia Village*. London: Dep. Tech. Cooperation, Overseas Publ. No. 2
124. Deleted in proof
125. Hawkes, K., Hill, K., O'Connell, J. F. 1982. Why hunters gather: Optimal foraging and the Ache of E. Paraguay. *Am. Ethnol.* 9:379–98
126. Hayden, B. 1981. Subsistence and ecological adaptations of hunter-gatherers. In *Omniverous Primates*, ed. R. S. O. Harding, G. Teleki. New York: Columbia Univ. Press
127. Hayes, J., Horswill, M., Larocque, P. 1975. Social indicators, time budgets and policy planning. See Ref. 206
128. Heidemann, C. 1969. *Die Hausfrau in Ihrer Stadtischen Unwelt*. Braunschweig: Inst. Stadtbauwesen
129. Heirman, B. 1976. *Pensionering en Vrije Tijd*. Leuven: Katholieke Univ. Leuven, Sociol. Onderzoeks-instituut
130. Hemmings-Gapiha, N. 1981. Baseline study for socioeconomic evolution of Tangaye solar site. See Ref. 52
131. Hill, C. R., Stafford, F. P. 1977. *Parental Care of Children: Time Diary Estimates of Quantities and Predictability*. Manuscript. Ann Arbor: Univ. Mich. Survey Res. Cent.
132. Hill, K. 1982. Hunting and human evolution. *J. Hum. Evol.* 11:521–44
133. Hill, K., Hawkes, K. 1983. Neotropical hunting among the Ache of E. Paraguay. In *Adaptive Responses Among Native*

Amazonians, ed. R. B. Hames, W. T. Vickers, pp. 139–88 New York: Academic
134. Hipsley, E. H., Kirk, N. E. 1965. *Studies of Dietary Intake and the Expenditure of Energy by New Guineans*. New Caledonia: South Pacific Commission
135. Hoberg, V. 1962. *Svensk Sommar*. Stockholm: aret i Norden, Bonniers. Comptabilities Sociales en Temps de Travail
137. Hornik, J., Schlinge, J. 1981. Allocation of time to the mass media. *J. Consum. Res.* 7(4):343–55
138. Hrdy, L. 1969. *Leisure in Czechoslovakia*. Prague: Sociol. Inst., Czechoslovak Acad. Sci.
139. Hughes, C. C. 1961. *The Concept and Use of Time in the Middle Years: St. Laurence Eskimo*, ed. R. W. Kleemeier. Oxford Univ. Press
140. Hungary, 1977. *Time Budget Survey of the Hungarian Population Aged 15–69 in 1976/1977*. Budapest: Hung. Cent. Stat. Off.
141. Hungary, Kozponti Statisztikai Hivatal. 1965. *The Twenty-Four Hours of the Day: Analysis of 12,000 Time Budgets*. Budapest: Hung. Cent. Stat. Off.
142. Deleted in proof
143. Hurault, J. J. 1972. *Les Indiens Wayana de la Guyane Francaise: Structure Sociale et Coutume Familiale*. Paris: ORSTOM
144. Hurault, J. J. 1972. *Francais et Indiens en Guayane*. Paris: Union Generale d'Editions
145. Ichikawa, M. 1983. An examination of the hunting-dependent life of the Mbuti Pygmies, Eastern Zaire. *African Study Monogr.* (Kyoto Univ.) 4:55–76
146. International Labor Organization: Office for Women 1981. *Women, Technology and the Development Process*. See Ref. 52, pp. 33–45
147. Iovane, A. 1977. *Lavoro Salariato e Tempo Libero*. Milano: Angeli
148. Irimoto, T. 1981. *Chipeweyan Ecology: Group Structure and Caribou Hunting System*. Senri Ethnol. Stud. No. 8. Osaka: Natl. Mus. Ethnol.
149. Javeau, C. 1970. *Les Vingt-quatre Heures du Belge*. Brussells: Inst. Sociol., Univ. Libre de Bruxelles
150. Javeau, C. 1975. Methodological problems in time-budget studies. See Ref. 206, pp. 137–67
151. Jochim, M. 1981. *Strategies for Survival*. New York: Academic
152. Johnson, A. 1975. Time allocation in a Machiguenga community. *Ethnology* 14(3):310–21
153. Johnson, A. 1977. *The energy costs of technology in a changing environment: The Machiguenga case*. Am. Ethnol. Soc. Proc. 1975 Ann. Meet., pp. 155–67
154. Johnson, A. 1978. In search of the affluent society. *Hum. Nat.* 1(9):50–59
155. Johnson, A. 1980. Comment on "Does Labor Time Decrease with Industrialization?" *Curr. Anthropol.* 21:292
156. Johnson, A., Behrens, C. A. 1979. *Machiguenga Food Production Decisions: Linear Programming Analysis*
157. Johnson, A. W. 1978. *Quantification in Cultural Anthropology: An Introduction to Research Design*. Stanford, Calif: Stanford Univ. Press
158. Johnson, O. 1977. *Domestic organization and interpersonal relations among the Machiguenga Indians of the Peruvian Amazon*. PhD thesis. Columbia Univ., New York, NY
159. Johnson, O., Johnson, A. 1975. Male/female relations and the organization of work in a Machiguenga community. *Am. Ethnol.* 2(4):634–48
160. Juster, F. T., Land, K. C., eds. 1981. *Social Accounting Systems: Essays on the State of the Art*. New York: Academic
161. Juster, F. T., Stafford, F. P., eds. (n.d.) *Time, Goods and Well-Being*. Ann Arbor, Mich: Inst. Soc. Res.
162. Kay, G. 1964. *Chief Kalaba's Village: A Preliminary Survey of Economic Life in an Ushi Village, Northern Rhodesia*. Manchester Univ. Press: Rhodes-Livingstone Pap. No. 35
163. Kilpio, E. 1981. *The Concept of Unpaid Housework and the Determination of its Value*.
164. Kleemeier, R. 1961. *Aging and Leisure*. New York: Oxford Univ. Press
165. Konner, M. 1977. Infancy among the Kalahari Desert San. In *Culture and Infancy*, ed. P. H. Leiderman, S. Tulkin, A. Rosenfeld. New York: Academic
166. Konner, M. 1977. Maternal care, infant behavior and development among the !Kung. In *Kalahari Hunter-Gatherers*, ed. R. B. Lee, I. Devore. Cambridge, Mass: Harvard Univ. Press
167. Konner, M., Worthman, C. 1980. Nursing frequency, gonadal function and birth spacing among the !Kung hunter-gatherers. *Science* 207:788–91
168. Kroner, I. 1978. *Freizeit in der Schule, Schulbau fur die Freizeit*. Basel: Karger
169. Kuhl, P. H., Munk, J. K. 1976. *Dognrytme: Befolkingens Tidsanvendelse Pa Ugens Dage*. Copenhagen
170. Kumar, S. K. 1977. *Role of the Household Economy in Determining Child Nutrition at Low Income Levels: A Case Study in Kerala*. Cornell Univ. Dep. Agric. Econ., Occas. Pap. No. 95

171. Kuzma, K. 1981. *Working Mothers: How You can Have a Career and Be a Good Parent?* Hunter College HQ775.8K895
172. LaPointe, J. 1978. *Residence patterns and Wayana social organization*. PhD thesis. Columbia Univ., New York, NY
173. Leach, G. 1975. Energy and food production *Food Policy* (Nov.):62–65
174. Lee, L. C., Ferber, R. 1977. Use of time as a determinant of family market behavior. *J. Bus. Res.* 5:75–91
175. Lee, R. B. 1968. What hunters do for a living, or how to make out on scarce resources. See Ref. 178
176. Lee, R. B. 1972. Work effort, group structure and land use in contemporary hunter-gatherers. In *Man, Settlement and Urbanism*, ed. P. J. Ucko, R. Tringham, G. W. Dimbleby, pp. 177–86. London: Duckworth
177. Lee, R. B. 1979. *The !Kung San: Men, Women and Work in a Foraging Society*. Cambridge: Cambridge Univ. Press
178. Lee, R. B., Devore, I. eds. 1968. *Man the Hunter*. Chicago: Aldine
179. Leiderman, H. P., Leiderman, G. F. 1973. *Polymatic infant care in the East African Highlands*. Presented at Minn. Symp. Child Dev., Minneapolis
180. Lemel, Y. 1974. *Les Budgets-Tempe des Citadins*. Paris: Inst. Natl. Stat. Etudes Econ.
181. Lewis, L. V. D. 1981. Domestic labor intensity and incorporation of Malian peasants into the local descent group. *Am. Ethnol.* 8:53–73
182. Lewis, O. 1951. *Life in a Mexican Village: Tepotzlan Revisited*. Urbana: Univ. Ill. Press
183. Lhermillier, A., Lhermillier, N. 1974. *Vie Economique et Sociale d'Une Unite Familiale Yanomami*. PhD thesis. Ecole Pratique des Hautes Etudes, Paris
184. Lhermillier, N. 1980. *La Societe Yu'pa-Macoita de la Sierra de Perija au Venezuela*. PhD thesis. L'Ecole des Hautes Etudes en Sciences Sociales, Paris
185. Linder, S. B. 1970. *The Harried Leisure Class*. New York: Columbia Univ. Press
186. Lingsom, S. 1972. *Time Use Surveys in Norway*. Cent. Bur. Stat. Norway
187. Lingsom, S. 1980. Open and fixed interval time diaries: A comparison.
188. Lizot, J. 1977. Population, resources and warfare among the Yanomami. *Man* 12:497–517
189. Lizot, J. 1978. Economie Primitive et Subsistence: Essai sur le Travail et l'Alimentation Chez les Yanomami. *Libre* 4:69–113
190. Lundberg, G. A., Komarovsky, M., McInery, M. A. 1934. *Leisure: A Suburban Study*. New York: Columbia Univ. Press
191. Malinowski, B. 1935. *Coral Gardens and Their Magic:* Vol. I, *Soil Tilling and Agricultural Rites* Bloomington: Indiana Univ. Press
192. Mann, C. H. 1928. *How Schools Use their Time: Time Allotment Practice in 444 Cities Including a Study of Trends from 1826 to 1926*. New York: Columbia Univ. Teachers Coll.
193. Manning, S. 1968. *Time Use in Household Tasks by Indiana Families*. Purdue Univ. Agric. Exp. Stn. Proj. 1169, Res. Bull. 837
194. Marks, S. A. 1976. *Large Mammals and a Brave People: Subsistence Hunters in Zambia*. Seattle: Univ. Wash. Press
195. Maybury-Lewis, D. 1967. *Akwē Shavante Society*. New York: Oxford Univ. Press
195a McAdams, D. P., Constantin, C. A. 1983. Intimacy and affiliation motives in daily living: An experience sampling analysis. *J. Pers. Soc. Psychol.* 45(4):851–61
196. McArthur, M. 1960. *Food Consumption and Dietary Levels of Groups of Aborigines*. Melbourne: Mountford
197. McCarthy, F., McArthur, M. 1960. *The Food Quest and Time Factor in Aboriginal Economic Life*. Melbourne: Melbourne Univ. Press
198. Deleted in proof
199. McSweeney, B. G. 1979. Collection and analysis of data on rural women's time use *Stud. Fam. Plann.* 10(10/11):379–83
200. Mead, M. 1953. *Cultural Patterns and Technical Change*. Paris: UNESCO
201. Mead, M. 1970. The art and technology of field work. In *A Handbook of Method in Cultural Anthropology*, ed. R. Naroll, R. Cohen, pp. 246–65. Garden City, NY: Nat. Hist. Press
202. Messer, E. (n.d.) Time allocation analysis: Its relevance for nutritional anthropology. In *Methodological Issues in Nutritional Anthropology*, ed. G. Pelto, P. Pelto. (Forthcoming)
202a. Messer, E., Bloch, M. N. 1983. *Women's and children's activity profiles in Senegal and Mexico: A comparison of time allocation and time allocation methods*. Michigan State Univ: Women in Int. Dev. Work. Pap. No. 42
203. Michelson, W. P. 1973. *The Place of Time in the Longitudinal Evaluation of Spatial Structures by Women*. Univ. Toronto Cent. Urban Community Stud.
204. Michelson, W. P. 1975. A conceptual introduction to the use of the time budget for the purposes of physical planning. See Ref. 206, pp. 66–75

205. Michelson, W. P. 1980. Spatial and temporal dimensions of child care. *J. Women Cult. Soc.* 5(35):S242–47
206. Michelson, W. P., ed. 1975. *Time Budgets and Social Activity*. Toronto: Univ. Toronto Cent. Urban Community Stud., Working Group on Time Budgets and Social Activity
207. Michelson, W. P., ed. 1978. *Public Policy in Temporal Perspective*. The Hague: Mouton.
208. Miessler, M. 1976. Leistungsmotivation und Zeitperspektive.
209. Minge-Kalman, W. 1977. On the theory and measurement of domestic labor intensity. *Am. Ethnol.* 4(2):273–84
210. Minge-Kalman, W. 1978. A theory of the European household economy during the peasant worker transition in the Swiss alps. *Ethnology* 17:183–96
211. Minge-Kalman, W. 1980. Does labor time decrease with industrialization: A survey of time allocation studies. *Curr. Anthropol.* 21:279–87
212. Minge-Kalman, W. 1978. *The evolution of commodity reproduction: Rise of cost of children*. Manuscript. Harvard Univ. Dep. Anthropol.
213. Minturn, L., Lambert, W. 1964. *Mothers of Six Cultures*. New York: Wiley
214. Modjeska, N. 1982. Production and inequality Perspectives from Central New Guinea. In *Inequality in Highland New Guinea Society*, pp. 50–108 ed. A. Strathern, Cambridge: Cambridge Univ. Press
215. Montgomery, E., Johnson, A. 1976. Machiguenga energy expenditure. *Ecol. Food Nutr.* 6:97–105
216. Moulton, D. 1979. *The Time Budget*. Monticello, Ill: Vance Bibilogr.
217. Mueller, E. 1983. Measuring women's poverty in developing countries. In *Women and Poverty in the Third World*, ed. M. Buvinic, Lycette, M. A., W. P. McGreevey. Baltimore: Johns Hopkins
218. Mundel, M. E. 1978. *Motion and Time Study: Improving Productivity*. Englewood Cliffs, NJ: Prentice Hall. 5th ed.
219. Munroe, R. H., Munroe, R. L. 1971. Household density and infant care in an East African Society. *J. Soc. Psychol.* 85:3–13
220. Munroe, R. L., Munroe, R. H., Shimmin, H. 1984. Children's work in four cultures: Determinants and consequences. *Am. Anthropol.* 86(2):342–48
221. Munroe, R. L., Munroe, R. H., Michelson, C., Koel, A., Bolton, R., Bolton, C. 1983. Time allocation in four societies. *Ethnology* 22(4):355–70
222. Nag, M., White, B. F., Creighton-Peet, R. 1978. Anthropological approach to study of economic value of children, Java and Nepal. *Curr. Anthropol.* 19(2):293–306
223. Nakanishi, N. 1982. A Report on the "How do People Spend their Time Survey" in 1980. In *Studies of Broadcasting*, No. 18. Public Opin. Res. Inst., NHK
224. Navera, E. R. 1978. The allocation of household time associated with children in rural households in Laguna, Philippines. *Philipp. Econ. J.* 17(1/2):213–23
225. Nerlove, S. B. 1974. Women's workload and infant feeding practices: A relationship with demographic implications. *Ethnology* 13:207–14
226. Nerlove, S. B., Roberts, J. M., Klein, R. E., Yarbrough, C., Habicht, J-P. 1974. Natural indicators of cognitive development: An observational study of rural Guatemalan children. *Ethos* 2:265–95
227. Nicollier, J. 1950. *Recherche sur la Renovation de l" Organisme de la Producteur dan l'Agriculture*. Grenoble: Impremerie Allier
228. Niebel, B. W. 1976. *Motion and Time Study*. Homewood, Ill: Irwin Ser. Manage. Behav. Sci. 6th ed.
229. Niemi, I. 1983. *The 1979 Time Use Study Method*. Oslo: Norway Cent. Stat. Bur.
230. Niemi, I., Kiiski, S., Liikkanen, M. 1981. *Use of Time in Finland*. Helsinki: Cent. Stat. Off. Finland, Tutkimuksia No. 65
231. Norgan, N. G., Ferro-Luzzi, A., Durnin, J. V. G. A. 1974. The energy and nutrient intake and the energy expenditure of 204 New Guinea adults. *Trans. R. Soc. Ser. B.* 268:309–48
232. Norway, Statistisk Sentralbyra. 1974. *Tidsnyttingsunderskelsen, 1971–72 (The Time Budget Survey, 1971–72)*.
233. Norway, Statistisk Sentralbyre. 1977. *Dognets 24 Timer: En Analyse Auy Tidsnytting 1971–72. (The Day's 24 Hours: An Analysis)* Oslo: Statisticsk Sentralbyre: I Kommisjon Has Aschenboug
234. Ohtsuka, R. 1983. *Oriomo Papuans: Ecology of Sago Eaters in Lowland Papua*. Tokyo: Univ. of Tokyo Press
235. Oledzka, A. 1975. *Kobieta, Budget Czasu, Praca Wielozmianowa*. Warszawa: Instytut Wydawniczy CRZZ
236. Paolisso, M., Sackett, R. D. 1982. *The role of hunting in Yukpa food production*. Presented at 81st Ann. Meet. Am. Anthropol. Assoc., Washington, DC
237. Pappas, P. 1968. *Time Allocation Study*. Athens: Athens Center Ekistics.
238. Patrushev, V. D. 1966. *On the Practical Use of Time Budget Data*. Moscow
239. Patrushev, V. D. 1975. The problem of organizing spare time in society under

conditions of the scientific and technological revolution. See Ref. 206, pp. 185–93
240. Patrushev, V. D. 1981. Changes in the structure and use of the rural population's time budget in the period of the building of socialism and at the stage of the creation of mature socialist society. *Soviet Sociol.* 19(3):3–35
241. Pimentel, D., Pimentel, M. 1979. *Food, Energy, and Society*. London: Arnold
242. Pimentel, D., Dritschild, W., Krummel, J. 1975. Energy and land constraints in food protein production. *Science* 190: 754–61
243. Poland, Time Allocation Surveys. 1978. *Budzet Czasu Mieschancow Polski*. Poland: Gowny Urzad Statystyczny
244. Popkin, B. M. 1980. Time allocation of the mother and child nutrition. *Ecol. Food Nutri.* 9:1–14
245. Popkin, B. M., Solon, F. S. 1976. Income, time, and the working mother and nutriture. *J. Trop. Pediatr. Environ. Child Health* 6:156–66
246. Pospisil, L. 1963. *Kapauku Papuan Economy*. New Haven: Yale Univ. Publ. Anthropol. No. 67
247. Putz, K. 1970. Zeitbudgetforschung in der Sowjetunion: Zur Empirischen Sozialforschung in der UdSSR. Meisenheim am Glan: A. Hain
248. Quizon-King, E. 1978. Time allocation and home production in rural households. *Philipp. Econ. J.* 17, 36, 1 and 2:185–202
249. Deleted in proof
250. Rappaport, R. A. 1968. *Pigs for the Ancestors: Ritual in the Ecology of a New Guinea People*. New Haven: Yale Univ. Press
251. Rappaport, R. A. 1971. Energy flow in an agricultural society. *Sci. Am.*
252. Redstockings, Collective 1971. The politics of housework. In *Liberation Now: Writings from the Women's Liberation Movement*, ed. D. Babcox, M. Belkin, pp. 110–15. New York: Dell Books
253. Richards, A. I. 1939. *Land, Labor and Diet in Northern Rhodesia: An Economic Study of the Bemba Tribe*. London: Oxford Univ. Press (Reprints 1952, 1951)
253a. Robertson, A. F. 1975. Composition and procedure in Ahafo councils. In *Changing Social Structure in Ghana: Essays in the Comparative Sociology of a New State and an Old Tradition*, ed. J. Goody. London: Int. Afr. Inst.
254. Robinson, J. P. 1967. Time expenditure on sports across ten countries. *Int. Rev. Sport Sociol.* 2:67–87
255. Robinson, J. P. 1977. *How Americans Use Time: Sociopsychological Analysis of Everyday Behavior*. New York: Praeger
256. Robinson, J. P. 1977. *How Americans Used Time in 1965*. Ann Arbor: Univ. Mich., Inst. Soc. Res. Univ. Microfilms Int., Distributor
257. Robinson, J. P. 1978. Time use as a social indicator. In *Public Policy in Temporal Perspective*, ed. W. Michelson. The Hague: Mouton
258. Robinson, J. P. 1980. Culture and leisure time in transition. In *Social Research and Cultural Policy*, ed. J. Zuzanek. Waterloo, Canada: Otium
259. Robinson, J. P. 1980. Household technology and household work. In *Women and Household Labor*, ed. S. F. Berk. Beverly Hills, Calif: Sage
260. Robinson, J. P. 1980. Television and leisure time: A new scenario. *J. Commun.*
261. Robinson, J. P. 1980. The changing reading habits of the American public. *J. Commun.* (January)
262. Robinson, J. P., Converse, P. 1972. Social change as reflected in the use of time. In *Human Meaning of Social Change*, ed. A. Campbell, P. Converse. New York: Sage
263. Robinson, J. P., Yerby, J., Somerick, N., Fie, M. 1978. Sex role differences in time use. *J. Sex Roles Res.*
264. Robinson, J. P., Godbey, G. 1978. Work and leisure: How we spend our time. *Leisure Today* (October)
265. Rogoff, B. 1978. Spot observation: An introduction and examination. *Q. Newsl. Inst. Comp. Hum. Dev., Rockefeller Univ.* 2, 2C:21–26
266. Rogoff, B. 1981. Adults and peers as agents of socialization. *Ethos* 9:18–36
267. Ruthenberg, H. 1980. *Farming Systems in the Tropics*. Oxford: Clarendon
268. Sacks, M. P. 1976. *Women's Work in Soviet Russia: Continuity in the Midst of Change*. New York: Praeger
269. Saffirio, G., Scaglion, R. 1982. Hunting efficiency in acculturated and unacculturated Yanomama villages. *J. Anthropol. Res.* 38(3):315–27
270. Sahlins, M. D. 1968. Notes on the original affluent society. See Ref. 178
271. Sahlins, M. D. 1972. *Stone Age Economics*. London: Tavistock
272. Salisbury, R. F. 1962. *From Stone to Steel: Economic Consequences of Technological Change in New Guinea*. Melbourne Univ. Press
273. Sanjek, R. 1978. A network method and its uses in urban ethnography. *Hum. Organ.* 37(3):257–68
274. Schmidt, R. M. 1983. Who maximizes what: A study in student time allocation. *Am. Econ. Rev.* 73(2):23–28

275. Schwartz, B. 1975. *Queuing and Waiting: Studies in the Social Organization of Access and Delay*. Chicago: Univ. Chicago Press
276. Sharman, A. 1970. *Social and economic aspects in Pahold Dukedi district, Uganda*. PhD thesis. Univ. London, England
277. Sillitoe, P. 1979. Stone versus steel. *Mankind* 12:151–61
278. Smith, E. A. 1984. Inuit foraging groups: Some simple models incorporating conflicts of interest, relatedness and central-place sharing. *Ethol. Sociobiol.* In press
279. Smith, P. K. 1973. Temporal clusters and individual differences in the behavior of preschool children. In *Comparative Ecology and Behavior of the Primates*, ed. R. P. Michael, J. Crook. New York: Academic
280. Soramaki, M., Sauri, J. 1977. *Time Use of the Finns*. Helsinki: Yleisradio
281. Sorokin, P. A., Berger, C. Q. 1939. *Time Budgets of Human Behavior*. Cambridge: Harvard Univ. Press
282. Deleted in proof.
283. Stajkov, Z., Petkov, P. 1975. A yearlong investigation of the time budget. See Ref. 206, pp. 48–65
284. Steward, J. 1955. Cultural Causality and law: Trial formulations in the development of early civilizations. In *Theory of Culture Change*, pp. 178–209. Urbana, Ill: Univ. Ill. Press
285. Stoller, E. P. 1982. Parental caregiving by adult children: A study of time allocation *Gerontology* 22(S1):236
286. Sutton, A. J. 1972. *Leisure and Hours of Work*. Sidney: Macquarie Univ., Sch. Behav. Sci.
287. Szalai, A., et al. 1972. *The Uses of Time*. The Hague: Mouton
288. Szalai, A., et al. 1966. The multinational comparative time budget project. *Am. Behav. Sci.* 10(4):Dec.
289. Tanaka, J. 1980. *The San, Hunter-Gatherers of the Kalahari*. Transl. D. W. Hughes. Tokyo: Univ Tokyo Press
290. Tanno, T. 1976. The Mbuti Net Hunters of the Ituri Forest, Eastern Zaire: Their hunting activities and band composition. *Kyoto Univ. Afr. Stud.* 10:101–31
291. Tax, S. 1953. *Penny Capitalism: A Guatemalan Indian Economy*. Washington DC: Smithsonian Inst., Inst. Soc. Anthropol., Publ. No. 16
292. Terashima, H. 1980. The hunting life of the BaMbote: An anthropological study of Hunter Gatherers in a wooded savanna. *Senri Ethnol. Ser.* 6:223–68
293. Terashima, H. 1983. Mota and other hunting activities of the Mbuti Archers: A socioecological study of subsistence ecology. Kyoto Univ. Afri. Stud. Monogr. 3:71–85
294. Thomas, R. B. 1976. Energy flow at high altitude. In *Man in the Andes*, ed. P. T. Baker, M. A. Little. Philadelphia: Dowden.
295. Thomas, R. B. 1973. *Human Adaptation to a High Energy Flow System*. Penn. State Univ. Occas. Pap. Anthropol. No. 7
296. Torrence, R. 1983. Time budgeting and hunter-gatherer technology. In *Hunter-Gatherer Technology in Prehistory*, ed. G. N. Bailey, pp. 11–22. Cambridge: Cambridge Univ. Press
297. Townsend, W. H. 1969. Stone and steel tool use in a New Guinea society. *Ethnology* 8:199–205
298. Travis, J. 1982. A method for the statistical analysis of time—Energy budgets. *Ecology* 63(1):19–25
299. Tripp, R. B. 1982. Time allocation in Northern Ghana. An example of the random visit method. *J. Dev. Areas* 16(3):391–400
300. Van Arsdale, P. 1978. Activity patterns of Asmat hunter-gatherers: A time budget analysis. *Mankind* (4):453–60
301. Van Deenen, B. 1964. *Materialien zur Arbeitswirtschaft*. Forschungs Gesellschaft fur Agrarpolitik und Agrarsoziologie. Bonn, 153
302. Vanek, J. 1973. *Keeping busy: Time spent in housework. U.S. 1920-1970*. PhD thesis. Univ. Mich., Ann Arbor
303. Van Vliet, W. 1978. *Theories, Methods and Applications of Activity Analysis*. Monticello, Ill: Vance Biblio.
304. Waddell, E. 1972. *The Mound Builders*. AEA Monogr. No. 6. Seattle: Univ. Wash. Press
305. Waddell, R., Krinks, P. 1968. *The Organization of Production and Distribution among the Orokaive*. New Guinea Res. Bull. No. 24, pp. 67–167
306. Wagenbuur, H. 1972. *Labour and Development: An Analysis of the Time Budget and of the Production Activity of Lime Farmers in Southern Ghana*. The Hague: Inst. Soc. Stud.
307. Walker, K., Woods, M. E. 1976. *Time Use: A Measure of Household Production of Family Goods and Services*. Washington, DC: Am. Home Econ. Assoc., Cent. Fam. Stud.
308. Walker, K. E., Gauger, W. 1973. *The Dollar Value of Household Work*. New York State Coll. Hum. Ecol. Consumer Econ. Bull. No. 60
309. Wallman, S. 1969. *Take Out Hunger: Two Case Studies of Rural Development in Basutoland*. New York: Humanities Press

310. Weisner, T. Gallimore, R. 1977. The brothers keeper: Child and sibling caretaking. *Curr. Anthropol.* 18:169–90
311. Wentland, E. 1983. *Use of Time in Formal Meetings*. Microforms
312. Werner, D. W. 1978. Trekking the Amazon Forest. *Nat. Hist.* 87:42–55
313. Werner, D. W. 1980. *The making of a Mekranoti chief: The psychological and social determinants of leadership in a native South American society*. PhD thesis. City Univ. New York
314. Werner, D. W. 1981. Are some people more equal than others? Status inequality among the Mekranoti Indians of Central Brazil. *J. Anthropol. Res.* 37(4):360–73
315. Werner, D. W., Flowers, N. M., Ritter, M. L. Gross, D. R. 1979. Subsistence productivity and hunting effort in native South America. *Hum. Ecol.* 7(4):303–16
316. Whiting, B., Whiting, J. W. M. 1975. *Children of Six Cultures: A Psycho-Cultural Analysis*. Cambridge, Mass: Harvard Univ. Press
317. Deleted in proof
318. Wigan, 1981. *The Transport Implications of Activity and Time-Budget Constraint*. Transportation Res., Part A
319. Winnett, R. A., Neale, M. S. 1981. Flexible work schedules and family time allocation. Assessment of a system change in individual behavior using self-report logs. *J. Appl. Behav. Anal.* 14(1):39–46
320. Winterhalder, B. 1981. Foraging strategies in the boreal forest: An analysis of Cree hunting and gathering. See Ref. 321.
321. Winterhalder, B., Smith, E. A. eds. 1981. *Hunter-Gatherer Foraging Strategies*. Chicago: Univ. Chicago Press
322. Wnuk-Lipinski, E. 1975. Essential findings of the Polish time-budget survey. See Ref.
323. Wolfe, B., Haveman, R. 1983. Time allocation, market work and changes in female health. *Am. Econ. Rev.* 73 (2):134–39
324. Woodburn, J. 1968. An introduction to Hadza ecology. See Ref. 178
325. Wynn, M. 1967. Time, work-discipline and industrial capitalism. *Past and Present* 38:56–97
326. Yost, J. A., Kelly, P. M. 1983. Shotguns, blowguns and spears: The analysis of technological efficiency. See Ref. 66, pp. 189–224
327. Young, M., Willmott, P. 1973. *The Symmetrical Family*. New York: Pantheon
328. Zelkind, I., Sprug, J. 1974. *Time Research: 1172 Studies*. Metuchen, NJ: Scarecrow Press
329. Zerubavel, E. 1979. *Patterns of Time in Hospital Life: A Sociological Perspective*. Chicago: Univ. Chicago Press
330. Ziegler, S., Michelson, W. P. 1981. Complementary methods of data gathering in literate urban populations. *Hum. Organ.* 40(4):323–29