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MARKED SET

Men's Time Allocation to Subsistence Work among the Ache of Eastern Paraguay

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Quantitative data on men's time allocation among the Ache of Paraguay are presented. The data indicate that Ache men work almost 7 hours daily in direct food acquisition, which is the major daily activity. The amount of time Ache men work is compared with the amount reported for other modern hunter-gatherers and tribal horticulturalists. The characterization of hunter-gatherers as the "original affluent society" does not agree with currently available data. The results show high variance across societies, both hunting and horticultural, and suggest that time spent in subsistence work is not simply a function of food "needs." We propose that the value of time spent in potential alternative activities must be considered in order to predict time spent in subsistence tasks.

KEY WORDS: hunter-gatherers; subsistence; time allocation; men.

INTRODUCTION

Anthropologists have long been interested in variation in subsistence effort in different societies. Most recent debates have centered around whether the amount of work per capita increases with increasing technology, greater social complexity, and intensification of production techniques (see Minge-Klevana, 1980 for review). Speculation concerning the amount of subsistence work that hunter-gatherers do has been of particular interest because of the apparent contrast with modern societies, and the paradoxical finding that hunter-gatherers seem to work fewer hours than members of almost all more complex societies despite the technological advancements of the last several thousand years. The puzzle of low work effort among hunter-gatherers has

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prompted several suggestions. One of the most popular comes from Sahlins (1968, 1972), who proposed that hunter-gatherers represent the "original affluent society," where needs are few and thus easily met. Because objectives are limited, they can be readily attained with available technology and manpower (Sahlins, 1972, p. 5). Agreeing that foraging peoples work few hours daily, Harris has proposed that some hunter-gatherers work little in order to avoid depleting the harvestable animal biomass (Harris, 1979, p. 81).

The ethnographic pattern which these ideas are offered to explain deserves scrutiny. This paper aims to empirically evaluate the widely held generalization about low work effort among hunter-gatherers. Do all hunter-gatherers really spend little time in subsistence work? What is the range of variation in amount of subsistence work for full-time foragers? Do members of societies practicing subsistence agriculture do more or less work than hunter-gatherers? Answers to these descriptive questions will provide the foundation for hypotheses about the variables that determine the amount of subsistence work that members of any society do.

In this paper, we describe the time allocation of Ache men who are foragers in lowland South America. We then compare the Ache data to those collected among other foraging societies in order to assess the range of variation. Finally, we compare the data from foragers with time allocation data collected among some tribal horticulturalists in order to see whether members of societies of one subsistence type work more than members of the other. We conclude by identifying the perspective of evolutionary ecology as a promising guide to further research.

BACKGROUND

There are several references to the Ache in historical accounts before the 1960's (see Metraux and Baldus, 1963), but the first modern ethnographic reports that were widely available are those of Clastres (1968, 1972) who studied two of the four living Ache (Guayaki) groups. The data presented here pertain to the northern Ache who have come into unarmed contact with outsiders only in the past decade (see Hill and Hawkes, 1983). The northern Ache, who were full-time hunter-gatherers until the mid-1970's currently live primarily at a Catholic mission (Chupa Pou) but continue to forage frequently in the nearby forest. We have previously described these foraging trips, reported figures on time costs and resources acquired, and begun to analyze the efficiency of Ache foraging strategies (Hawkes, Hill, and O'Connell, 1982; Hill and Hawkes, 1983). We have also described the seasonal pattern of food acquisition (Hill, Hawkes, Kaplan, and Hurtado, 1984) and the sharing of food resources (Kaplan, Hill, Hawkes, and Hurtado, 1984).

During the 10 years prior to their first peaceful contact with outsiders (1960–1970) the Ache probably numbered between 600–800 persons (Hill, 1983). Their traditional range is an area of about 12,000 km², between 54–56° west and 24–25° south. Much of the area is covered by tropical broadleaf evergreen forest, which the Ache prefer to open grassland. Rainfall is quite unpredictable from month to month and year to year, although there are statistically significant wet and dry seasons. Annual average precipitation is about 1600 mm. Fluctuations in temperature are much more regular, with an annual January maximum around 40°C and a July minimum of about −3°C. Ecology and climate are more fully described in Hill *et al.*, (1984).

The Ache take a wide variety of animal species. Among the most important are peccaries, white-lipped and collared (*Tajassu tajacu* and *Tajassu pecari*), pacas (*Cuniculus paca*), coatis (*Nasua nasua*), armadillos (*Dasypus novemcintus*), and capuchin monkeys (*Cebus apella*). They also exploit numerous plant products, especially of the palm *Arecastrum romanzolfianum,* from which they take the fruit, the heart, and starch from the trunk. Fruits and honey are also major resources, with insects providing a small but consistent component of the diet. More complete descriptions of the diet are given in Hawkes *et al.* (1982), Hill and Hawkes (1983) and Hill *et al.* (1984).

METHODS

Data on time allocation were collected between October 1981 and April 1982, on nine foraging trips out from the mission settlement, ranging from 5–15 days in length. A total of 63 focal man days were recorded using one of two sampling techniques. First, focal men were chosen arbitrarily (the man nearest the ethnographer each morning who had not been sampled) without replacement until all adult men on a trip had been the focus of a day's observation. At that point, some men were arbitrarily chosen again. The focal man sample thus includes up to 6 days on 28 different men. Using this sampling technique, men chosen to be a focal man were followed throughout the day, with the ethnographer noting all activities during daylight hours. This is equivalent to focal animal sampling common in animal behavior studies (Altman, 1974).

With the second sampling technique, the chosen men's activities were recorded every 10 minutes throughout the day except during travel time, which was recorded from beginning to end (since we could not stop long enough to make notebook entries). This methodology is a combination of focal person and instantaneous scan sampling. The two methodologies produced

Table I. Definition of Activities

a	Walk in line. Walking in single file line with essentially all band members present. This represents movement of the camp from one spot to another with men in the lead breaking the trail and searching for game.
	Walk alone. Walking with only ethnographer present.
	Walk with men. Walking with a group of men but no women or children present.
	Walk with spouse. Walking with spouse as only other adult Ache companion.
	Walk with men and women. Walking with a group that includes some men and some women but not the entire band (or almost all of it).
	Walk with boy(s). Walking with adolescent boy(s) as only other Ache companions. The boys are primarily along to learn hunting skills, but also help adult hunters.
	Walk, carry child. Walking in line as above, carrying own children or spouse's children.
	Walk, carry large game. Walking with any size group carrying game larger than 10 kg (peccaries, deer). Although men continue to search for game while carrying a carcass, their perception is considerably hampered.
	Hunt. This represents the time that the focal man was out of sight during a hunting episode. This was the only category for which the focal person reported his activity rather than being directly observed. Most of this time is probably walk/search for game or game pursuit.
	Directed search. Pursuing signs of a specific game item but without having made direct auditory or visual contact with the game or its definitie location, i.e., burrow. Most of this time represents tracking peccary herbs.
	Game pursuit. Active pursuit of direct signs of game in immediate vicinity. Begins when visual or auditory contact with potential game item is made, or when signs indicate that game is extremely near and behavior is altered noticeably in the attempt to stalk and kill the prey item. Includes all time spent tracking a wounded animal and retrieving arrows that have been shot.
	Honey pursuit. Chopping a tree where honey has been located, building a fire to smoke out bees, and pulling out pieces of honeycomb.
	Vegetable pursuit. Climbing or chopping a tree to acquire fruit or vegetable resources. Collecting vegetable resources from ground or chopping rotten logs for larvae.
	Simultaneous vegetable acquisition and consumption. Vegetable pursuit as above but including intermittent eating of the resource being collected.
	Wait for tool/help. Waiting at the sight of a resource encounter for the tool or help necessary to effectively exploit that resource.
	Wait at honey pursuit. Waiting at the sight of encounter with honey, while some other band member does the work to acquire that honey.
	Watch game or vegetable pursuit. Watching other band members pursue meat or vegetable items while not actively participating in the attempt to acquire those items.

Table I. Continued

Sit/rest/talk. Time spent involved in no other category on this list. Frequently recorded as "sitting doing nothing" or "resting."
Play. Playing with spouse, other adult or child (not own offspring) or pets.
Lying down/sleeping. Resting in prone position doing no other activity.
Eating. Holding food and intermittently consuming some of it. Drinking.
Tool manufacture and repair. Sharpening arrows, readjusting arrow points or feathers, straightening arrows, manufacturing arrows, adjusting and manufacturing bows, sharpening axes and machetes, making carrying or cooking implements.
Food processing. Butchering and singeing game items, redistributing food, making honeywater, processing vegetable foods.
Cooking. Actively attending an item on the fire or the cooking fire itself.
Grooming/hygiene. Grooming self, spouse, bathing, picking teeth, urinate, defecate.
Childcare. Sitting with child on lap, playing with child, grooming or feeding child.
Campwork. Clearing brush for camp, building huts, getting firewood or water, building fire, making a bed, feeding pets, packing up to move camp.
Unknown. Time when focal person was not monitored or out of sight from ethnographer.

9 Walk/Search

equivalent results for all activity categories, and the data have been combined for presentation and analysis. In addition, all men were clocked into and out of the camp every day, resulting in 594 man days of known foraging times, covering 36 different men.

Activity categories are described in Table I. Although all the activities are not necessarily mutually exclusive, we observed few cases where two of the defined activities occurred simultaneously for men, so that for our sample, the categories are in fact mutually exclusive.

The sample day was defined by daylight hours and thus varies slightly in length from day to day and seasonally. We generally began recording activities when there was enough light to see and stopped at dark. The mean number of daylight hours during our field period was 13.7 (twilight to twilight, calculated from the Astronomical Almanac, 1983), and the mean sample period was 12.8 hours in duration. In order to determine how time was spent after dark, we used a flashlight to monitor activities of a focal person until he was asleep. This was only done on five occasions because the light was an irritation to our subjects.

Foraging rates for different men were measured and calculated as described in Hawkes *et al.* (1982) and Hill and Hawkes (1983). Other details

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of time and food measurements as well as overall field conditions can be found in Hill *et al.* (1984) and Kaplan *et al.* (1984).

It is important at this point to note that we are observing behavior on short foraging trips in an attempt to reconstruct the behavior of the Ache when they were full-time foragers before establishment of the mission. On these trips, Ache foragers are totally dependent on wild food products, and organize each day around the food quest. There are potential problems with this type of extrapolation, especially if there is reason to believe that current circumstances of Ache life at the mission will appreciably alter the behaviors of interest when the Ache are in the bush.

It is possible that the Ache on our foraging trips did more subsistence work than they would have before the mission settlement. However, Ache informants report that the pattern we observed on short foraging treks was in most respects typical of their life in the recent past. They specifically state that men hunted as frequently before contact as they do now. In addition, Hill has observed some Ache bands who were almost completely dependent on forest products for more than 3 months and yet seemed to work as much as did members of the trips we joined. Nevertheless, the fact that most other important activities take place at the mission settlement, as well as the fact that the mission diet is less varied and lower in protein and fat, may induce Ache foragers to work hard and gorge themselves on meat and other wild foods while on short foraging trips. We will continue to investigate this possibility, but for the present assume that our results can be taken at face value to represent the behavior of the Ache when they were full-time foragers. For a more in depth discussion of the effects of the mission on Ache foraging behavior see Hill (1983).

RESULTS

The mean number of minutes during daylight hours that focal men spent in each activity defined in Table I is shown in Table II. Days are divided into two categories, "normal activity days" and "stay in camp days." Normal activity days represent 84% of the foraging days in 1981–1982. They are almost always sunny days or days of very light rain. Stay in camp days, representing only 16% of the foraging days we monitored, were, with only one exception, days of heavy rain. The mean for all days is also given in the table.

Most impressive is the fact that almost 7 hours per day are devoted to food acquisition on normal activity days, resulting in a mean of greater than 6 hours per day of food acquisition for all days combined (rainy days show only 2 hours of food acquisition). Only 27 minutes per day of this time

Table II. Men's Daily Time Allocation

	Normal activity days (min/day)[a]		Stay in camp (min/day)[b]		All days (min/day)[c]	
Food acquisition						
Walk/search	265 (82)	417 (75)	78 (86)	129 (122)	237 ± 13	373 ± 16
Game pursuit	125 (74)		26 (42)		110 ± 10	
Vegetable pursuit	19 (33)		14 (18)		18 ± 4	
Honey pursuit	8 (17)		11 (25)		9 ± 2	
Nonwork						
Wait for tool/help	5 (13)	204 (81)	0 (0)	447 (142)	4 ± 1	241 ± 16
Wait for honey	9 (18)		8 (16)		9 ± 2	
Wait for vegetable/game	2 (6)		0 (0)		2 ± 1	
Rest/talk	123 (60)		180 (87)		122 ± 9	
Eat	73 (41)		216 (171)		86 ± 11	
Lie/sleep	15 (21)		43 (56		17 ± 4	
Miscellaneouswork						
Tool work	41 (35)	82 (52)	34 (34)	138 (106)	36 ± 4	91 ± 8
Process food	15 (21)		50 (96)		18 ± 5	
Groom	21 (21)		24 (27)		18 ± 3	
Childcare	11 (19)		15 (21)		10 ± 2	
Campwork	7 (11)		15 (16)		8 ± 2	

[a] $N = 53$; $\bar{X}$ (*SD*).
[b] $N = 10$; $\bar{X}$ (*SD*).
[c] $N = 63$; $\bar{X} \pm SE$.

was devoted to exploitation of honey or collected items. The vast majority of men's foraging time is spent searching or in pursuit of game. The overall mean for miscellaneous work is about 1.5 hours, and about 4 hours of nonwork time were recorded daily (eating contributes over an hour to this). Because of fairly large sample size and low variance, the standard error of most measurements is quite low, which supports confidence that the means are representative.

It is also noteworthy that variance in total food acquisition work per day is quite low on normal activity days, thus giving a very low coefficient of variation (0.18). This indicates low variance from man to man, and day to day; men do not work many hours one day and few hours the next. Instead, they maintain a fairly consistent subsistence activity profile day after day.

The variance in miscellaneous work is considerably higher, giving a coefficient of variation of 0.65. Thus, men are likely to do much miscellaneous work on one day and little the next, or there is high variance between ~~mean for miscellaneous work is about 1.5 hours, and about 4 hours of non~~ spend a mean of only 36 minutes per day in tool manufacture and repair, and that no difference can be detected between the amount of tool work they do on sunny or rainy days. Food preparation (mainly butchering of game)

The phrase marked is not correct please see manuscript p. 7 for correct phrase.

contributes a mean of only 18 minutes per day to men's work; thus, direct food acquisition is by far the most important component of subsistence work for Ache men. Camp work (clearing camp, building huts, etc.) shows a mean of only 8 minutes per day, and about 10 minutes per day are spent in childcare (as defined in Table I). The actual amount of time devoted primarily or partially to childcare is probably considerably greater, but was not measured by our methods because physical contact was a prerequisite for childcare as we defined it. The costs of childcare for both men and women are notoriously hard to measure (see Lee, 1979 for example).

Table III gives a more detailed breakdown of activities on "normal activity days." The day is divided into four parts, morning in camp, daytime out of camp, evening in camp, and after dark. Minutes spent in each activity during each time period are shown. Walk/search time is also divided into several categories in order to provide a more detailed description of the men's foraging day. It can be seen that the two most important categories of walking are "walking in line," referring to a single file line containing all members of the band, and "walk alone," the hunter accompanied only by the ethnographer. Each of these activities represents more than an hour per day, while men walk in the company of other men (no women or children present) for only about a half hour daily. This pattern is best described as follows: All members of the band usually abandon camp together in the morning and walk at a leisurely pace for a while. Later, men separate from each other, probably in order to increase the area they can search for game. If game is found, most men are called to participate in the pursuit, and the women and children frequently arrive at the spot before the pursuit has ended. The cycle then begins again with men separating from the women's group fairly rapidly.

From these data it can also be seen that tool-making is primarily done in the morning, as the Ache seem to wait until just before tools are needed before working on them. Arrows are also sharpened at the kill site, either before pursuit begins, or immediately following it. Major nighttime activities are eating, sleeping, grooming, and food preparation.

In addition to the 63 focal man days that we recorded, we monitored departure and arrival at camp for a total of 594. In order to determine the usefulness of the measure of time out of camp as a measure of true work done, the time recorded out of camp for focal men was compared with the actual time we recorded them as working on food acquisition. The correlation between the two measures day by day was high (Pearson product moment = .90), and we calculated that 87% of the time that focal men spent out of camp they were actually working on food acquisition. The mean number of hours out of camp for the entire 1981–1982 sample of men was 7.9 hours per day on normal activity days and 7.1 hours (SD = 2.6 hr, SE =

Table III. Daily Breakdown of Activities

	Morning (N = 50)	Day (N = 53)	Evening N = 44)	Night (N = 5)
Walk/search	–	–	7	2
Walk in line	–	72	–	–
Walk with men	–	32	–	–
Walk alone	–	79	–	–
Walk with spouse	–	12	–	–
Walk with men and women	–	2	–	–
Walk with boy(s)	–	16	–	–
Walk, carry child	–	15	–	–
Walk, carry large game	–	1	–	–
Directed search for game	–	38	–	–
Hunt	–	–	5	–
Game pursuit	3	110	12	–
Honey pursuit	–	9	–	–
Vegetable pursuit	–	7	7	–
Simulteneous acquisition and consumption of vegetables	–	8	–	–
Wait for tool/help	–	5	–	–
Wait at honey pursuit	–	9	–	–
Watch vegetable or game pursuit	–	2	–	–
Sit/rest/talk	49	44	33	21
Sleep/lying down	13	–	4	44
Play	2	–	–	–
Eat	26	18	26	46
Tool manufacture and repair	30	8	2	–
Food processing	3	4	6	6
Cooking	1	–	2	17
Grooming/hygiene	6	4	10	24
Childcare	5	1	5	1
Campwork	3	2	4	4
Unknown	2	–	5	–
Sing	–	–	–	2
Total minutes	143	498	128	167
$\bar{x}$ Time begin	6:22	8:53	5:03	7:00
$\bar{x}$ Time end	8:47	5:12	7:07	9:46

should be $\bar{X}$

0.1 hr) for all days. This agrees very closely with the figure we reported earlier (Hill and Hawkes, 1983) of 6.9 hours subsistence work daily for all days from our 1980 sample of 604 man days.

In summary, we conclude that the largest component of Ache men's time is that spent in direct food acquisition. Almost three-fourths of this is spent in search for resources, with the other fourth being spent in direct pursuit once a resource is encountered. Time spent acquiring resources other than meat is negligible. Food preparation and tool manufacture make up only a small fraction of total subsistence work for Ache men.

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COMPARISON WITH OTHER HUNTER-GATHERERS

The most widely quoted study on time allocation for a group of foraging people is that of Lee (1968, 1969, 1979). From Lee's data (1979, p. 278) we calculate that !Kung men devote 185 minutes per day to food acquisition, 64 minutes per day to tool manufacture and repair, and 132 minutes per day to other miscellaneous work (60 minutes of which is food preparation). The rest is presumed to be nonwork time. It should be noted however that only the amount of time spent on food acquisition was actually measured. Tool work and miscellaneous work are estimated and may therefore contain large errors. Our own work is stimulated in part by Lee's seminal work in this field and his emphasis on quantification rather than subjective description. In order to carefully evaluate the differences between the !Kung and the Ache, we must examine the measurement procedures that produced his results.

Lee's subsistence data are based on 28 days in July and August 1964. Because they are based on a short time during one season of one year and since there is no measure of variance given, it is difficult to assess how representative they are. Given the rainfall pattern in the Kalahari desert (Lee, 1979), seasonal variance is likely to be quite high. The tallies presented are based on day-by-day monitoring. According to Lee, "the whole camp was checked at sunrise and sunset to determine what each individual was doing each day" (1979, p. 13). Camp activities were not broken down into hours and minutes, but rather each person's major activity was recorded as either hunting, gathering, in camp, or visiting (1979, p. 254). A day during which hunting and gathering was carried out was considered a whole workday, even if the day was short, and days spent in camp or visiting were not counted as workdays even if tool-making or food processing were carried out (1979, p. 255). Days of subsistence work are later converted into hours by using a sample of unspecified size where time of departure and return to camp were recorded.

Procedures for defining work introduce another problem. Lee considers three categories as "not work days" in his calculations (1979, p. 260). One of these, days "in camp," indeed appears to have nothing to do with direct food acquisition; however, food processing done on these days probably should be considered subsistence work. The other two are not so clear. The category labeled "other" in Lee's table (1979, p. 260) refers to !Kung who were out of camp during the day working for Herero tribesmen (1979, p. 263). Whether or not this should be counted as subsistence work is unclear, but classifying it as a "no work day" seems questionable. Undoubtedly, the !Kung receive something in return for their labor.[2] In addition, Lee (1979,

[2]Since these !Kung were counted as consumers and probably ate some food provided by their employers at Kangwa, Lee's measures of consumption during this period are probably also too low.

p. 260) calculates the category "visiting" as representing "no work days" despite the fact that his data show that visitors to Dobe from other areas do in fact do some work. If we assign out-visitors the same amount of work that in-visitors do, and consider the work days in !Kangwa as true work days rather than leisure, the mean work days for !Kung men (residents) per week rises to 4.1 (120.3 work days/206 total days). This is 59% of all days, rather than the "one or two days per week", that is frequently cited (Harris, 1979, p. 81; Sahlins, 1972, p. 21). Women's work days per week (residents) are then calculated as 2.5 (75.5 work days/212 total days). In these calculations, it is important to remember that only time devoted directly to food acquisition is counted. Adding in food processing time would raise the levels of subsistence work considerably (see Hawkes and O'Connell, 1981).

A final concern is the impact that Lee's own presence and that of other outsiders may have had on the !Kung's decision about whether or not to leave camp. People may be less willing to leave camp if they think something exciting will happen there, or if there is a chance to get something by staying around. The mere presence of anthropologists in a base camp that rarely sees outsiders may be enough to keep the curious hanging around camp for a week. Although this may not have been a serious bias in Lee's data (he had already been at Dobe for some time when he began his measurements) it may have a strong effect on shorter expeditions that seek to measure work effort (see McCarthy and McArthur, 1960 for example). How many "goods and services" the !Kung could expect from both the anthropologists and other visitors that might happen by Dobe (such as Herero tribesmen or the district officer; see Lee, 1979, p. 267) is not clear, but whatever the value of these, a !Kung adult would miss out on such opportunities if he were out in the bush.

The ratio of in-visiting to out-visiting (204 person days to 58 person days) during Lee's (1979, p. 259) sample period suggests that possibly the presence of the anthropologists alone was enough to motivate many !Kung to stay at the Dobe water hole where they could take full advantage of this special "resource." This is less a problem in the Ache data where work time was monitored only when we were away from our base camp and had nothing to offer the people if they hung around than worked. We took no food (or other dispensable goods) into the forest with us and left camp ourselves almost every day, so our presence provided minimal encouragement for people to stay in camp.

Despite these difficulties with work effort tallies from Dobe, there is apparently at least one study covering a larger time period and using more accurate monitoring techniques which essentially confirms Lee's conclusion that the !Kung devote relatively few hours to food acquisition (Draper cited in Lee, 1979, p. 262). Unfortunately, the details of this study are not yet published.

In another valuable study on the !Kung, however, the picture is quite different. Yellen (1977, Appendix B) presents raw data on !Kung men's ac-

Table IV. Days Worked and Game Killed by !Kung Men[a]

	Camp Number	Hunt days	Honey days	Gather days	Total days	Game (kg)
N'au						
Feb	1.2	2	0	1	5	7.6
Feb	3.1	0	0	2	3	0
Total		2	0	3	8	7.6
Bo						
Feb	1.2	2	0	1	5	25.8
Feb	3.1	0	0	1	3	0
Total		2	0	2	8	25.8
Toma						
June	2	5	2	0	9	107.5
Feb	3.1	8	0	1	9	31.2
Mar	3.2	2	0	0	2	0
Dec	4.3	5	1	0	6	.5
Jan	4.4	5	0	2	7	19.5
Feb	4.5	2	0	0	2	2.4
Feb	5	1	0	1	2	2.9
Feb	6	3	0	0	3	113.1
Mar	7.1	5	0	0	5	23
May	7.2	2	0	0	5	9.1
Mar	9	1	0	0	2	12.1
June	12	3	0	0	3	6.1
May	13	3	2	0	5	18
June	16	0	0	0	1	0
Total		45	5	4	61	345.4
Naishe						
June	2	4	4	0	9	5.6
Feb	3.1	7	0	2	9	15.4
Mar	3.2	2	0	0	2	9.1
Dec	4.3	2	0	0	3	2.4
Jan	4.4	3	0	2	6	0
Feb	4.5	2	0	0	2	4.8
Feb	5	1	0	1	2	7.7
Feb	6	3	0	0	3	0
Mar	7.1	5	0	0	5	7.0
May	7.2	2	0	0	4	0
Mar	9	2	0	0	2	14.5
June	12	0	0	0	3	0
May	13	1	1	0	5	0
June	16	3	2	0	6	0
Total		37	7	5	61	66.5
GAU						
Mar	3.2	2	0	0	2	0
Dec	4.3	4	2	0	6	2.9
Mar	6	3	0	0	3	0
Mar	7.1	5	0	0	5	13.6
May	7.2	1	0	0	4	0
Mar	9	2	0	0	2	14.5
June	12	2	0	0	3	6.1
May	13	3	2	0	5	18
June	16	2	2	0	6	9.1
Total		24	6	0	36	

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Table IV. Continued

	Camp Number	Hunt days	Honey days	Gather days	Total days	Game (kg)
XASHE						
Dec	4.3	4	0	0	6	2.4
May	7.2	1	0	1	4	0
June	12	2	0	0	3	5.6
May	13	2	1	0	5	0
June	16	4	1	0	6	0
Total		13	2	1	24	8
KA//KA	(1)					
May	7.2	2	0	0	4	0
June	12	2	0	0	3	6.1
May	13	4	2	0	5	18
June	16	2	1	0	6	10.1
Total		10	3	0	18	34.2
KA//KA	(2)					
June	16	3	1	0	6	1.0
Total		3	1	0	6	1.0

	Dry season (May–June)	Wet season (December–March)
Total days sampled	110	112
Days hunting	53 = 48%	83 = 74%
Days gathering	1 = 1%	14 = 13%
Days honey extraction	21 = 20%	3 = 3%
Days subsistence work	69%	90%

"Tabulated From Yellen (1977, Appendix B).

tivities in bush camps between December 1967 and June 1968. His sample of 222 man days is summarized in Table IV. In this sample, 61% of all man days were devoted to hunting, 11% to honey extraction, and 7% to gathering vegetable resources. Adding these, we calculate that !Kung men devote 79% of all days in the bush to subsistence work. These measurements are made for !Kung bands foraging in the bush (not stationed at permanent water holes) and are therefore more equivalent to our Ache data, which cover only foraging trips out from a mission settlement. The methods also avoid some of the problems of interference from the anthropologist (although there are cases when "visiting the anthropologist's camp" was the main activity of the day).

The conclusion to be drawn concerning !Kung men's time allocation to subsistence work is that they probably devote between 60–90% of all days to direct food acquisition, depending on season and particular conditions at the time (we consider the problem of women's work separately; see Hurtado, Hawkes, Hill, and Kaplan, 1985). Even if one takes into account the greater time that !Kung men seem to spend in food processing and tool work, Ache men clearly do more subsistence work than !Kung men do in dry sea-

son permanent camps. On the other hand, in bush camps, !Kung men seem to be involved in food acquisition essentially the same amount as Ache men (79% of days for Kung and 84% of days for Ache). The question remains: Why don't the !Kung work harder in the dry season permanent camps, and what is determining the amount of work that both !Kung and Ache men do?

Few data sets on hunter-gatherers using traditional technology are available for comparison. We are aware of studies on only three other foraging peoples which also present data that can be compared with figures for men's work presented above. The first of these was reported by McCarthy and McArthur (1960). In their report, they calculate the mean hours per day that men work on subsistence for two groups of native Australians in Arnhem land. The mean number of hours of subsistence work for men was only 3.8 hours in the first group and 5.1 hours in the second group. Unfortunately, the sample sizes are only 7 days and 14 days, respectively, and many of the difficulties with Lee's data apply here as well. Especially important is the short duration of the expedition and the possibility that people were staying around camp to watch the anthropologists and to get something from them rather than going about their normal daily routine. This and other problems with McCarthy and McArthur's data have been discussed by Altman (1982) who concludes, based on his own data of modern Australian foragers using new technology, that foragers in Arnhem land using traditional technology must have worked long hours daily in order to maintain the same level of nutrition that characterizes them now.

Studies of Mbuti pygmies have provided some quantitative data on subsistence work. From Hart (1978, p. 335), one can calculate that Mbuti men hunt a mean of 3.2 hours per day when traders are not in camp (4.1 days/week × 5.4 hr/day) and 5.8 hours per day (5.9 days/week × 6.9 hr/day) when traders are present. Since meat given to traders is traded for carbohydrate at a very favorable exchange rate, (in calories) all work can be taken as subsistence effort. Traders were present on 61 days and absent on 81 days, so the overall mean is 4.3 hours of food acquisition per day (this does not include food processing or tool work) or hunting on 70% of all days. Hart's sample covers a large number of days, although sampling methods are not specified, and it is unclear how many of the days not hunted were days of extreme weather. Harako (1976, p. 60) presents data that allows for a partial calculation of men's subsistence work among a band of Mbuti net hunters. During the first 9-day period (Dec. 28–Jan. 5) men hunted 5 days. During the next 17-day period (Feb. 14–Mar. 2) men hunted 12 days. Harako (1976, p. 62) also mentions that men "went monkey hunting (with bows) when they had a day off from net hunting," but the data do not allow for precise calculations of this time. The mean duration of a man's hunting day is given as 8.2 hours (Harako, 1976, p. 60); therefore, we can calculate mean *minimum* men's subsistence work at 5.4 hours per day (17 days work/26 days total × 8.2 hr/day) hunting on at least 66% of all days. Harako mentions heavy rainfall as an

important reason why men did not hunt on some days. Ichikawa (1983), using his own data on food return rates and all other available data on Mbuti pygmies, concludes that the pygmies without agricultural trade would have been forced to work long hours each day in order to obtain enough calories to keep them from starving, and could not have maintained the caloric intake that they do currently (see also Bailey and Peacock, in press, on this point).

The final set of quantitative data published about men's work using traditional technology is Tanaka's (1980) study of the Gwi San. Tanaka's results are based on a sample of eight men for 10 days; thus, the reservations about small sample size during a short period of 1 year apply. During his sample period, Tanaka recorded that men hunted on 76% of all days for a daily mean of 6.3 hours. He also mentions (Tanaka, 1980, p. 77) that one of the men was sick and did almost no hunting during this sample period. Tanaka estimates that men work about 2 hours daily on tool manufacture and repair.

Comparing the total subsistence labor by men in each of these societies above is complicated, partly because methods are not clearly spelled out in all studies, but also because important components of true subsistence work, such as tool manufacture and repair and food processing are not measured. Because resources exploited by different foragers have greatly different properties, we might expect food processing time, for example, to vary considerably. Variance in tool work may also be high from group to group, e.g., a mean of 36 men/day for Ache men compared to the 2 hr/day Tanaka estimated for the Gwi.

The picture is only a partial one, but several conclusions concerning men's subsistence work can be drawn at this time. First, the database is extremely improverished, and the sample size of societies is too small to feel confident of any large-scale generalizations. Second, there appears to be considerable variability in time spent in food acquisition between the different groups studied, and even within groups depending on specific conditions. Third, all of the groups for which quantitative data exist work more than most generalizations of hunter–gatherer work effort have claimed in recent years. Specifically, Lee's study represents the lower extreme reported for daily hours spent in subsistence work by male foragers. Now let us compare this scant data set to the considerably more detailed information available on subsistence agriculturalists.

COMPARISON WITH SUBSISTENCE AGRICULTURALISTS

Many studies of time allocation to subsistence work among tribal subsistence horticulturalists have been carried out (Gross, 1984). Two recent reviews of this work (Minge-Klevana, 1980; Hames, in press) are particular-

ly useful in providing a broad sample for comparison. We use data from Hames (in press) because it is more comprehensive for tribal level agriculturalists (it separates "intensive horticulturalists" from tribal level people). According to Hames' calculations, based on a sample of 11 societies in lowland South America, men spend a mean of 193 minutes per day in food acquisition, and 98 minutes per day in food processing and tool manufacture and repair. This is 5.3 hours total subsistence work per day including all subsistence-related activities. It is notable once again that there is considerable variance between societies in the amount of subsistence work that men do, even though all are in similar environmental circumstances and exploit similar domestic and wild resources. Hames also calculates for three societies of New Guinea horticulturalist–pig herders that mean total men's subsistence work is 4.9 hours per day.

At the present time, therefore, it seems clear that no significant difference can be shown to exist between amount of men's subsistence work in foraging societies and subsistence horticultural societies. The mean number of hours of subsistence work for different societies in the two subsistence modes totally overlap, and because sample sizes for both are so small and variance within each class so high, there is no empirical support for the claim that men in societies dependent on either subsistence type work more than men of the other.

DISCUSSION

The data presented allow for several conclusions. First, the "original affluent society" model of hunter-gatherers is counterfactual. Many foragers work long hours daily on subsistence tasks. This is not surprising given that most animals have needs no more extravagant than those of hunter-gatherers, yet spend many long hours foraging. Since food production requires only a tiny fraction of the labor expended by members of modern industrial societies, there is no justification for labeling foragers as affluent in comparison. In addition, there is good reason to question a measurement of so-called "leisure" time as an indicator of affluence. It is not clear that members of any society have ever had the goal of maximizing the number of hours they could sleep or do nothing during the day. Ache foragers frequently complain about having to spend time in camp on rainy days, and what may appear to be leisure time might be just as rationally labeled "boredom." The midday siesta which is common in low latitude countries throughout the world is probably better understood as a strategy to minimize risk of heat exhaustion than a sign of affluence. Members of modern societies clearly do not seek

to maximize the number of hours they can sleep during the day. Why should foragers?

The evolutionary approach to behavioral studies assumes that the true goal of all foragers is to maximize their inclusive fitness. Such a viewpoint suggests that organisms should spend more time in activities that give the highest fitness payoffs. A trade-off model suggests that foragers will spend less time foraging if the food returns are low and other alternative activities are available that give equal or higher fitness returns (Hill, 1983). This may be the case for modern !Kung foragers that have been studied in large water hole camps. The presence of large number of !Kung along with Herero tribesmen and their cattle have depeleted game near water holes and greatly decreased the average amount of game taken daily by !Kung hunters. New economic opportunities from the Herero and other visitors (including tourists and anthropologists) provide added incentives for staying around camp.

The data also indicate that there is no simple relationship between rate of food acquisition and number of hours of subsistence work. All horticulturalists in Hames' (in press) survey produce more calories per hour than do any foragers, yet some work more hours than foragers and some work fewer hours. !Kung men in the bush get approximately the same number of kilograms of meat per hour as do Ache men, and forage approximately the same percentage of days. !Kung men at water hole camps get only half the amount of meat per hour yet forage fewer days per week. Pygmy net hunters get less meat per hour than do Ache men, yet they spend about the same number of hours daily hunting as do Ache men. Arnhem land foragers in Altman's (1982) study got much more meat per hour than those in McCarthy and McArthur's (1960) study, and yet they worked about the same number of hours daily. Clearly, there is no set level of nutritional need that each of these groups is aiming for (Hawkes and O'Connell, in press). Some eat considerably more calories and protein *because* they work more.

It is instructive to note for example that the Ache work more hours than that reported for any of the 14 horticulaturalist societies in Hames' survey, or the four other hunter-gatherer societies for which we have quantitative data. This is interesting because the Ache consume, per capita, more calories per day and more protein (Hill *et al.*, 1984) than any of these societies for which nutrition has been measured. The Ache also weigh more than any other group in their height range. This suggests that each human group may have a slightly different optimal strategy for time spent in subsistence and amount of food consumed. It is our expectation that these differences are conditioned by details of local ecology which alter not only the costs and benefits of foraging, but also the fitness costs and benefits of activities which conflict with foraging (Hawkes and O'Connell, in press). As more detailed

data on time allocation becomes available we can begin to pose and test specific hypotheses about these trade-offs. The first task is to learn enough about the actual patterns to ensure that the problem we are set to solve is really there.

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