VARIANCE REDUCTION AND THE EVOLUTION OF SOCIAL CONTROL

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ABSTRACT

Three complementary triangulation methods are used to arrive at a diachronic hypothesis about the origin of social control. First a cladistic methodology is used to establish a baseline which shows that an ancestral ape hunted, shared meat, and used subordinate coalitions to reduce the power of alphas. Second, archaeological inferences are used to show that band size and emphasis on taking large game increased as the Upper Paleolithic approached. And third, a new means of analogizing from present hunter-gatherers to late Pleistocene foragers is developed, based on a large sample of 154 mobile/independent extant band societies. Analogizing is accomplished by projecting behavioral central tendencies backwards in time to the Upper Paleolithic, rather than by relying on specific band "types," and it is proposed that today's egalitarian syndrome was also yesterday's, with suppression of strong leadership and bullying behavior and equalized meat distribution within bands. The result is a three stage explanation of moral origins that begins with a pre-adaptive potential for social control in the *Pan*-Human Ancestor, moves to group suppression of domination by alphas on the part of subordinates bent on egalitarianism, and ends with morally well-regulated variance reduction practices that make large game hunting a highly efficient subsistence strategy.

VARIANCE REDUCTION AND THE EVOLUTION OF SOCIAL CONTROL[a]

HOW DO WE STUDY MORAL ORIGINS?

Moral communities always seem to manipulate the bad and the good in human nature. They are aggressively given to punishment, for community investments in what Durkheim (1933) characterized as social control involve not only the use of social pressure, but applications of raw political power (see Black 1984). That is how groups sanction lustful or greedy deviants who endanger everybody's quality of social life (see Edgerton 1975; von Fürer-Haimendorf 1967). At the same time, they preach in favor of altruism (Campbell 1975, 1979): moral communities regularly accentuate the positive, manipulating group members in directions that are prosocial. This two-pronged approach to making individual behavior the business of the group is truly remarkable in the animal world, and it is only human to wonder how this came about.

In *The Descent of Man*, Darwin (1871) speculated about "moral origins" as much as he dared with the scant data available, and ended by mainly discussing "sympathy" in social mammals and how this could be supported by natural selection. Many have taken his cue, to use the New Synthesis in biology as a tool for dissecting the natural-historical basis of moral behavior, but even with major advances in method and theory, the problem of origin sequences has remained highly elusive. In the pages that follow, I shall try to improve our understanding of how such special communities came into being and developed to their present state—even though this will involve pushing the canons of science.

Over the last several decades, scholars of many persuasions have tried to explain the ultimate basis of moral life. The list must begin with evolutionary biologists (e.g., Erlich 2000; Lewontin 1998; Sober and Wilson 1998; Stent 1981; Waddington 1960; Wilson 2002) and especially sociobiologists (e.g., Alexander and Borgia 1978; Alexander 1987; Ridley 1996; Trivers 1971; Wilson 1975, 1978, 1998; Wright 1994), but many others have been intrigued by this problem. They include psychologists (e.g., Campbell 1972, 1975, 1979, 1983, 1991; Dunbar 1996; Tooby and Cosmides 1992); anthropologists (e.g., Boehm 1982, 1999b; 2000; Boyd and Richerson 1992; Fox 1983; Knauft 1989, 1996, 2000, 2001; Leakey and Lewin 1992); ethologists (e.g., Eibl-Eibesfeldt 1970, 1971; de Waal 1996; Wickler 1977, 1989, 1991); and a variety

of philosophically-oriented scholars (e.g., Katz 2000; Midgely 1994, 1995; Pugh 1977; Ruse and Wilson 1985; Sober 1988; Sober and Wilson 1998; Wilson 1993).

With all this recent effort certain contentious issues are becoming well-debated, particularly with respect to Darwin's notion that genetic group selection might be helping to shape social life (*con:* Alexander and Borgia 1984; Ridley 1996; Wilson 1975, 1978; *open-minded:* Boehm 1997b; Campbell 1975; Campbell and Gatewood 1994; Knauft 1994a, 1996; Sober and Wilson 1998). But none of these studies tries to explain moral origins on a diachronic basis—not even if "origins" are specified in the title (e.g., Ridley 1996; de Waal 1996). Rather, the custom has been to look for a general fit between Darwinian selection principles and what humans do socially, focusing on the paradox of generosity and cooperation in a putatively selfish species.

To take the investigation a long step in a different and specifically "historical" direction will require some imaginative—yet responsible—triangulation into the past. My interest here is in the evolution of social control by groups, and the general thesis is far from novel: our human type of cooperative social community evolved in close association with a pattern of large game hunting, which became fully developed in the Upper Paleolithic.

Although similar hypotheses have been proposed over the years, for the past several decades they have been out of vogue. This was triggered largely by the questionable instinctive/"territorial" theories of Ardrey (1966), but another negative reaction involved "Man the Hunter" characterizations of extant hunter-gatherers (see Kelly 1995). In the latter case, a recent and major correction has been taking place (e.g., Binford 2001; Kaplan et al 2000; Stanford 1999; Stanford and Bunn 2001; Stiner 2002). Indeed, solid new analyses support a very important subsistence role for large game hunting in the Late and even the Middle Pleistocene.

My natural-historical treatment of this venerable thesis will be quite different from previous attempts. I shall be suggesting that as we know them today, moral communities (or reasonable facsimiles) arose sometime between 500,000 BP and 40,000 BP, and that they arose only after hunter-gatherers were able to throw off the yoke of alpha male systems: this enabled them to use social control to facilitate an efficiently equitable division of large game. Given the obvious problems of paleoanthropological reconstruction, this hypothesis is remarkably specific. But I shall support it by combining three complementary and potent methods of triangulation.

First, cladistic analysis provides a methodology that becomes quite reliable whenever several closely-related species are recently divergent. This means that with a substantial degree of reliability (see Wrangham 1987), any major and distinctive pattern of behavior that is today engaged in unanimously by ourselves and the other three African great apes can be attributed to our shared ancestor. Developing such a baseline permits us to identify subsistence and socio-political preadaptations which could have provided important "fodder" for the evolutionary development of moral communities. Second, there are limited but very important direct archeological inferences to be made about late Pleistocene band sizes and subsistence patterns, as well as their Cultural Modernity (e.g., Potts 1996; Tattersall 1998). The third means of triangulation also involves what humans were doing in the Upper Paleolithic, but here my approach will provoke some controversy.

I believe that many of today's hunter-gatherers can be reasonably good models for hunter-gatherers of the Upper Paleolithic, but if—and only if—one does the following. First, sample foraging societies strategically, keeping in mind what has been learned recently about unstable Pleistocene environments. Second, set aside the inhibition that prevents many anthropologists from emphasizing patterns of behavior that are humanly universal (see Brown 1991)—or are very widespread within a certain category of society. After some extensive methodological justification I shall use a special "type" of forager society—one built on salient and appropriate extant central tendencies—to create a description of Upper Paleolithic socioecological life that is as comprehensive and reliable as possible.

The Common-Ancestral sociopolitical pattern will provide a homologically-based starting point in time; the archeological record will provide a reasonably specific historical outline of cultural, subsistence and climatic patterns; and the analogically-based portrait of Upper Paleolithic sociopolitical life will provide a surprisingly detailed behavioral terminus. The aim, to state it starkly, is to explain how an olfactory attraction to animal flesh led to the formation of band-level communities that became fully moral, this in the context of highly changeable—and frequently dangerous—Late-Pleistocene hunting environments.

THE MEAT-SHARING HYPOTHESIS

Actively hunting large game was important to the evolutionary development of human sociality because meat-sharing systems involved cooperation above the nuclear family level, and because equalization of meat intake was rule-based (e.g., Foley 1988, 2001; Stanford 1999; Winterhalder 2001). Why did our ancestors riskily go after large game? Acquiring such carcasses is directly stimulated by ecological opportunities or constraints, but ultimately "meat" (fat and muscle) tends be a highly desirable food at the level of olfaction, presumably because this innately disposed attraction[1] has been useful to human reproductive success (Cordain et al 2000; Cordain et al 2001). As today, Middle and Late Pleistocene foragers surely were enthusiastic hunters who wanted to eat meat often.[2]

There is general agreement that mobile hunter-gatherers share their large game at the band level whenever it is acquired sporadically (Smith 1988; Winterhalder 1986; see also Kelly 1995), and that this likely held for the Upper Paleolithic (Winterhalder 2001; see also Foley 1988; Mithen 1990). Although the basic insights are derived from optimal foraging theory, in the human case there is sufficient "actuarial intelligence" involved (see Boehm 1997a) that we may assume conscious strategizing to be at work (e.g., Smith 1991). In short, hunter-gatherers are smart enough to see that there are major advantages in distributing large game equally among all the families in a band—rather than letting a single hunter preside over a kill and heavily favor his own family or relatives. This means that people are using their capacity for social control to transform what would be an impracticable, feast-or-famine large-game diet into a steady, moderate intake of meat which is far more useful nutritionally and offers the pleasure of frequent meat-eating. The result is band-wide sharing.

IS THERE SOME GENETIC BASIS FOR SHARING?

Within families, the ultimate basis of sharing is readily explained by inclusive-fitness (see Wiessner 2002). Concomitantly, within family circles the sharing of plant foods, insects, small game, and family allotments of large-game meat tends to be socially unproblematic (see Kelly 1995). As a widespread cultural pattern which surely has genetic underpinnings, we may assume that intrafamilial food-sharing has been thoroughly integrated with an evolved human

syndrome that included not only male hunters provisioning female mates and offspring, but also a lengthened life span (Kaplan et al 2000).

However, with very large individual differences in hunting productivity (see Gurven 2002; Kaplan 1985; see also Kelly 1995), substantial meat-sharing among distant relatives generates an evolutionary puzzle (e.g., Alexander 1987; Boone 1998). Indeed, inclusive-fitness arguments (Wilson 1975) or reciprocal altruism models (Trivers 1971) don't really fit. There is also the controversial possibility that group selection could be an underlying force (Boehm 1997b; Wilson and Sober 1994; see also Kaplan and Gurven 2002). However, at a much more immediate level of causation we know that social proscriptions, social pressure, and group coercion can compel such "generosity" (see Boyd and Richerson 1992)—at the same time that generosity is being positively stimulated by means of prosocial exhortations (Boehm 2000) or awarding of respect (Alexander 1987). It is the origin of this socially-stimulated dimension of sharing that I try to explain here, so this paper is very much about cultural evolution.

EXTANT PATTERNS OF HUNTER-GATHERER SHARING

Mobile bands regularly include unrelated families because the boundaries of bands are so porous (see Palmer et al 1998), "unrelated" families being ones too distantly related to make a significant difference in terms of kin selection.[3] For instance, Wiessner (2002, Table 5) calculates the proportion of families that were "distantly" related[4] for 6 !Kung groups at /Kae/Kae in 1974 at the 25% level. Nonetheless, sporadically-acquired large game is divided equally among all the families in nomadic bands (Kelly 1995), and this distribution takes place without consideration for kin ties (e.g., Kaplan and Hill 1985; see also Erdal and Whiten 1996; Wiessner 1996; 2002).

We may assume that the degree of within-band relatedness will vary widely across mobile bands simply because descent and residence rules vary so among foragers (Ember 1978; see also Kelly 1995), and also because of ecologically and socially-caused annual fluctuations in nomadic band size. But no matter what the proportion of distant kin, morally-based cultural rules regularly trump close familial connections—worldwide. These sharing principles apply whether men are killing enormous game such as kudu in Africa or merely wallaby or kangaroo in Australia, and they apply whether meat is an obligatory diet item as with the Inuit (e.g., Balikci 1970), or a varied array of plant resources (including fatty ones) seems to be available (e.g.,

Lee 1979). If a band is mobile, it is safe to predict that a cultural formula exists for the equalized or quasi-equalized[5] sharing of sporadically-acquired large game, and that this formula will be carried out unless game becomes very abundant—or extremely scarce.

We may ask why and how such "biologically indiscriminate" sharing began to take place, and this brings us back to the strongly positive olfactory response to fatty meat, a disposition that drives mobile foragers everywhere not only to hunt,[6] but to respect good hunters. We are not concerned with how a predilection for meat and fatty-meat could have evolved (see Cordain et al 2001; Finch and Stanford 2002; Schoeninger et al 2001), but with its effects on social cooperation and the cultural evolution of moral communities during the later Pleistocene. To think about this evolutionary sequence, which of course involves environmental constraints and cultural factors as well as innate olfactory propensities, we need a solid baseline to start from.

TWO CLADISTIC RECONSTRUCTIONS

Humans, bonobos, chimpanzees, and gorillas share DNA at above the 98% level (Ruvolo et al 1991). Recently (Boehm 1999b) I built on the pioneering work of Wrangham (1987; see also Duncan and Stuessy 1984; Moore 1996; Stanford 1998) to create a remarkably detailed behavioral portrait of their Common Ancestor. The methodology was simple: (1) you concentrate on major conventional categories of behavior and make a check list; (2) if a pattern is present in all four African apes, you assume that this is not a statistically unlikely accident of convergent evolution; and (3) you attribute the behavior to the shared ancestor. If a pattern is present in, say, three out of four species, the chances of convergent evolution would still be unlikely, but in the interest of keeping the analysis conservative you discount that behavior.

With advances in information about extant African great apes (e.g., Kano 1992; Wrangham et al 1994; McGrew et al 1996), the potential to flesh out such behavioral portraits is improving on a yearly basis. I shall first sketch the sociopolitical behaviors of Wrangham's very conservative 4-species "Common Ancestor," which at 7-9 MYA includes gorillas, and then construct an analytically more useful portrait of the more recent shared ancestor of bonobos, chimpanzees, and humans, which dates molecularly to only 5-7 MYA (Ruvolo et al 1991).

All four species have closed social groups with female emigration, and all can show hostility toward others of the same species, so these patterns hold for the Common Ancestor

(Wrangham 1987). Recently, in amplifying this description (Boehm 1999), I suggested that all four also share social dominance hierarchies, which are based on dispositions to dominate and submit (Tiger 1969; Tiger and Fox 1971; Wrangham and Peterson 1996; see also Blurton-Jones 1972). More generally, there is a noteworthy tendency to avoid being subordinated: all four species form subordinate coalitions to diminish the political advantages of higher-ranking males (Boehm 1999b). In addition, all four exhibit some type of conflict intervention (e.g., Boehm 1994; Fossey 1983; de Waal 1989) by which third-party "peacemakers" ameliorate the effects of competition and conflict, while individuals also "make up" on their own (see de Waal 1982; 1989). This entire suite of behaviors holds not only for the Common Ancestor, but also for every descendant species in the direct human line—including *Homo erectus* and modern humans.

This four-species model cannot not tell us whether the ancestor lived in fission-fusion groups (humans, both *Pan* species) or in compact harems (gorillas), nor anything about male-female bonding (humans, gorillas) versus promiscuity (both *Pan* species). It can tell us only that there were closed social groups and a long-term mother-infant tie. Nor can it tell us reliably whether this ancestor regularly hunted and ate meat with nutritional benefits, for gorillas seem to do neither. However, if we move to a somewhat less conservative, three-species ancestral model, which includes just the two *Pan* species and humans, we may add not only fission-fusion foraging groups, but also hunting and meat-eating: humans, chimpanzees, and bonobos all do this (see Wrangham 1999). To formally differentiate this more recent ancestor at 5-7 MYA from Wrangham's four-species Common Ancestor, I shall refer to it as the "*Pan*-Human Ancestor."

Like humans, chimpanzees seem to have a special propensity for fatty body parts of their prey (Stanford 1999; see also Speth 1987, 1989), and more generally we both savor "meat." This leaves the less well-studied bonobo (see Kano 1992; Susman 1987). Stanford (1998, 1999) and Wrangham (1999) make it clear that bonobos do not hunt with anything approaching the regularity and intensity of chimpanzees. However, they do hunt in environments that are so well provided with plant foods that foraging party sizes remain substantially and consistently larger than for *Pan troglodytes* (see Kano 1992; White 1996; Wrangham 1999). *Pan paniscus* takes baby duiker and other smaller mammals, and like humans and chimpanzees it shares such food

(see Susman 1987).[7] Thus, the *Pan*-Human Ancestor did at least a modicum of hunting, and it shared meat in its fission-fusion bands.

At some point some version of *Homo* began, uniquely, to develop moral communities with social control (Boehm 2000); it might even have been hominids (see Knauft 2000). We have just seen several preadaptations that could have contributed to this important sociopolitical development, which in conjunction with a growing linguistic competency (Lieberman 1998) transformed human sociality in ways that were profound. One was the capacity to form larger-than-dyadic political coalitions (Boehm 1999b), for a basic tenet of human social control is that groups gang up against problematic individuals. Later, I shall compare the way people do this with how the other three African apes also manage to do it—to a certain fascinating degree. With this, along with hunting and meat-sharing, the *Pan*-Human Ancestor had several preadaptive "head-starts"[8] in the direction of the type of moral community that we see with foragers today.

MEAT-POOLING AMONG MOBILE HUNTERS

Basically, "variance reduction" (Smith 1988; Winterhalder 1986) is a mathematical way of explaining how all the members of a band manage to obtain a steady supply of nutritious flesh, do so even though killing large game is sporadic (see also Kaplan and Gurven 2002). Mobile hunters do not necessarily pool their stalking efforts, but they regularly pool their kills—in spite of the fact that there are such large productivity discrepancies among the hunters. These occur not only on a life-cyclical basis, but also in terms of differences in motivation and ability, or vagaries of health or luck in the chase (see Kaplan et al 2000; Smith and Boyd 1990).

Sharing among families can involve not only large packet foods but any sporadically acquired food that is scarce or highly appreciated (see Wiessner 1982). Whenever the benefits of "averaging" become perceptually obvious, foragers will share (e.g., Gould 1982)—even if acquisition was individual. Indigenous actuarial insights have led to various methods of seeing to it that successful hunters are (in effect) divested of selfish control of their large game (see Erdal and Whiten 1996; Hawkes 2001; Wiessner 1996). Possibly the most elaborate is the Netsilik system of having "body-part partners." During seal hunting season, a hunter will have a series of such partnerships with numerous unrelated hunters in a very large camp (Balikci 1970). With

each he regularly exchanges some specified body-part such as the flipper or heart: the overall result is a steady flow of blubber and meat within a large collection of families. Bushmen hunters on the Kalahari Desert exchange arrows extensively (e.g., Lee 1979), and then live by the rule that the owner of the arrow presides over the kill and its equalized distribution. There are many similar "systems" (see Gurven 2002): on different continents, a rich variety of cultural techniques is used to accomplish very much the same goal (Kelly 1995; Wiessner 1996).

The actuarial intentionality (see Boehm 1997a) that shapes such subsistence systems can be seen as a "cognitive" phenomenon associated with an exceptionally large-brained mammal (e.g., Kaplan et al 2000), but political and moral calculations are also crucial. Foragers not only realize the advantages of averaging; they also know that victorious hunters are likely to be ambivalent about sharing (e.g., Lee 1979), and they stay poised to exert strong social pressure on those who are momentarily the providers of meat. Peterson (1993; see also Blurton-Jones 1984) calls this "demand sharing," and in many ethnographies (e.g., Holmberg 1950; Lee 1979) the process can become quite contentious, whereas in others it can have an appearance of automaticity. But the widespread existence of social devices which distance successful hunters from their kills suggests that a fundamental underlying problem of the successful hunter's political ego and meat-selfishness is being coped with everywhere, and that sharing outside the family involves strong, predictable ambivalences.

In achieving nutritionally significant variance reduction, band-level moral communities would seem to be working with a human nature that they believe to be strongly selfish—but also socially responsive and perhaps innately generous to some significant degree. Accordingly, bands employ a moralistic mix of "sticks" and "carrots" (Boehm 2000). The best hunters are pressured as needed (e.g., Lee 1979; Woodburn 1980, 1982), but they also are praised and given respect (Alexander 1987; Hawkes 1991).[9] The widely-predictable result, be it contentious or smooth, is reasonably even-handed meat distribution (see Gurven 2002).

Foragers understand that the subsistence arrangement they so carefully maintain acts as a system of "insurance" (e.g., Wiessner 1977), just as they understand that by using a judicious mixture of positive and negative incentives they can motivate their skillful (or lucky) "hunter of the day" to relinquish his kill to the entire band. This man does not simply waive his possession

of a carcass out of fear of having it taken away (see Kaplan et al 2000). He knows that a generalized exchange system (see Alexander 1987) will help him at other times; he understands the reputational advantages of generosity (see Alexander 1987); and he circumspectly exploits whatever prestige he earns (see Hawkes 1991; Wiessner 1996). As a result, in a typical band most of the men are highly motivated to hunt—and share—large game (e.g., Wiessner 2002).

LEVELS OF COOPERATION

This "generosity with meat" pattern adds up to an actuarily sophisticated system of "insurance" (Wiessner 1977, 1982; see also Cashdan 1980), and assisting victims of circumstance is not restricted just to meat. There is usually a strong ethos of being helpful in bands, and, even though this applies most strongly to close kin, in theory it can apply to all band members (e.g., Briggs 1970). One predictable type of misfortune in band life is growing too old to forage or travel, which in migratory life often tends to be "terminal." But another is to be seriously ill or injured with prospects of recovery (Kaplan et al 2000), as with malaria, snakebite, or frostbite. Illness and accidents strike unpredictably, and one way to cope with such threats is to join up with a rather amorphous yet reasonably predictable "group plan"—one that involves risk sharing up to a point (e.g., Wiessner 1977).

Kaplan et al (2000) suggest that this plan is more limited than the "meat-for-all" plan, for after an accident or during an illness it will be the band members you have preferentially shared a variety of things with that are most likely to sustain you (see also Wiessner 1982). Because those who haven't shared previously tend to be excluded (see Kaplan and Gurven 2001), what we have is a sharing network between families. So, caretaking in bands does extend beyond equalized sharing of meat—but in other matters the system becomes far less "generic."

The meat-sharing plan has some potential rough edges, for at the level of effort there may be non-reciprocators or "free-riders." However, there seem to be limits to how many free-loaders a band will tolerate (see Boehm 2000; Kaplan and Gurven 2001), and in a typical band all or most of the males will make an effort to hunt successfully. In other respects, most families will behave generously enough to maintain a reliable network of reciprocating families in case of accidents or debilitating illnesses.

Thus, meat sharing can be seen as the backbone of what amounts to a wider welfare system. Large game is a constant and universal focus for cooperation in mobile bands, and it habituates people to at least one pattern of systematic, morally-backed, generic sharing. Within families, a similar pattern prevails for meat and many other types of aid. But between families, meat aside, support is given in a more "personal" way, on the basis of closer kin ties, immediate affinal ties, and previous patterns of exchange. Indeed, aside from sharing meat, the communal concern for being generous should not be over-portrayed. As with our own insurance systems, benefits to the needy are far from being given generically and without calculation. The best support will come from close kin, but even they will not devote their entire lives to your care. That is why at certain points old people are left behind even by their own children (e.g., Balikci 1970; Holmberg 1950; see also Woodburn 1980).

If meat sharing is very similar across mobile bands, Kaplan and Gurven (2002) point out that for other sharing patterns there exists a great deal of cross-cultural variety. If I were asked why distribution of large game is the only type of sharing that seems to be both "generic' in distribution strategy and universal among highly mobile foragers, my answer would be that love of fatty meat, combined with the large "packages" the most desirable meat comes in, would be at the base. Love of fat is salient because large game provides more proportionate fat than small game (Cordain et al 2000)—especially with prime-of-life prey (Stiner 2002). Its culturally well-reinforced olfactory attractiveness helps to motivate mobile foragers everywhere to hunt such game intensively, and also to share it cooperatively.

I do not wish to over-characterize these sharing patterns in terms of a powerfully empathetic responsiveness to needs of others, for I have been describing what amount to "reasonably fair-weather" policies. If band members can improve their standard of subsistence by going after large game because generic sharing makes this practicable, they will do so, and this may even be the key to group survival under certain circumstances. However, when actual famine takes over, systems of sharing tend to break down (see Gurven 2002; Laughlin and Brady 1978). Thus, the sharing of large game is pervasive, but if meat is either extremely scarce, or so plentiful that sharing doesn't make sense (e.g., Binford 1978), extrafamilial sharing is likely to cease.

Social cooperation by band members extends beyond meat and health care. Band members join together to keep down dominators and other deviants (Boehm 1993), and collectively they may also challenge members of other bands. Many hunting territories are impossible to defend (see Dyson-Hudson and Smith 1978), but some foragers engage in perimeter defense of concentrated resources such as water, wild game, or concentrated plant sources. A milder version of resource-guarding is social boundary defense (Cashdan 1983), which involves having to ask permission to join a band. In hard times, this gives a local group a way to say no.

Among mobile foragers an overall pattern of inter-familial sharing that extends well beyond meat distributions would appear to be universal or very widespread within bands. By contrast, inter-band cooperation (and competition) seem to be far more "situational." Wider exchange systems, revenge parties, and the defense of resources by groups are all subject to cultural diversity, and (of course) to specific stimulation from the natural environment. It is sharing at the inter-familial level within bands that is of interest for the origin of social control. The question is, were such patterns prevalent in the Upper Paleolithic? On the basis of behavioral-ecological models, Winterhalder (2001) believes this is quite likely.

EARLIER SOLUTIONS TO THE PRESENT-TO-PAST ANALOGY PROBLEM

Here a different methodology is used to reinforce Winterhalder's point. In contravention to widespread archaeological conviction (e.g., Kelly 1995), I firmly believe that hunting nomads studied over the past century can be taken as reasonable models for Upper Paleolithic hunter-gatherers. However, one must look strategically for central tendencies among the right kind of foragers, and one must avoid several modes of thinking that have outlasted their usefulness.

There has been a natural tendency to "analogize" with just a single group (e.g., Bushmen), and Woodburn (1980) and Kelly (1995) have decried this venerable habit.[10] Any single-society model is bound to be wrong, just as it is wrong to think about any single type of environment, or single subsistence strategy, or even any very specific band type as representing the cyclically changeable Upper Paleolithic (see Boehm 1999a). However, Kelly (1995) also seems to be expressing the opinion of many other archaeologists (e.g., Keene 1981; Foley 1988; Wobst 1978) when he insists that the entire "direct-analogizing" enterprise is fruitless. Aside from cultural diversity, the most prominently cited reason is "marginalization" of extant hunter-

gatherers by Neolithic types: environments inhabited today are "atypical," and (by implication) impoverished.

Two decades ago, James Woodburn (1980:96) saw two ways of proceeding in a different direction. One was to find a series of "virgin" (i.e., uncontacted, unmarginalized) hunter-gatherers to serve as models, while the other was to "try from the start to generalize from a reasonably wide range of studies of contemporary hunters and gatherers without prejudgments about their virginity." Woodburn preferred the second course because when a group takes up hunting and gathering it will have to use its habitat efficiently, and therefore it will largely conform to the basics of a hunting and gathering mode of adaptation no matter what its situation or history. I agree. But I also think that a degree of "virginity" might be a desirable control in making a first essay at what I shall call analogizing-by-central-tendency.

Woodburn (1980, 1982) made a typological distinction between immediate-return and delayed-return foragers. With the delayed-return approach, people make major technological investments so acquiring a food supply for storage may take months; but afterwards there is a steady supply of nourishment. This approach is used by all agriculturalists and by some hunter-gatherers. By contrast, the immediate-return approach involves going out daily for your food with just a modicum of technological investment, and then consuming it immediately or over just a few days. In provisionally sorting out these two types, Woodburn (1980:98-99) found that today just a handful of hunter-gatherers take this "immediate" approach (see Table 1).

Table 1. Immediate Versus Delayed Return Societies[11]

IMMEDIATE RETURN	DELAYED RETURN
!Kung; Mbuti; Hadza; Hill Pandaram; Paliyan; Batek Negritos	I. Part-time hunters: Siriono; Nambikwara; Lele; Bisa; Nyamwezi; Lapps; Barasana. 2. Sendentary or Semi-sedentary: Haida; Kwakiutl; Ainu. 3. Fishermen who invest: Eskimo who invest in boats, dams, fishtraps. 4. Trappers who invest: usually part- time hunters who use pits, dead-falls, stockades. 5. Beekeepers who invest: Mountain Dorobo, also part-time hunters. 6. Many Australian Aborigines.

Woodburn (1980:113) sums up as follows:

> In principle, I can see no reason why modern hunters should be substantially unrepresentative of those in the past. The major difficulty is, I suppose, that our modern sample is small and, given the much greater abundance of hunting societies at that time, I would expect greater diversity in economy and in social organization than occurs in modern representatives of this way of life.

He continues:

> The clear archaeological evidence for large trap sites and substantial sedentary communities in the pre-neolithic period is, I think, an unmistakable indication that systems of delayed return existed at that time. Immediate return is a simpler system and one which is more adaptable to climatic and other change: it is likely, in certain circumstances, to have provided advantages then as now, and I would expect that some pre-neolithic societies will have had systems of this sort.

Building on Woodburn's analysis, Knauft (1991) set up the clearly-defined category "simple foragers" to include bands with lack of recognized leadership roles or significant status differentials among adult males, and pervasive egalitarianism. There are no year round residences, no pronounced food storage systems, no substantial material wealth accumulation, and no intensive reliance on fishing or domestic animals—patterns associated with "complex foragers."

Knauft's simple-forager examples are the !Kung, Mbuti, Netsilik, and the Guayaki/Aché, and they fit fairly well with Woodburn's immediate-return profile, even though the Netsilik invest in major equipment like sleds and sometimes store meat in caches (Balikci 1970), and the Mbuti, who Woodburn also included, "invest" in long-term trading relationships with farmers (Turnbull 1965). Knauft's complex foragers, by contrast, have elaborate political and economic status differentiation with rank and chiefs, and tend to be associated with sedentary residence or with very rich resources that can be stored. They fit closely with Woodburn's "delayed-return" economic type. Knauft also has an intermediate type which involves moderate food storage and status differentiation; he believes that HRAF samples are weighted heavily with such societies, and that they are relatively recent compared to simple foragers.

Knauft believes simple foragers to be representative of the Upper Paleolithic, and, in considering Wrangham's (1987) Common Ancestor and associated arguments by Foley (1988), Ghiglieri (1987, 1988), and Manson and Wrangham (1991), he prefers just to triangulate backwards analogically from simple foragers—rather than also working forward homologically from the Common Ancestor as I shall be doing. In using the simple-forager analogy Knauft (1991) took Middle and Upper Paleolithic climatic instability into account, citing Foley (1988) and Mel-

lars and Stringer (1989) to suggest that in periglacial Eurasia, when large game was the main resource available, late Pleistocene humans became more like complex hunter-gatherers.

PLEISTOCENE-HOLOCENE SIMILARITIES AND DIFFERENCES

A decade later we know that in the Upper Paleolithic and earlier, climatic perturbations due to glaciation were much more short-term and dramatic than previously assumed, and we also know that populations lived successfully at high latitudes even during colder periods (see Potts 1996; Stiner 2002). This means that for a period of over 100,000 years Anatomically Modern People were adjusting their behavior patterns to a wide variety of gradually-but-radically-changing environments. It also means that regionally the ever-changing environments they exploited were sometimes quite adequate, sometimes dangerously inadequate, and sometimes impossible. In this context, Knauft's emphasis on upper latitude adaptations and his flexibility in applying his own typology were well vindicated.

With respect to social life the question is, how do such instabilities affect the challenge of building analogies from present to past? Kelly's (1995) case that marginalization and diversity preclude analogizing is well presented, and at first blush these problems seem persuasive—as arguments against trying to use typological analogies as Knauft and Woodburn have. However, present knowledge about Pleistocene climates suggests that Upper and Middle Paleolithic humans were being "marginalized" quite regularly; that is, climatic changes were putting them into less desirable environments likely to affect subsistence. As Potts (1996) points out, they faced cycles of cold weather that recurrently transformed temperate mid-latitude inland environments into cold areas, including tundras friendly to large game where minimal gathering possibilities existed. Also, at mid-and-lower-latitudes there would have been cycles of very hot weather with significant landscape desiccation except for right around the equator. On a regional basis, both trends would have recurrently created extensive "marginal" environments for cycles of several hundred to several thousand years.

As climates worsened, human groups which once flourished side by side would surely have found themselves in serious contention for resources. This means that in all likelihood they would have been actively "marginalizing" one another by political means (see Boehm 1999a), somewhat similarly to what happened in the Neolithic with agriculturalists as aggressors. Given

what we know about climates then and now, I think it is time to consider more seriously Woodburn's and Knauft's approaches. We must set aside "marginalization" as one of two compelling reasons not to analogize from present to past.

It certainly is true that today's foragers are *diverse*, even though they have been living for 10,000 years under relatively stable Holocene conditions. And as Woodburn (1980) suggested, still greater diversity was likely to have prevailed prehistorically simply because foragers were more numerous then. In addition we now know that Late Pleistocene cultural diversity must have been amplified radically by more than 100,000 years of dramatic, short-term cyclical shifts in climate. With all this diversity at both ends, we arrive at a challenging question: how does one analogize reliably from one population to the other?

Kelly's book is useful because hunter-gatherer diversity did need to be emphasized. However, Kelly (1995) fails to emphasize the important regularities that prevail among today's foragers—and especially among one very salient and numerous subset of foragers. Whereas "immediate-return" or "simple" societies are few in number, there are scores of extant foraging societies that conform to the following criteria: they are mobile, politically egalitarian, and intent on sharing the large game that they value. They may or may not store some food, and they may show some noteworthy degree of status differentiation (see Fried 1967)—but they quite predictably exhibit strong political egalitarianism that keeps serious power and authority away from leaders. And economically and politically, the great majority of these mobile groups are essentially independent with respect to farmers or herdsmen, even though they are far from being "virginal" in the matter of culture contact.

What I am suggesting, is that one might start with politically and economically independent mobile foragers, who seem almost always to be politically egalitarian, emphasize hunting, and share their meat, and basically project this very broad "type" backwards in time to at least 40,000 years ago. However, this must be done with some care.

APPLYING A LARGE-SAMPLE TYPOLOGY

As a hunter-gatherer ethnologist, Peter Gardner (2000) recently took me to task (see Boehm 2000) for following in the footsteps of Sahlins and many others who have used extant foragers too indiscriminately in projecting today's behaviors into the past. This criticism, along

with the publication of a very large data set on foragers by Binford (2001), stimulated this attempt on my part to create a systematic methodology for "recent" prehistoric behavioral reconstruction.

To assess appropriate extant behavioral central tendencies using a reliably large corpus of data, I began with the comprehensive 339-society list of adequately-described hunter-gatherers which Binford (2001, Table 5.01) developed by very substantially expanding the *Ethnographic Atlas* sample. Variables measured by Binford included the division of labor between hunting, fishing, and plant collection, and quantitative estimates of the extent of mobility in terms of number of annual moves and distances moved in a year.

To make analogizing rigorous I decided to include only societies that were mobile, essentially economically and politically independent at the time of study, and otherwise appropriate to the Upper Paleolithic. First to be eliminated were such obviously inapplicable forager types as mounted horsemen and commercially-involved fur trappers. I did this crudely, on a regional basis. Without evaluating them myself, I also eliminated dozens of cases that Binford for a variety of reasons thought were "suspect." These included the very well-studied Aché, who live at missions but exhibit a classical hunting syndrome while foraging, and also Pygmies, Dorobo, Apaches, Agta, Chenchu, Paliyan, Nambikwara, Siriono, and many others, for a total of 54. This took care of groups involved with domestication beyond dogs or tobacco. I also triaged the large part of Binford's corpus that was entirely sedentary—even though there may have been some societies like these in the Upper Paleolithic, living, for instance, along now deeply immersed coastlines (see Rowley-Conwy 2001). I did include societies that made only a few moves or short moves annually, however, because there were probably a number of Upper Paleolithic societies that tended strongly to stay in one place (e.g., Soffer 1985).

By Woodburn's (1980) standard, such draconic culling might be seen as "purism." However, I wished to address the hesitation shown by most archaeologists, and also by many ethnographers who study hunter-gatherers, to analogize to the past. I therefore reduced the corpus from 339 societies to 154 mobile societies that appeared to be not only dependent solely on hunting, gathering, and fishing, but also essentially independent economically and politically.

The complete tabulation of 154 mobile/independent "semi-pure" hunter-gatherers, on which Table 2 is based, can be found in Appendix A. (The geographic sub-divisions are my own.)

Table 2. 154 Economically/Politically Independent Mobile Extant Tribes[12]

AREA [No. of Societies]	% Hunting/Fishing Combined	% Hunting	% Fishing	% Gathering	Moves Annually [miles]	Annual distance moved
AFRICA [6]	41.8	41.0	0.8	58.2	9.5	202
ASIA [3]	51.7	25.0	26.7	48.3	9.7	58.3
AUSTRALIA [35]	51.9	23.6	28.3	48.1	10.9	178.0
ARCTIC [22]	99.6	34.3	65.3	0.4	8.1	233.2
BC/NW COAST [22]	86.3	27.1	59.2	13.7	4.5	67.9
WESTERN N. AMER [11]	68.2	40.0	28.2	31.8	10.8	210.2
SOUTHWEST [50]	50.9	29.4	21.5	49.1	6.3	104.9
SOUTH AMERICA [5]	65.8	43.2	22.6	34.2	30.4	256.0
AVERAGE	64.525	32.95	31.575	35.475	11.3	163.8
LARGE-PACKET AVERAGE	51.625	26.36	25.26			

Of special interest to my arguments about variation-reduction and social control are prized large-packet foods that stimulate systems of sharing and exchange, but Binford's figures were not perfectly suited for assessment of such items. One reason is that over the past three decades often the subsistence impact of hunting has been ethnographically underestimated (Kaplan et al 2000). Another is that in terms of variance-reduction arguments the separation of fishing and hunting can be seen as being rather arbitrary. For this preliminary analysis, I have merged figures for Hunting and Fishing to create a new category (Hunting/Fishing Combined) that reflects indigenous interest in obtaining large packets which contain unusually high proportions of fatty flesh. Because small game is seldom distributed among families (Kelly 1995), a further adjustment was necessary. Terrestrial hunters may take small or large game, and the same is true of marine hunters, so in arbitrarily subtracting 20% from the relevant averages I have made a very rough (and perhaps generous) estimate of the percentage of the average "flesh" diet that is small-packet (e.g., see Hawkes et al 1991). Thus, the Large-Packet Average constitutes about half of today's forager diet worldwide, with terrestrial and marine intakes being about equal. In the Upper Paleolithic the overall percentage of reliance on large-packet flesh might have been greater because of the proliferation of megafauna, but surely the terrestrial proportion would have been substantially greater then.

In general flesh, that is, fat (including bone marrow and brains), muscle, cartilage, and internal organs, is a preferred food. This is reflected by the widespread tendency to favor "meat" over most plant foods (see Kelly 1995). Thus, the figures in Table 2 are not merely a function of availability: the love of flesh helps to drive food acquisition behavior, and as with larger terrestrial mammals, large sea mammals or salmon have a higher fat content than small fish so people are driven to acquire large-packet flesh in both cases.

Environmental constraints operate, of course: the Ildawongga in Australia are rated as being merely 20% meat eaters, and the Nukak in South America and one Death Valley group also approach that low figure (see Binford 2001, Table 5.01), but they still prefer and share meat. By the same token, Arctic foragers are not able to fulfill whatever affinity they have for plant foods. But these societies do not affect the analogizing process I am proposing here; they are at the tails of a normal distribution, and we are focusing on central tendencies.

With a species that is as adaptable to varying environments as Upper Paleolithic humans were (see Potts 1996), we may expect at least a similarly diverse pattern to have prevailed in changeable Late Pleistocene environments. However, if we straightforwardly transpose the central tendencies in Table 2 to the Upper Paleolithic, when Anatomically Modern Humans were coping sometimes with very cold climates and probably were adapting along coastlines much more than has been assumed (Rowley-Conwy 2001), it is not difficult to make the case that strongly-valued large packets of animal flesh were statistically prominent in most diets.

What about spatial mobility? In Table 2 annual moves average between 4.5 on the Northwest Coast, where some listed cultures engage in very intensive storage of concentrated resources, to several dozen in South America where tropical resources are very scattered. Annual migration totals range from 58 to 256 miles, so the societies in this sample qualify as being mobile—even though some are operating out of permanent or semi-permanent home bases, and some are not. Again, similar variability is expectable for the Upper Paleolithic.

What about politics? Again, let us think in terms of central tendencies. Because they are to some degree mobile, a very substantial majority of the 154 societies in Table 2 can be expected to be classically egalitarian (e.g., Fried 1967; Knauft 1991; Woodburn 1982), with very weak leadership that is nonhereditary, absence of anything like pronounced social classes, and

of course no slavery. One can readily check on the sizable portion of the Binford corpus that was drawn from the Ethnographic Atlas, to see how those societies are listed politically. The rest would have to be checked by hand, but I am confident that the exceptions are few. Today a few Northwest Coast societies that qualify as being mobile may have pronounced social hierarchies, or hereditary leadership, or even some slaves (see Donald 1997), and with their intensive use of storage some of them may not be prone to share their meat—except within families (see Gould 1982). But these exceptions prove the rule.

In terms of strong central tendencies, if you have mobility combined with substantial dependence on large game you predictably get what I have called an "egalitarian syndrome" (Boehm 1997b). This involves a set of features that not only go together correlationally, but are functionally interrelated. The same egalitarian ethos that makes possible efficiently equalized meat distributions supports not only a weak, popularly chosen type of leadership which leads to consensual decision-making, but also a serious curbing of tendencies toward social class formation.

Let us consider this syndrome more closely. Hunter-gatherer political egalitarianism predictably results in several types of "leveling." As a generalized, anti-bullying political program egalitarianism not only spreads out political power quite equitably; it evens out the consumption of large game, and it also makes it unlikely that dominant types could monopolize a band's women. By using spatial mobility, political egalitarianism, and a substantial dependence on large game with variance reduction as the earmarks of this syndrome, one can reliably project this ethos-driven cluster of practices right back into the Upper Paleolithic, when Culturally Modern people surely lived in mobile moral communities that were oriented to large-packet hunting. It was only by means of social control that they could have kept down the alpha-types in their midst and distributed meat efficiently for variance reduction, so we may confidently include the moral community with its egalitarian ethos in this cluster.

This experimental analysis has not been founded on criteria of "virginity," at least not in absolute terms as Woodburn (1980) conceived it. However, something like a virginity principle was operative when I set aside totally sedentary hunter-gatherers, mounted horsemen, and fur trade trappers, and accepted Binford's disqualifications. I believe that such a methodology has

promise with respect to establishing greater confidence in triangulation methods, and thereby creating a far more detailed assessment of Upper Paleolithic social and political behaviors. Such an approach, with the degree of specificity it allows, could profoundly enhance many behavioral reconstructions of archaeologists (see also Boehm 1999a).

The tabulations on Table 2 are preliminary. As a next step, it would be useful to employ a more refined system of triage, and to examine Binford's "suspect" cases individually to see how well they conform to the patterns seen in Table 2. For instance, if the Aché (e.g., Kaplan and Hill 1985) during their hunting treks conform closely to the central pattern of mobility, large game preference, variance reduction, and political egalitarianism, which I believe they do, the very important models and insights derived from studying them could be applied to the Upper Paleolithic. This assumes that some *natural* resource could have made possible a semi-nomadic residence pattern then, and this seems quite possible. However, I would have much greater problems with incorporating models based on the Mbuti or on mounted hunters into any such analysis, since the point is to reconstruct subsistence patterns before domestication became a significant factor.

Compared to Knauft's tiny group of four "simple foragers" and Woodburn's handful of "immediate-return" societies, I have greatly broadened the number and scope of societies that are candidates for Late Pleistocene modeling. In doing so, I have moved from a single specific "type" to a more flexible typology based on central tendencies, with a core syndrome that allows for diversity in many other areas. This seems appropriate given the great socio-ecological variegation which is documented even for the stable Holocene (see Kelly 1995).

At this point, it will be interesting to consider Steward's (1955) idea of a "cultural core"—a subsistence-determined configuration of social and demographic behaviors which go together. The cross-cultural type I have in mind here is not a "patrilineal band," but rather a flexibly mobile and independent band that on average gains about half its living from large-packet flesh, and practices variance reduction. There is also a predictable political-ideological component: a reading of Cashdan (1980), Woodburn (1982), and Gardner (1991), along with Kelly (1995), Knauft (1991, 1994b), and Erdal and Whiten (1994, 1996), demonstrates conclu-

sively that as long as foragers are highly mobile, they always seem to be egalitarian politically and morally, and that this enables them to share their large-packet flesh equitably.

I emphasize that the central tendencies discussed above—large game hunting, spatial mobility, political egalitarianism effected by social control, and equalization of large-packet meat resources within groups—are tightly interconnected. Such equalization is facilitated directly by the predictable, morally-based egalitarian ethos identified by Cashdan (1980) and Gardner (1991), which emphasizes personal autonomy and makes possible not only an equalized approach to sharing of meat, but diffusion of political power in general. The strength of these cognitive, social, moral, and economic connections lends substantial weight to the arguments made above—that this entire syndrome prevailed in the Upper Paleolithic (Boehm 1997b).

This may suggest an ecologically-driven "cultural core," much as Steward (1955) conceived of it theoretically, but there are some important differences. For one thing, both descent and residence rules would seem to be in rather free variation (see Ember 1978). For another, a major and causally contributory constant is the egalitarian ethos. In emphasizing that ethos and its important effects in helping to shape the egalitarian syndrome (Boehm 1997b), I have added an "ideological" element to the cultural core that surely would make "materialist" scholars like Steward (1955), but especially Binford (2001) and Harris (1968), less than comfortable. However, ideology would seem to be a key causal variable in a species that understands its own hierarchically-inclined political life well enough to modify it quite drastically (see Boehm 1993), and does so in ways that impinge very directly upon subsistence practice.

To sum up these arguments, it is not difficult to make the case archeologically that the dominant pattern for Upper Paleolithic bands involved spatial mobility, and that large packets of animal flesh were prominent or predominant in many diets, much of the time. This means that in order to depend so heavily upon large game, variance reduction practices would have been very useful—and often probably necessary at higher latitudes. This, in turn, means that the requisite social control is very likely to have been present, and that moral communities were already developed—an unprovable assumption that is well-supported, nonetheless, by the very fact of Cultural Modernity. On this basis I can hypothesize strongly that the egalitarian ethos, with all of its moral implications, is at least 20,000-40,000 years old.

A HYPOTHESIS ABOUT SOCIAL CONTROL

It bears emphasis that as part of this core syndrome, when extant bands share meat they often create rules which in effect "dispossess" the successful hunter, and transfer "ownership" of the carcass to the entire group (see Wiessner 1996). This also prevents some camp bully from appropriating another's meat and monopolizing it. Such assertively-selfish dominance behaviors are presaged in well-studied Gombe chimpanzee hunting patterns (e.g., Stanford 1999; Goodall 1986; Teleki 1973), and to a lesser degree in the meat-sharing of West African chimpanzees (Boesch 1994). It was because egalitarians moralistically tried to suppress all greedy, despotic, manipulative dominance behaviors outside the family, that they made equalized meat-sharing relatively easy to invent—once humans had become intelligent enough, actuarily, to see the advantages of variance reduction.

Whallon (1989) surely provided a key paleoanthropological insight, when he doubted that effective meat sharing could have been accomplished by groups with essentially unrestrained alpha males. Even today, in bands the all too apparent human propensity for "alpha-hood" becomes compelling in individuals unusually given to status rivalry and domination. Thus, to keep an egalitarian order in place it is necessary for the rank and file to exert social control preemptively, and sometimes very harshly, in the interest of avoiding domination (Boehm 1993). We see this pattern among extant mobile-independent foragers, and there is no reason to believe that earlier egalitarians did not face the same problems and solve them similarly.

Because such strong social control is necessary to routinely keep alphas in check, the prehistoric transition to political egalitarianism might have been abrupt—in a sense, "revolutionary," with subordinate rebellions being necessary (Boehm 1999b)—and therefore entirely cultural. It also is possible that a cultural transition from despotic to egalitarian political orders could have been more gradual, with subordinate coalitions incrementally increasing their control over dominants. But if it was *extremely* gradual, then coevolution (see Durham 1991) might have figured importantly in this transition, perhaps with human nature losing some of its dominance component along the way.

Although thousands of generations under egalitarianism surely affected human nature, it is difficult to say how. Today, foragers sometimes are driven to execute dominators (Boehm

1993)—even though these upstarts have been duly socialized as egalitarians, and definitely should know better. Such a strong extant tendency to dominate suggests that it might have been a "band-by-band" series of relatively abrupt anti-alpha political insurrections that led to widespread egalitarianism, rather than a much more gradual political transition which came about through gene-culture co-evolution and profoundly transformed human nature.

It is this decisive victory of "the group" over its would-be alpha-dominators that makes it efficient for a multi-family band to emphasize large game hunting as extant foragers do. We know that humans have been taking large game since .5 MYA, and that this pattern intensified about .25 MYA (Kuhn and Stiner 2001). What we cannot firmly estimate, with present archeological evidence, is whether these earlier hunters lived in bands large enough to contain not only multiple but unrelated families (however, see Dunbar 1996). Given the force of kin selection (Hamilton 1964) in human evolution, if earlier multiple-hunter bands were considerably smaller and, aside from exogamy, had a basically permanent membership, they would have amounted to extended families. In that case, we would not necessarily need powerful social control to explain variance-reduction practices for large game. Instead, one could assume that even if an alpha-male system was in place, a substantial degree of sharing could have taken place because of strong innate propensities to nurture offspring, other close kin, and also breeding partners—just as a matter of inclusive fitness.

When band size and flexibility reached modern levels, with a practical minimum of 25 persons (Kelly 1995) involving perhaps four to six families (see Dunbar 1996), and with constant moving back and forth between bands (Palmer et al 1998), the problem of sharing became more problematic from a biological perspective because distant kin and non-kin needed to regularly share their meat if effective variance reduction was to be practiced. In this context, we know that there was a Middle Paleolithic progression toward taking largish ungulates (Stiner 2002), but there is precious little direct information relevant to band size prior to the Upper Paleolithic,[13] when decisive architectural evidence is available to support band-size estimates that fall in the modern range.

Obviously, a key point is that socially-enforced variance reduction was invented at latest by the Upper Paleolithic. Along with band size, the strongest evidence for this is simply the fact

that large-game hunting was pervasive by then, and that this subsistence pattern would have been so useful in colder climates where gathering plant foods could not serve as a buffer against variation in the intake of large carcasses. This meant that *somehow,* alpha male types needed to be neutralized, so that large game could be shared equitably.

Not only were Upper Paleolithic bands easily large enough to be multi-family with variance reduction, but the patterning of "trade goods" (see Stiner 2002) at least suggests that there might have been *inter-band* economic exchange systems (e.g., Wiessner 1977) which provide distant safe-haven contacts in regions subject to micro-ecological diversity. When Stiner (2002) suggests that Upper Paleolithic distribution patterns of "trade goods" could mean that variance-reduction was taking place at the inter-band level, she points out that migrations by single bands could leave similar evidence trails. However, if I am correct about *within-band* variance-reduction being necessary to adaptations that focused heavily on large game, this would offer some indirect support for her interpretations: once people had variance-reduction systems that worked well within their bands, their capacity to average risks could have been applied more distantly by means of trading alliances between families in different bands.

This concludes the arguments about projecting central tendencies from extant mobile/independent/egalitarian foragers back into the Upper Paleolithic. I have made the case that the causally inter-connected syndrome of behaviors we find today was also present—in varied forms—in the Upper Paleolithic, and possibly much further back. I offer this methodology as one that could substantially enhance the sociopolitical side of paleoanthropological reconstructions.

FOLEY'S DIMORPHISM HYPOTHESIS

There have been worthy alternative interpretations. Archaeologist Robert Foley (1988) does not believe extant hunters to be a useful model for Upper Paleolithic hunters because climatic and ecological changes during the Mesolithic led humans entering the Holocene Era to diverge onto two novel subsistence paths. Some continued as foragers, but he believes they developed a new and quite different approach to foraging starting about 10,000 years ago. Others domesticated plants and developed a still more different subsistence pattern—farming. If Foley is correct, today's foragers would obviously be very poor models for the Upper Paleolithic.

A major piece of Foley's argument is that at the time that Anatomically Modern Humans became Culturally Modern, they were taller and more dimorphic sexually than their Mesolithic successors, with heights of 1.74 and 1.59 meters respectively for males and females. Their Mesolithic heights were merely 1.67 and 1.56 meters, respectively, while the dimorphism equation was reduced from an Upper Paleolithic figure of 1:1.09 to merely 1:1.07 in the Mesolithic. According to Foley (1988), comparative mammalian studies show that body size and dimorphism may reflect one or both of two selection pressures: (1) male-male competition for mates with the larger specimens coming out ahead, and (2) different foraging strategies pursued by males and females, with males facing more arduous tasks or else provisioning the females.

Foley therefore posits a possible decline in male-male mating competition and a change in sex roles with respect to subsistence. He sees earlier Upper Paleolithic males having been much more the hunting specialists, with a greater emphasis on taking very large game and provisioning females. He believes that with modern hunter-gatherers, the differences in male-female food procurement roles are much less pronounced, and that this correlates with Holocene humans being shorter, more gracile, and less dimorphic because essentially the males are not provisioning the females. A decade and a half later, with a venerable "Man the Hunter" emphasis staging what seems to be a measured but significant and appropriate comeback, Foley's arguments would appear to have less force.

Foley goes on to talk about variance-reduction through meat sharing as an Upper Paleolithic adaptation, and I obviously agree with this part of his scenario. But, what about the specific hypothesis about decreasing robustness and dimorphism?

A CULTURALLY-BASED ALTERNATIVE

Foley's scenario may be logical, but I think this decline is more readily explained by a cultural factor—one which could be missed if one focused mainly on animal models. Egalitarians proscribe all types of extrafamilial bullying, and we know that an Upper Paleolithic alpha-bully's "inferiors" were armed with projectile hunting weapons quite suitable for ambushing him at a safe distance—just as with foragers today (see Woodburn 1982). Once humans became both well-armed and egalitarian, the adaptive advantages of large body size in mate competition and in other types of male-male competition would have been diminished radically (Boehm 1999b).

The camp bully could neither monopolize his own carcasses nor confiscate those of others. Nor could he blatantly and persistently take over (or openly mate with) the mates of other men, as might be expected with an alpha-male system. In short, the advent of decisive political egalitarianism, in conjunction with lethal weapons usable at a distance, could readily explain the morphological changes noted by Foley—even though the arguments are not mutually exclusive.

With respect to Upper Paleolithic foragers being of a different ilk, I believe Foley could be mistaken. If I have been arguing from "analogy" here, in fact a significant portion of the triangulation can be made homological. The *Pan*-Human Ancestor was quite nicely pre-adapted to move toward life in flexible, fission-fusion bands that were subject to hierarchical behaviors but whose members were aggressively intolerant of excessive male domination—bands which began to emphasize hunting strongly, and shared their meat. This gives us a basis for saying that key elements of the egalitarian syndrome were present throughout the Paleolithic, including of course the Upper Paleolithic, when they assumed a highly "culturized" form that in my opinion was directly comparable to today's patterns among mobile/independent egalitarians.

These two avenues of triangulation—from distant past to recent past, and from present to recent past—mesh quite nicely. The third avenue is archeological inference, and in that same recent past—the Upper Paleolithic—we have seen that there is good evidence for nomadic foraging with emphasis on taking large game, and for bands being large enough to profit from variance reduction. Although it would be easy to single out any one of these methods and call my relatively detailed findings "highly speculative," these three modes of triangulation reinforce one another in ways that are quite powerful. Because falsification is, overall, out of the question, this combination of interlocking hypotheses will simply have to compete with other theories in the ever-controversial arena of relative plausibility.

MORAL UNIVERSALS AND MORAL ORIGINS

On the basis of all three methodologies used in concert, I can now make the case that human moral life could have evolved in several distinct but related phases. In doing so, it will make sense to determine what the most prevalent types of moral behaviors are today in foraging bands, and then ask if there were any significant ancestral precursors. If one were to take a large sample of mobile/independent forager ethnographies such as that represented in Table 2,

and enumerate the moral strictures that guide their efforts at social control, obviously one salient proscription would be against acting the bully (see Boehm 1999b). Such societies are basically egalitarian, and in the long run such proscriptions, backed by social control, are needed to keep down political upstarts.

We have seen that one specific application is to "disempower" the proud killers of large meat, in order to share it widely. In this meat-sharing context, the moral code goes well beyond the condemnation of powerful intimidators. Deceptive hunters may consume their kills secretly, while other cheaters-on-the-system may steal distributed meat from other families—and in both cases they may also lie about it. In addition, those in charge of dividing up the carcass may favor their family or friends, while blatant free-riders may feign chronic illness to avoid the rigors of hunting. These and other "cheating" behaviors are reported anecdotally as being proscribed in socially detailed ethnographies (e.g., Lee 1979; Turnbull 1965; see also Gurven 2002; Wiessner 1996), and surely such proscriptions are widespread.

There are other moral universals among mobile foragers. Brown (1991:138-139) has assembled some human universals which automatically apply to foragers. People admire generosity; they condemn rape and other types of undue violence as they see it; they value reciprocity and trust; and as suggested above, they condemn cheating. They also believe in social etiquette, and have standards involving sexual modesty and elimination. By contrast, other aspects of moral codes, such as food taboos, may diverge quite radically—and this even seems to apply to proscriptions that guard against "incest," however this may be defined locally.[14]

At first blush, the task of figuring out how all of these prohibitions came into existence, and which was likely to have come first, seems truly formidable. However, our cladistically arrived-at baseline can tell us a great deal about what behavioral raw materials were available for both natural and cultural selection to work with. If we combine Brown's (1991) and my own (2000) analyses of widespread moral prohibitions, we can form a short list of extant moral prohibitions that are regularly sanctioned by mobile/independent bands to see if any precursors existed in the Common Ancestor. This universal proscription list would have to include: undue violence, including rape and abusive incest; serious deception involving lying, cheating, or

stealing; flaunting bodily functions; being discourteous; excessive domination linked to greed or status rivalry; and possibly consensual incest.

Now, let us consider which of these behaviors might fit with ancestral tendencies that are at all suggestive of group social control. There is no evidence to suggest a group reaction against "incest" in the Common Ancestor or Pan-human Ancestor—even though individual apes may strenuously reject the sexual attentions of individuals closely bonded to them (e.g., Goodall 1986). Sexual forcing, "incestuous" or not, amounts to "rape," but again no collective reactions. Nor do groups of wild apes show concern about public copulation or elimination. Something like "social etiquette" exists in the form of reciprocated ritualized greetings, and an individual might take some breach amiss—but again the onlooking group would never do so. Likewise with "tactical deception" (e.g., Whiten and Byrne 1988; see also Menzel 1974; de Waal 1982) which we might associate with lying: apes are intelligent enough to occasionally practice deception, but when they do so a disapproving coalition does not suddenly arise to punish them. The same goes for both theft and for failure to reciprocate major favors like grooming, which might be viewed as "cheating." A dispossessed or unreciprocated individual may show signs of hostility (see de Waal 1992, 1996), but again no coalition arises to punish the thief or cheater. Such group reactions are never reported for any wild ape, and the only thing similar in captivity is an instance of a large female political coalition's punishing a defector who tried to reconcile with the alpha male when the rest were intent on dominating him (de Waal 1996).

This brings us to one last item, the human proscription of bullying behavior. We already know that egalitarian humans in mobile bands do not tolerate bullies. Something rather similar goes even for relatively despotic human societies (see Boehm 1999b), where authoritative leaders may rule strongly but with the consent of the governed: there is always a political yardstick that is applied by any rank and file, and at the negative end is serious "abuse of power," i.e., illegitimate domination. The antidote is deposition by subordinates. And even if an ugly despotism is being imposed by force, a similarly moralistic yardstick applies—but now the sole antidote is popular revolution, or assassination. So, all human societies—from egalitarian to highly despotic—deal with morally illegitimate bullies, as defined by highly variable local moral standards. And all will put down these upstarts as moral deviants.

Are there ancestral precursors? In the other three African great apes there are noteworthy antecedents. In the wild, *Pan troglodytes* routinely forms expedient power-coalitions at the dyadic and sometimes triadic or higher level (see Goodall 1986; Nishida 1979), male coalitions that can be seen as exerting something akin to very narrowly-focused "social control." In addition, there are rare but analytically important reports at two African field sites (Goodall 1992; Nishida et al 1995) of very large male or male-and-female coalitions, hostile ones, intervening to keep an aggressive ex-alpha male from trying to unseat his successor.

In captivity, this potential for social-control-like behaviors is even more suggestive (see Boehm 1999b). In one case (de Waal 1996), two females in a large group at the Arnhem Zoo dawdled coming inside in the evening, when the keepers' rule was that no animal was to be fed until all were in their night cages. Next day, the entire large group retaliated physically and the "deviants" desisted. This case does not involve suppressing bullies, nor is it suggestive of lying, cheating, incest, or rape. The "crime" was merely one of being inconsiderate. But in its political dynamics, it most definitely is suggestive of social control that damps deviant behavior.

In a more politically definitive captive instance, at Yerkes a large female coalition watched their chosen alpha seriously chasing a younger male who had behaved as a sexual competitor, and their hostile vocalizations became not only unanimous but so threatening that the alpha broke off the chase (see de Waal 1996). Taken in the overall context of how sizable and powerful captive female coalitions work (de Waal 1982, 1996), this is definitely a case of bully-suppression by a large, hostilely-aroused group that is bent on countering domination.

We might not expect such behavior among gorillas with harems decisively dominated by huge muscular silverbacks. However, in the wild females do rarely form political coalitions (Fossey 1983), and in captivity the following was observed (see de Waal 1982). A young blackback male was acting as master of a multiple-female harem when keepers tried to introduce a new silverback. As a coalition the females were able to mob the silverback and drive him to an extremity of the enclosure, and by this means they kept the blackback as their leader. This collective political manipulation was very similar to those effected by wild chimpanzees at Gombe and Mahale, when they peripheralized disliked former alphas who were trying to stage comebacks. With this one gorilla anecdote, we are dealing with a rare captive behavior which none-

theless demonstrates the behavioral *potential* of the species—which is directly relevant to possibilities for pre-adaptation.

This leaves bonobos. Like chimpanzees, bonobo males are somewhat larger than females, and like chimpanzees bonobo males establish dominance hierarchies among themselves (see Wrangham 1999). However, in trying to get ahead these males do not join up with male coalition partners, and, unlike chimpanzee males and silverback gorillas, bonobo males do not routinely dominate the adult females in their wild communities. This is because the females regularly form enduring political coalitions that can be dyadic, triadic, or larger (Kano 1992), and their effect is to keep the females from being bullied by the males.

The overall pattern is quite telling—if one is thinking about a behavioral potential that was available to be further shaped by natural selection. I am speaking of preadaptation, so the potential might easily have led somewhere else, or nowhere, depending. But in fact this tendency of subordinates to collectively resist domination did go in a moral direction, presumably because a variety of selection pressures were favorable to this. In an increasingly cultural and communicative species, resentment of being subordinated, combined with the ability to form coalitions, provided key preliminary ingredients for the evolutionary development of social control as we know it. In all probability, the first "moral deviant" was a heavily outnumbered alpha male, and the first moral community was a defiant subordinate coalition.

SEQUENCING MORAL ORIGINS

Stage I. The African great ape evidence points to a Common Ancestor that used at least moderately-sized political coalitions to reduce the power of dominants, a behavior that continued with the *Pan*-Human Ancestor and with every species in the direct line leading to *Homo sapiens*. At the level of preadaptation, this provided critical evolutionary raw material for Stage II to develop, with entire groups becoming involved as "counter-dominant" political coalitions.[15] And because the *Pan*-Human Ancestor had already begun to hunt and share meat, this provided additional preadaptations that were useful to Stage III of moral development, which went well beyond culturally routinized bully-suppression.

Stage II. This development involved regularized, continuous, and definitive (rather than ephemeral or partial) group suppression of alpha domination, and it involved both raw political

power and refined moral components. Politically, groups were prepared to attack and if necessary kill the bullies they were now labeling as deviants. The moral aspect involved not only well-communicated group values and judgments about individual domination behavior, but also some kind of a crude shared template, carried in the heads of group members, about what kind of political society they wished to live in. Minimally, this required a capacity to communicate abstractly enough for this intuitive blueprint to emerge, a plan that promoted personal autonomy and political equality for the band's household heads. Communication also facilitated gossip (see Dunbar 1996), and because this involved symbolic language with displacement (see Hockett 1963) it was possible to report on the behaviors of upstarts who victimized others out of sight of the group, and to evaluate contradictory accounts of such victimization. This enabled groups to act as judge and jury, as well as policeman (Boehm 2000).

The result was a group that could readily reach a moral consensus about politically deviant behavior, and was in a position to prevent what it defined as inappropriate domination behavior ("bullying"). This was accomplished by far-reaching surveillance of individual behaviors, by information pooling, and by collectively exerting social pressure and punishment as needed. As a result leadership became attenuated as entire groups made decisions that affected all, including decisions of social control. With alphas removed from power, bands now had an effective methodology for collective social problem solving, which could be applied to other types of deviance. All they had to do was to gang up against an individual—or threaten to do so.

Stage III saw this methodology of group social control being applied to more complicated problems, this surely in the context of increasing language ability. Because a significant hunting-and-sharing pre-adaptation existed in the *Pan*-human Ancestor, I am hypothesizing that the first major new application had to do with intensive hunting and sharing of large game, and my assumption is that before this, more limited systems of exchanging meat between co-resident families might have been in place already, reciprocal systems that were maintained by individuals rather than entire groups. This limited pattern of sharing would have presented a perceptually obvious stimulus for creating a wider, truly systematic, and morally-based meat-sharing system, one that permitted bands to become larger—and therefore more efficient in their subsistence because the benefits from variance reduction increase with group size. These new,

band-wide variance-reduction practices were generic: they included all the band's families, and a number of these families would have been unrelated. Thus, an ancient, ad hoc tendency to share meat with closer kin was elaborated into a systematic, generic sharing system, based on social control. This enabled large groups with shifting memberships to share an innately-valued and highly nutritious food much more equally, and do so without undue conflict.

The new band-level system was quite sophisticated. In the face of individual tendencies to monopolize, hide, or expropriate meat, or to let others do all the hunting, building an efficient system of equalized meat distribution surely was more complicated socially than was the prior accomplishment of suppressing the alpha male role. At Stage II the latter required little more than a consistent group show of dominant force, in combination with a single "no bullying" rule. This set a pattern for the more complicated rules that followed.

Depending on when and how Stage III arrived, this application of social control to achieve subsistence variance reduction could have involved either a relatively advanced form of protomorality, or a very close approximation of social control as this is practiced today. This would depend on how well-developed symbolic communication was, and how closely Cultural Modernity was being approached. But I emphasize that morally-enforced variance reduction came after the suppression of alpha roles for two reasons. One was that unrestrained alphas would have disrupted such a system—and (indeed) would have made it difficult even to imagine. The other was that the problem being solved was far more complicated.

TIMING THE SEQUENCE

Stage I. It is easy enough to find a date for our starting point. On a molecular basis, we know that the preadaptive potential for forming large, counter-dominant subordinate coalitions existed 7-9 MYA, in the Common Ancestor. We also know that at 5-7 MYA, the Pan-Human ancestor was providing important further preadaptations, in the form of hunting and meat-sharing.

Stage II. The regularized or "institutionalized" overthrow of alphas could have come fairly early, assuming that some prototype of symbolic communication was becoming available. Because linguists are obliged to be increasingly vague as their language-origins theories proceed back to *Homo erectus* and beyond, it is difficult to estimate when a threshold was reached that would have permitted a permanent, symbolically elaborated, culturally-institutionalized elimina-

tion of the alpha role through social control. To hazard a guess about earlier hominids would be sheer speculation, but *Homo erectus* would be a good candidate on the basis of brain size and evidence for reasonably sophisticated hunting strategies, and also on the basis of current hypotheses about language development (see Knauft 2000; Lieberman 1998).

Stage III. Archaeological evidence (and its absence) becomes crucial in thinking about the advent of social control based variance reduction as the next type of moral behavior to arise. From the standpoint of a modern behavioral ecologist, an objective need to reduce variance may have been present quite early, insofar as *Australopithecenes* appear sometimes to have been processing large mammalian carcasses (Bunn 2001). However, their brain size suggests that sharing might have taken place mainly within smallish extended-family groups that were genetically prepared to share with closer kin, while morally-enforced variance reduction among unrelated families was not likely. Indeed, even if they lived in largish, multi-family bands, it is doubtful that they could have understood the long-term concept of "averaging" as modern hunter-gatherers do, based on indirect-reciprocity principles (e.g., Alexander 1987).

Starting about .5 MYA with later *Homo erectus*, and in conjunction with systematic large-game hunting documented by Stiner (2002), brain size does suggest that needs for variance reduction in meat intake could have become perceptually obvious to band members. But there remains the question of whether their bands were large enough, or sufficiently made up of non-kinsmen who were not breeding partners, to require social control in regulating meat sharing.

There are two specific archeological indices for the kind of largish, fission-fusion, multi-family bands that we find today, and these are found increasingly as the Upper Paleolithic approaches. One is evidence relative to group size, and compared to the Upper Paleolithic we simply do not know much about *Homo erectus* group sizes—except as these might be roughly inferred from sites where butchering was done. The other index is large-game hunting and particularly the heavy reliance on such game at upper latitudes. The point is obviously arguable, but I suggest that wherever a plethora of such game was not available but people did hunt regularly, variance-reduction within bands could have been either extremely useful or mandatory. In this respect, *Homo erectus* is at least a decent candidate for having larger bands, and Upper Paleolithic humans are *excellent* candidates.[16]

If we consider Anatomically Modern Humans as they existed before Cultural Modernity phased in about 40,000 years ago, there is a window of at least 75,000 years when people perhaps matched modern humans in brain power but had not yet become as culturally flexible and inventive as we are—perhaps because their population densities did not oblige them to. This period was characterized by very little evidence of long-distance/exotic-item trade, while Kuhn and Stiner (2001) surmise that populations were thinner and group sizes smaller than in the Upper Paleolithic. They believe that one reason for Upper Paleolithic population densities increasing could have been social mechanisms for buffering risk, and in this context the advent of Stage III of moral origins would have contributed significantly.

During the early Upper Paleolithic, when humans were recently Culturally Modern, there began a protracted cold period that was not punctuated by warm interludes as had taken place previously (Kuhn and Stiner 2001), and this means that heavier reliance on large game could have been environmentally mandated in many places. With these developments came a greater need for larger bands and within-band variance reduction through social control.

If the earlier Upper Paleolithic seems propitious for the invention and widespread practice of variance reduction within multi-family bands, and possibly also between bands, by the time the later Upper Paleolithic phased in, at about 20,000 years BP, architectural evidence for living-groups large enough to contain multiple families was firm (see Kuhn and Stiner 2001). Thus, in assigning a window of time to Stage III of moral origins, we must consider *Homo erectus* a distinct possibility, Pre-Upper-Paleolithic Anatomically Moderns a still better one, Early Upper Paleolithic people a very good possibility, indeed, and Late Upper-Paleolithic people as extremely likely to be practicing variance-reduction in ways we might recognize today.

DISCUSSION

I have presented three interconnected hypotheses that are sequential, and therefore historical. First, at about 5-7 MYA our more recent ape ancestors were hunting some, sharing meat some, and forming purposeful coalitions to partially control the dominance of their more powerful males. They lacked morality, but they did have something like a proto version of social control in the form of small to medium subordinate coalitions which discouraged alpha domination.

The second phase of moral evolution saw a much more definitive, culturally-institutionalized curbing of dominance behavior as humans (possibly hominids) gained enough symbolic capacity to collectively do away with alpha male ascendancy quite decisively, and on a permanent basis. This means they had group social control, but the exact nature of their moral communities is a matter for speculation. The third phase could have been stimulated by higher population densities and by environments that militated for large game hunting, with bands reaching a size and composition appropriate for variance reduction. Such systems required far more specific and sophisticated applications of social control, which were designed to suppress a variety of antisocial cheating behaviors as well as willful domination. Were we fortunate enough to see them today, it is likely that such communities would be recognizable to us as moral communities—with their manifold cultural rules and sanctions.

The emergence of band-level moral communities was heavily involved with cooperation because sharing meat was a central issue in terms of food preferences—and, sometimes, survival. In theory, this third phase could have arrived anytime between 500,000 and 20,000 years ago, depending on language development, cognitive development, and environmental stimulation that led people to reduce variance in their meat intake. But with present evidence it seems most likely that an essentially modern type of moral community arrived with Anatomical or, better, Cultural Modernity. As a cultural phenomenon, this development involved people who were intelligent enough actuarily to understand the advantages of having larger band sizes with more hunters and of practicing band-level variance reduction, and were intelligent enough, socially, to create a sophisticated system of rules to promote variance reduction free of undue conflict.

At a more abstract level, moral origins were heavily involved with principles of equalization, for after political power was equalized by means of social control in Stage II, this set the stage not only for equalizing large-game meat intake in Stage III, but for more or less equalized access of males to mates. I propose that in combination these successive but related developments brought with them a moral life that today's hunter-gatherers would readily recognize as being very much akin to their own.

As Stage III moral communities developed, local consensus groups mobilized against deviants who broke the rules, and these groups appreciated their own collective power sufficiently to create new rules as needed. They continued to use a combination of social pressure, ostracism, expulsion, and execution as they expanded the domain of social control to modern levels. Once the basics of equalizing political power and meat consumption were taken care of, there was in place a methodology that permitted groups to invent a wide variety of prohibitory bells and whistles such as incest taboos, special exogamy rules, food taboos, menstrual taboos, and many other locally-concocted rules which, as today, were far from being universal and often had little direct impact on the basics of subsistence and social life. They fell outside of the cultural core as I have described it as an egalitarian syndrome.

A methodological conclusion is that reasonably conservative ethnographic triangulation by central tendency should permit far more detailed and reliable socio-political-ecological reconstructions by paleoanthropologists in a variety of contexts, and also the formation of new hypotheses. This should apply whether the interest is in the Common Ancestor and its immediate descendants, or in some intervening species in the human line, or more particularly in Culturally Modern Humans of the Upper Paleolithic.

With respect to social control, another conclusion is that by combining analogical triangulation with homological models and with direct archeological inferences, one can develop a highly specific set of hypotheses which add a badly-needed diachronic dimension to the theory of moral origins. Any work on this subject is necessarily speculative, but if we are driven to speculate about our own prehistory, there can be no more important and fascinating area than understanding how just one of the many social species on our planet developed moral communities with social control.

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NOTES

1. It is important to clarify what is meant by "innately based," and what is not. Humans do not have to eat meat in order to survive, and with appropriate ideological training we can become so aversive to meat that it tastes bad or makes us sick, so anything like "genetic determinism" simply is not at issue. But all other things being equal, we more readily learn to savor fats, and probably fatty meat in particular, than many other types of food that are also nutritious. Such flexible but innate "learning-readiness" is the result of natural selection, for it has guided our food preferences in nutritional directions that were useful to reproductive success.

2. Bunn (2001) has made the case that significant meat-eating can be strongly inferred in early hominids, and Stiner (2002) shows that large game was important for *Homo erectus*.

3. Obviously, in kin-selection equations the degree of relatedness must be considered in the context of how great the costs are to donors, and how great the benefits are to their related genetic competitors. The context, here, involves major disparities among families with respect to time, energy, devoted to hunting contributions, and major differences in hunting success (see Kaplan and Gurven 2002).

4. Wiessner counted maximal degree of relatedness between most-closely-related members of pairs of families to arrive at a between-family figure for r. Arbitrarily, an r value of 1/16 or less can be counted as a distant relation; I count it here as a very weak connection in terms of inclusive fitness in the specific context of there being great disparities in the contributions of different hunters to band-level meat consumption (see Kelly 1995): in short, these substantially-disproportionate contributions of the best hunters are not at all likely to be compensated by inclusive fitness effects when $r<1/8$. There is probably no way to quantify this assumption for hunter-gatherers in general.

5. It is interesting that with meat sharing, the basic idea always seems to be to distribute meat more or less evenly to everyone, but there can be one exception. The actual procurer—the successful hunter—sometimes receives either a somewhat larger or a somewhat smaller portion, or—very rarely—no portion at all (Wiessner 1996; see also Kelly 1995).

6. That such preferences continue robustly with us today is evident also to common sense: consider the large numbers of people who remain strongly attracted to life-shortening fried foods, or gourmet preferences for well-marbled cuts of grain-fed beef.

7. One interesting twist about bonobos' hunting practices is that even though they savor meat (Wrangham and Peterson 1996), they never go after monkeys (Wrangham 1999) whereas chimpanzees do so regularly (Stanford 1999).

8. An additional pre-adaptation was conflict intervention, treated elsewhere (see Boehm 1994, 1999b, 2000; de Waal 1989, 1996). This behavior seems to be ancillary to social control, and in any event will not be considered here in the interest of keeping to a manageable scope.

9. In all probability, they are also being reproductively rewarded (Kaplan and Hill 1985; Hawkes 1991), but that is an ultimate effect.

10. For some reason, Inuit groups studied immediately upon discovery—some of which were living in highly productive areas (see Riches 1974) with minimal contact with adjacent peoples—have never found great favor as single models, even though many Upper Paleolithic environments inhabited by *sapiensis* were very cold.

11. Table based on Woodburn (1982).

12. Table based on Binford (2001), Table 5.01.

13. In the Terra Amata site there is evidence of a 20 foot long shelter at about 400,000 years BP (see Tattersall 1998).

14. Brown (1991) believes that after a century of working at this problem, anthropologists cannot yet be certain that the "incest taboo" is actually universal (see also Leavitt 1989). Furthermore, the remedies vary widely: sometimes incest is merely seen as being dangerous supernaturally, whereas often it is actively punished—or at least discouraged as deviant—by means of social control (see Durham 1991).

15. I borrow the term "counter-dominant" from Erdal and Whiten (1994, 1996).

16. With respect to the Middle Paleolithic, I shall simply set the Neanderthals aside. Their predilection for large game certainly could have led to variance reduction, and their brains certainly were large enough to suggest that they understood averaging, but they could have been tangential to this story.

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APPENDIX A 154 Mobile/Independent Hunter-Gatherer Societies

[Derived from Binford 2001, Table5.01]

AREA	***LOCATION***	***SOCIETY***	***H&F***	***HUNT***	***FISH***	***GATH***	***NO MOV***	***DIS MOV***	***% hgf***
AFR	South Africa	/Auni Khomani	48.0	48.0	0.0	52.0	13.0	352.0	100.0
AFR	Botswana	Ko	45.0	45.0	0.0	55.0	12.0	310.0	100.0
AFR	Botswana	G/Wi	45.0	45.0	0.0	55.0	11.5	270.0	100.0
AFR	Tanzania	Hadza	40.0	40.0	0.0	60.0	7.0	80.0	100.0
AFR	Zambia	Hukwe	40.0	35.0	5.0	60.0	8.0	125.0	100.0
AFR	Botswana	!Kung	33.0	33.0	0.0	67.0	5.5	75.0	100.0
AFRICA	AVERAGE		41.8	41.0	0.8	58.2	9.5	202.0	
ARCTIC	Alaska	Nunamiut Inuit	100.0	89.0	11.0	0.0	11.0	501.0	100.0
ARCTIC	Alaska	Noatak Inuit	100.0	75.0	25.0	0.0	12.0	360.0	100.0
ARCTIC	Northwest Territories	Caribou Inuit	100.0	55.0	45.0	0.0	16.0	440.0	100.0
ARCTIC	Northwest Territories	Mackenzie Inuit	100.0	38.0	62.0	0.0	6.0	145.0	100.0
ARCTIC	Northwest Territories	Aivilingmiut Inuit	100.0	35.0	65.0	0.0	14.0	400.0	100.0
ARCTIC	Alaska	Point Hope Inuit	100.0	35.0	65.0	0.0	2.0	75.0	100.0
ARCTIC	Northwest Territories	Utkuhikhalingmiut	100.0	30.0	70.0	0.0	15.0	380.0	100.0
ARCTIC	Greenland	Polar Inuit	100.0	30.0	70.0	0.0	11.0	350.0	100.0
ARCTIC	Newfoundland	Labrador Inuit	100.0	29.0	71.0	0.0	4.0	135.0	100.0
ARCTIC	Northwest Territories	Netsilik Inuit	100.0	25.0	75.0	0.0	11.0	307.0	100.0
ARCTIC	Northwest Territories	Copper Inuit	100.0	25.0	75.0	0.0	14.0	444.0	100.0
ARCTIC	Alaska	Tareumiut Inuit	100.0	25.0	75.0	0.0	3.0	60.0	100.0
ARCTIC	Quebec	Great Whale Inuit	100.0	18.0	82.0	0.0	3.0	85.0	100.0
ARCTIC	Northwest Territories	Ingulik Inuit	100.0	15.0	85.0	0.0	12.0	385.0	100.0
ARCTIC	Greenland	West Greenland	100.0	15.0	85.0	0.0	3.0	70.0	100.0
ARCTIC	Greenland	Angmakaslik	100.0	10.0	90.0	0.0	2.0	13.0	100.0
ARCTIC	Alaska	Sivokamiut Inuit	100.0	10.0	90.0	0.0	2.0	16.0	100.0
ARCTIC	Northwest Territories	Baffin Island Inuit	100.0	5.0	95.0	0.0	4.0	175.0	100.0
ARCTIC	Alaska	Kobuk Inuit	99.0	63.0	36.0	1.0	9.0	225.0	100.0
ARCTIC	Russia	Siherian Eskimo	99.0	30.0	69.0	1.0	3.0	90.0	100.0
ARCTIC	Alaska	Ingalik	98.0	43.0	55.0	2.0	4.0	64.0	100.0
ARCTIC	Russia	Yukaghir	95.0	55.0	40.0	5.0	17.0	410.0	100.0
ARCTIC	AVERAGE		99.6	34.3	65.3	0.4	8.1	233.2	
ASIA	Andaman Islands	Onge	65.0	20.0	45.0	35.0	8.0	40.0	100.0
ASIA	Andaman Islands	Jarwa	50.0	20.0	30.0	50.0	9.0	59.0	100.0
ASIA	Andaman Islands	North Island	40.0	35.0	5.0	60.0	12.0	76.0	100.0
ASIA	AVERAGE		51.7	25.0	26.7	48.3	9.7	58.3	
AUS	Aus—Queensland	Kaiadilt	87.0	7.0	80.0	13.0	7.0	35.0	100.0
AUS	Tasmania	Tasmanians (W.)	85.0	25.0	60.0	15.0	7.0	65.0	100.0
AUS	Aus—No. Territory	Larikia	80.0	15.0	65.0	20.0	7.0	60.0	100.0
AUS	Aus—Queensland	Yintjingga	80.0	5.0	75.0	20.0	6.0	25.0	100.0
AUS	Tasmania	Tasmanians (eastern)	75.0	35.0	40.0	25.0	12.0	165.0	100.0
AUS	Aus—Queensland	Waimbaria	75.0	5.0	70.0	25.0	4.0	30.0	100.0
AUS	Aus—No. Territory	Nunggubuyu	70.0	10.0	60.0	30.0	10.0	85.0	100.0
AUS	Aus—No. Territory	Groote-eylandt	70.0	10.0	60.0	30.0	8.0	60.0	100.0

AUS	Aus—Victoria	Bunurong	65.0	25.0	40.0	35.0	10.0	90.0	100.0
AUS	Aus—New South Wales	Badjalang	65.0	25.0	40.0	35.0	8.0	90.0	100.0
AUS	Aus—Queensland	Kuku-yalanji	65.0	10.0	55.0	35.0	6.0	18.0	100.0
AUS	Aus—No. Territory	Anbara	65.0	10.0	55.0	35.0	3.0	17.0	100.0
AUS	Aus—Queensland	Lardil	65.0	5.0	60.0	35.0	4.0	35.0	100.0
AUS	Aus—No. Territory	Tiwi	60.0	25.0	35.0	40.0	10.0	75.0	100.0
AUS	Aus—South Aus	Karuna	55.0	20.0	35.0	45.0	8.0	100.0	100.0
AUS	Aus—W. Aus	Nakako	50.0	45.0	5.0	50.0	17.0	360.0	100.0
AUS	Aus—Queensland	Wikmunkan	50.0	30.0	20.0	50.0	14.0	238.0	100.0
AUS	Aus—No. Territory	Arenda (No.)	45.0	45.0	0.0	55.0	14.0	285.0	100.0
AUS	Aus No. Territory	Murngin (Yolngu)	45.0	35.0	10.0	55.0	15.0	160.0	100.0
AUS	Aus—Queensland	Jinibarra	45.0	30.0	15.0	55.0	8.0	32.0	100.0
AUS	Aus—No. Territory	Kakadu	45.0	20.0	25.0	55.0	12.0	150.0	100.0
AUS	Aus—W. Aus	Kariera	45.0	10.0	35.0	55.0	8.0	130.0	100.0
AUS	Aus—W. Aus	Worora	40.0	30.0	10.0	60.0	13.0	150.0	100.0
AUS	Aus—W. Aus	Jeidji (Forest River)	40.0	15.0	25.0	60.0	14.0	218.0	100.0
AUS	Aus—South Aus	Jankundjara	35.0	35.0	0.0	65.0	12.0	298.0	100.0
AUS	Aus—Queensland	Karuwali	35.0	35.0	0.0	65.0	15.0	275.0	100.0
AUS	Aus—No. Territory	Pintubi	35.0	35.0	0.0	65.0	15.0	325.0	100.0
AUS	Aus—No. Territory	Alyawara	35.0	35.0	0.0	65.0	14.0	325.0	100.0
AUS	Aus No. Territory	Pitjandjara	35.0	35.0	0.0	65.0	15.0	289.0	100.0
AUS	Aus—W. Aus	Dj aru	35.0	30.0	5.0	65.0	13.0	350.0	100.0
AUS	Aus—Queensland	Yir-yoront	35.0	25.0	10.0	65.0	15.0	145.0	100.0
AUS	Aus—W. Aus	Mardudjara	30.0	30.0	0.0	70.0	15.0	416.0	100.0
AUS	Aus—No. Territory	Walbiri	30.0	30.0	0.0	70.0	14.0	380.0	100.0
AUS	Aus—W. Aus	Ngatatjara	25.0	25.0	0.0	75.0	14.0	373.0	100.0
AUS	Aus—W. Aus	Ildawongga	20.0	20.0	0.0	80.0	15.0	380.0	100.0
AUSTRALIA	AVERAGE		51.9	23.6	28.3	48.1	10.9	178.0	
BC NWC	British Columbia	Gitksan	99.0	30.0	69.0	1.0	4.0	45.0	100.0
BC NWC	British Columbia	Tsimshim	95.0	20.0	75.0	5.0	3.5	40.0	100.0
BC NWC	British Columbia	Kaska	90.0	65.0	25.0	10.0	9.0	280.0	100.0
BC NWC	British Columbia	Alcatcho	90.0	55.0	35.0	10.0	5.5	90.0	100.0
BC NWC	British Columbia	Carrier	90.0	47.0	43.0	10.0	12.0	275.0	100.0
BC NWC	British Columbia	Lillooet	90.0	40.0	50.0	10.0	8.0	90.0	100.0
BC NWC	British Columbia	Cowichan	90.0	30.0	60.0	10.0	6.0	60.0	100.0
BC NWC	Washington	Twana	90.0	20.0	70.0	10.0	4.0	65.0	100.0
BC NWC	Washington	Clallam	90.0	20.0	70.0	10.0	4.0	45.0	100.0
BC NWC	Washington	Quinault	90.0	15.0	75.0	10.0	2.0	12.0	100.0
BC NWC	Washington	Lummi	90.0	15.0	75.0	10.0	2.0	20.0	100.0
BC NWC	Oregon	Alsea	90.0	15.0	75.0	10.0	3.0	22.0	100.0
BC NWC	British Columbia	Stalo	90.0	15.0	75.0	10.0	4.0	40.0	100.0
BC NWC	Washington	Makah	90.0	10.0	80.0	10.0	2.0	15.0	100.0
BC NWC	Washington	Sinkaietk	85.0	25.0	60.0	15.0	7.0	90.0	100.0
BC NWC	British Columbia	Squamish	85.0	25.0	60.0	15.0	2.0	34.0	100.0
BC NWC	Washington	Puyallup	85.0	15.0	70.0	15.0	2.0	50.0	100.0
BC NWC	Washington	Wenatchi	80.0	25.0	55.0	20.0	2.0	19.0	100.0
BC NWC	Washington	Sanpoil	75.0	35.0	40.0	25.0	5.0	75.0	100.0
BC NWC	British Columbia	Okanogan	75.0	30.0	45.0	25.0	3.0	40.0	100.0
BC NWC	Oregon	Tillamook	70.0	25.0	45.0	30.0	2.0	16.0	100.0
BC NWC	Washington	Tenino	70.0	20.0	50.0	30.0	6.0	70.0	100.0
BC NW COAST	AVERAGE		86.3	27.1	59.2	13.7	4.5	67.9	
SOAM	Argentina	Ona	95.0	75.0	20.0	5.0	24.0	320.0	100.0
SOAM	Argentina	Yahgan	95.0	25.0	70.0	5.0	7.0	90.0	100.0
SOAM	Argentina	Tehuelche	70.0	65.0	5.0	30.0	17.0	360.0	100.0
SOAM	Suriname	Akuriyo	45.0	40.0	5.0	55.0	49.0	285.0	100.0
SOAM	Colombia	Nukak	24.0	11.0	13.0	76.0	55.0	225.0	100.0
SO AMERICA	AVERAGE		65.8	43.2	22.6	34.2	30.4	256.0	
SW	California	Yurok	80.0	10.0	70.0	20.0	2.0	24.0	100.0
SW	California	Yuki (Coast)	75.0	15.0	60.0	25.0	8.0	100.0	100.0
SW	California	Tolowa	75.0	10.0	65.0	25.0	5.0	60.0	100.0
SW	California	Achumawi	70.0	40.0	30.0	30.0	3.0	64.0	100.0
SW	California	Chimariko	70.0	30.0	40.0	30.0	2.0	34.0	100.0
SW	Mexico	Seri	70.0	10.0	60.0	30.0	7.0	95.0	100.0
SW	California	Wiyot	70.0	5.0	65.0	30.0	1.0	12.0	100.0
SW	California	Wintu	65.0	25.0	40.0	35.0	6.0	139.0	100.0
SW	California	Tekelma	65.0	20.0	45.0	35.0	6.0	70.0	100.0
SW	California	Honey Lake Painte	60.0	50.0	10.0	40.0	9.0	165.0	100.0
SW	California	Sinkyone	60.0	15.0	45.0	40.0	4.0	60.0	100.0
SW	Nevada	Little Smoky Shoshoni	55.0	55.0	0.0	45.0	11.0	260.0	100.0
SW	Nevada	Reese River Shoshoni	55.0	40.0	15.0	45.0	8.0	150.0	100.0

SW	California	Wukchumi	55.0	40.0	15.0	45.0	5.0	50.0	100.0
SW	California	Yana	55.0	25.0	30.0	45.0	4.0	85.0	100.0
SW	California	Shasta	55.0	25.0	30.0	45.0	3.0	55.0	100.0
SW	California	Mono Lake Paiute	52.0	45.0	7.0	48.0	11.0	215.0	100.0
SW	Nevada	Washo	52.0	37.0	15.0	48.0	7.0	198.0	100.0
SW	Colorado	Antarianunts So Paiute	50.0	35.0	15.0	50.0	10.0	200.0	100.0
SW	California	Tubatulabal	50.0	35.0	15.0	50.0	9.0	110.0	100.0
SW	Nevada	Suprise Valley Palute	50.0	30.0	20.0	50.0	9.0	210.0	100.0
SW	Nevada	Fish Lake Paiute	50.0	30.0	20.0	50.0	9.0	150.0	100.0
SW	Nevada	Cattail Paiute	50.0	30.0	20.0	50.0	5.0	90.0	100.0
SW	California	Patwin	50.0	30.0	20.0	50.0	2.0	14.0	100.0
SW	California	Nisenan	50.0	30.0	20.0	50.0	1.0	5.0	100.0
SW	California	Monache	50.0	30.0	20.0	50.0	9.0	85.0	100.0
SW	California	Maidu (Mountain)	50.0	30.0	20.0	50.0	4.0	28.0	100.0
SW	Nevada	Pyramid Lake Paiute	50.0	20.0	30.0	50.0	3.0	35.0	100.0
SW	California	Lake Yokuts	50.0	20.0	30.0	50.0	1.0	4.0	100.0
SW	California	No. Foothill Yokut	50.0	25.0	25.0	50.0	6.0	70.0	100.0
SW	Nevada	Rainroad Valley Shoshoni	45.0	45.0	0.0	55.0	5.0	90.0	100.0
SW	Nevada	Kawich Mountain Shoshoni	45.0	45.0	0.0	55.0	12.0	270.0	100.0
SW	California	Deep Spring Paiute	45.0	45.0	0.0	55.0	8.0	195.0	100.0
SW	Nevada	Ruby Valley Shoshoni	45.0	37.0	8.0	55.0	7.0	120.0	100.0
SW	California	Miwok	45.0	35.0	10.0	55.0	4.0	32.0	100.0
SW	California	Diegueno	45.0	25.0	20.0	55.0	7.0	80.0	100.0
SW	Mexico	Kiliwa	45.0	15.0	30.0	55.0	7.0	90.0	100.0
SW	California	Wappo	45.0	15.0	30.0	55.0	2.0	8.0	100.0
SW	California	Serrano	40.0	40.0	0.0	60.0	7.0	90.0	100.0
SW	California	Saline Valley Shoshoni	40.0	40.0	0.0	60.0	14.0	180.0	100.0
SW	California	Koso Mountain Shoshoni	40.0	40.0	0.0	60.0	14.0	220.0	100.0
SW	California	Kawaiisushoshoni	40.0	40.0	0.0	60.0	9.0	150.0	100.0
SW	Arizona	Kaibab Southern Paiute	40.0	40.0	0.0	60.0	8.0	200.0	100.0
SW	California	Nomlaki	40.0	30.0	10.0	60.0	3.0	33.0	100.0
SW	California	Luiseno	40.0	15.0	25.0	60.0	2.0	18.0	100.0
SW	California	Eastern Porno	40.0	15.0	25.0	60.0	3.0	36.0	100.0
SW	California	Panamintshoshoni	35.0	35.0	0.0	65.0	11.0	220.0	100.0
SW	California	Owens Valley Paiute	35.0	30.0	5.0	65.0	2.0	17.0	100.0
SW	Mexico	Guaicura	30.0	15.0	15.0	70.0	8.0	135.0	100.0
SW	California	Death Valley	25.0	25.0	0.0	75.0	13.0	225.0	100.0
SOUTHWEST	AVERAGE		50.9	29.4	21.5	49.1	6.3	104.9	
WNA	Oregon	Tututni	90.0	30.0	60.0	10.0	5.0	75.0	100.0
WNA	Montana	Kutenai	85.0	45.0	40.0	15.0	13.0	285.0	100.0
WNA	Idaho	Sheep-eater Shoshoni	80.0	55.0	25.0	20.0	13.0	270.0	100.0
WNA	Idaho	Coeur d'Alene	80.0	55.0	25.0	20.0	11.0	300.0	100.0
WNA	Idaho	Salmon-eater Shoshoni	70.0	50.0	20.0	30.0	12.0	210.0	100.0
WNA	Oregon	Klamath	70.0	20.0	50.0	30.0	6.0	84.0	100.0
WNA	Utah	Grouse Creek Shoshoni	60.0	45.0	15.0	40.0	14.0	315.0	100.0
WNA	Utah	Hukunduka Shoshoni	55.0	35.0	20.0	45.0	12.0	250.0	100.0
WNA	Oregon	Harney Valley Paiute	55.0	35.0	20.0	45.0	11.0	250.0	100.0
WNA	Oregon	Modoc	55.0	30.0	25.0	45.0	9.0	45.0	100.0
WNA	Utah	Gosiute Shoshoni	50.0	40.0	10.0	50.0	13.0	228.0	100.0
W. N. AMER	AVERAGE		68.2	40.0	28.2	31.8	10.8	210.2	1.0