Research

Property and wealth inequality as cultural niche construction

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In contrast to other approaches, evolutionary perspectives on understanding the power and wealth inequalities in human societies view wealth and power not as ends in themselves but as proximate goals that contribute to the ultimate Darwinian goal of achieving reproductive success. The most successful means of achieving it in specific times and places depend on local conditions and these have changed in the course of human history, to such an extent that strategies focused on the maintenance and increase of wealth can even be more successful in reproductive terms than strategies directed at maximizing reproductive success in the short term. This paper argues that a major factor leading to such changes is a shift in the nature of inter-generational wealth transfers from relatively intangible to material property resources and the opportunities these provided for massively increased inequality. This shift can be seen as a process of niche construction related to the increasing importance of fixed and defensible resources in many societies after the end of the last Ice Age. It is suggested that, despite problems of inference, the evidence of the archaeological record can be used to throw light on these processes in specific places and times.

Keywords: Inter-generational resource transfers; reproductive success; property rights; partible and impartible inheritance; parental investment; archaeological evidence for property

1. INTRODUCTION

Attempts to find an explanation for the emergence of huge wealth and power inequalities in human societies have a very long history in the social sciences. Most of those attempts have focused on the wealth and the power as ends in themselves although the motors for the different models that have been advanced vary enormously on a spectrum from exploitation to managerial mutualism. Many of them also draw a strong contrast with hunter–gatherer societies seen as characterized by a ‘zen’ ethic that attaches little importance to material goods. What is different about the evolutionary models that have been developed in more recent years (e.g. [1–5]) is that they take the achievement of wealth, power and status not as ends in themselves but as proximal goals whose achievement contributes to the ultimate goal of reproductive success. However, this still raises the question of how these proximate goals came to be important. In other words, in contrast to non-evolutionary approaches to the question of how and why societies changed from ‘zen’ to materialist values, this evolutionary perspective proposes that the ultimate human goal in all societies, including modern industrial and post-industrial societies on some views [6], has been the maximization of reproductive success, but that the means of achieving it have altered. Not only did reproductive success come to depend on the achievement

and holding of material wealth, but strategies focused on the maintenance and increase of wealth could even become more successful in reproductive terms than strategies directed at maximizing reproductive success in the short term (cf. [7]). This paper will examine the general processes that led to this situation, from the perspective of niche construction.

In their characterization of ecological inheritance Odling-Smee *et al.* [8] point out that it only exists if the consequences of modifications to the selective environment are not wiped out with each generation, but are passed on through the generations and change the selection pressures faced by the organisms concerned. They make it clear that ecological inheritance is very different from genetic inheritance and suggest that it is more like the inheritance of property. It is this idea that is the focus of this paper. Human niche construction, like that of other species, involves modifications to the physical environment, but at least as importantly, it includes the creation of new social institutions, which produce novel ecologies for human action and are arguably rather curious new niches existing at the boundary of cultural and ecological inheritance.

2. INTER-GENERATIONAL RESOURCE TRANSFERS

In many species differences in parental condition are passed on to their offspring by a variety of mechanisms (see [9] for a review), including the inheritance of maternal rank (e.g. [10]). The same is true of human societies, even those hunter–gatherer societies

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that are generally regarded as strongly egalitarian. This is hardly surprising given the very strong evidence that the emergence of a long period of childhood dependence was central to the evolution of the modern human life-history pattern and required massive investment from parents and other close relatives [11,12]. Lee [13] has shown how the nature and extent of inter-generational resource transfers are crucial to the evolution of species-specific mortality patterns where offspring are dependent on those transfers for survival and reproductive success, and how they explain the existence of post-reproductive survival. A consequence of this is that we would never expect the inequality scale to be re-set all the way to zero in each generation in human or indeed other animal societies where differences in parental condition are heritable.

In a series of major recent studies, albeit on limited data sets, Borgerhoff-Mulder and colleagues [14–20] have characterized three different types of inter-generational resource transfers and obtained measures of their importance in a given society, of the extent to which they are transmitted, and of their association with different degrees of inequality. Embodied wealth refers to investment in nutrition affecting offspring body weight, for example, or training in practical skills; relational wealth refers to networks of useful social contacts that may be passed on from parents to their children; material wealth obviously refers to property, such as land and animals. They were not able to obtain a corresponding measure of the transmission of ritual knowledge and its impact, although they note its potential importance (cf. [21–23]).

In the study of hunter–gatherer inter-generational resource transfers, Smith *et al.* [19] concluded, unsurprisingly, that material wealth was much less important as a transmitted resource than embodied or relational wealth, but still found that values of the intergenerational wealth transmission coefficient were such that the offspring of an individual in the top 10 per cent of the population would be at least three times more likely to be in that top 10 per cent than the offspring of an individual from the bottom 10 per cent. Moreover, degrees of inequality in these societies were not insignificant, coming out close to those for present-day industrial Denmark, based on the value of the Gini coefficient (a measure of inequality generally based on the income distribution of a society that ranges between 0, for complete equality, when everyone has the same share of the total income, and 1, for complete inequality, corresponding to a situation in which one member of the society monopolizes all the income and the rest have nothing). The relationship between transmission and inequality was borne out by the correlation of 0.79 between the corresponding Gini values and transmission of embodied and relational wealth, the most significant forms in these societies, weighted by their estimated importance in each society ($n = 8$, $p = 0.02$), excluding two cases where the embodied wealth is represented by body weight, which does not follow the general pattern (see [20, fig. 5]).

The emergence of differential rights to specific material resources within a given social entity, held

by groups such as lineages, expanded the range of variation enormously. This claim is strongly borne out by the results of the recent studies referred to above (see especially [14,20]). The Gini coefficients for pastoralist societies (0.4 overall), and even more so for agriculturalists (0.51 overall), are far higher than for hunter–gatherers (0.19), indicating much higher degrees of inequality. Moreover, the contribution of material, as opposed to embodied or relational, wealth to inequalities in the former societies is much greater, as is the rate of inter-generational material wealth transmission: 0.53 for landed wealth and 0.67 for livestock.

When the transmissibility of wealth and the importance of the different types are taken into account, it appears that children whose parents are from the top 10 per cent of the wealth distribution are 16 times more likely to be there than children whose parents were in the bottom 10 per cent. For agricultural and pastoral societies taken together the correlation between the transmission of material wealth, weighted by its estimated importance in each society, and the Gini coefficient of inequality is 0.59 ($n = 9$, $p = 0.092$). In short, the existence of rights to inheritance of productive material resources has enormous consequences and enables the rich to get richer on previously unimaginable scales, for a variety of reasons: the increased mitigation of risk that wealth provides; the economies of scale available in the management of larger herds and estates [24]; and the ‘complementarities’ between different resources [20], whereby greater material wealth can lead to greater relational wealth, for example, in the form of followers vital in intra-elite factional competition (e.g. [23,25]). The result is the Pareto power law distributions of wealth that are so familiar to us, in which the majority of the population have very little and a small number have the majority of the wealth, together with the political power and influence that go with being at the top end of the scale (cf. [26]).

A key factor here is the characteristics of the resources themselves; specifically, the extent to which they are excludable and divisible and thus amenable to some sort of private ownership [27]. All production involves the application of land, labour and capital (understood in the most general terms) and the transactions associated with the distribution of the results, but these processes always take place within the context of a set of institutions that define the rights that groups and individuals have to use those resources and to exclude others from their use. Like Dyson-Hudson & Smith [27], North [28] argues that the basis of the property rights that emerge in particular situations arises from the benefits that the rights provide in relation to the costs of enforcing them when compared with those of the status quo. Thus, if a resource becomes scarce then it may become worthwhile for some individuals or groups to pay the costs of changing the nature of the existing property rights and start excluding people who previously had rights. In effect, a changed distribution of costs and benefits may pay at least some parties to press for renegotiation of the existing institutions, which may then feedback into the content of social norms. Moreover, to the

extent that such property rights are predictable and sustainable, then the 'bird in the hand is worth two in the bush' principle may be weakened and it may become worthwhile to invest in resources for the future.

Many important foraged resources are neither densely nor predictably enough distributed to meet this requirement and mobility is essential to their successful exploitation. Others, however, certainly do satisfy the requirement, particularly those that come to be exploited when groups intensify and have to shift down the hierarchy of preferred resources; examples include groves of productive trees or good fishing sites (e.g. [29,30]). Such intensification is generally associated with increasing sedentism, both appearing at the end of the last Ice Age, most probably in connection with increasing population [31] and greater climatic stability [32]. As the authors note, Smith *et al.*'s analyses [19] described above did not include any of this type of hunter-gatherer society because none are still extant.

Of course, agriculture provides the most obvious basis for the creation of ownable resources, but it is important to realize that this will not always be the case (cf. [17]). Just as some foraged resources lend themselves to ownership whereas others do not, the same is true of agriculture. It is not a matter of foraging versus farming but of resource permanence and potential for ownership in terms of excludability and divisibility. Thus, the swidden clearings of shifting horticulture have less potential than fixed fields or herds of animals. This is reflected in the fact that in Smith *et al.*'s [20] comparisons horticultural societies show a pattern of both inequality and transmission of the different wealth categories much more similar to hunter-gatherers than to pastoralists and agriculturalists.

Adler's [33] cross-cultural survey of land tenure found that the duration of access to resource areas tended to increase with the amount of labour invested in the resource. He also found that while the size of the access group initially increases with the amount of labour invested, it then declines, so that at high levels of investment it is households/individuals that become the primary access group. At the same time, the size of the communities in which the access groups are embedded and which are involved in the resolution of access disputes also increases (figure 1). The rights of these individuals/households to their resources may also include inheritance: their passing-on to a new generation, at the death of the individuals concerned or during life, in institutions such as bridewealth and dowry.

Thus, as agricultural input intensifies, rights become more permanent and more exclusive. Among the Hopi of the North American Southwest, for example, spring-fed terraced land was owned and passed down by individual households, and among the Zuni irrigated land belonged to individual households while less intensively used land was open to the broader community ([33]; cf. [34, pp. 24–25]; [35, pp. 60–67]) for similar arrangements among European Alpine communities). For Adler then, land tenure systems are social institutions concerned with specifying rights of access to resources over varying

Figure 1. Idealized relationship between primary resource access group size, level of horticultural labour invested in production and size of community within which primary resource access groups are found. As intensity of agricultural labour increases, community size increases. At the same time the size of the primary resource access group first increases then decreases (from [33, fig. 2]. Copyright (1996), with permission).

periods of time, where the length of time tends to increase with the degree of intensification, and at more intensive levels they provide 'long-term insurance' concerning the future availability of valued resources thus created. Of course, they only provide this so long as the social system that assigns the relevant rights continues to exist. Equally obviously, the possessors of rights to superior resources recognized by the social group will have a competitive advantage.

Many modern hunter-gatherers are known to resist the institution of ownership and to insist on sharing when group members try to establish private property rights, but the number of cases where individuals in sedentarizing hunter-gatherer groups succeed in establishing such rights, and the relationship demonstrated by Adler between intensification and increasing rights, suggest that this is a general tendency in many circumstances. Moreover, while hunter-gatherers depend on sharing to mitigate risk, horticultural households are much more self-sufficient [17], and generalized sharing may even be deleterious for them in some circumstances as a risk mitigation strategy [36,37]. Thus, transitions from sharing to private property should not necessarily be seen simply as a triumph of one set of interests over another; rather the benefits of sharing as a means of risk reduction may have been decreasing and therefore less worth defending against those attempting to assert property rights.

In this context it is worth adding that while stronger rights to tenure with increasing intensification, resulting in the recovery of the costs of investment, do provide an incentive for increased economic activity,

it should not be assumed that improved economic efficiency is the sole, or even the most important result. The existence of power differentials within society, where the powerful are able to create institutions that are largely in their own interest, will have a major impact on outcomes, especially in situations where there are poor dispersal opportunities for lower ranking individuals and groups, and/or where levels of competition between elite factions seeking followers are low (cf. [38]). The inherited ownership rights and privileges jealously maintained by aristocracies against commoners the world over are ample evidence of this. Aristocracies also have the strongest reasons to contest both factional struggles within their own polity and wars between polities since defeat can result in the wholesale reallocation of ownership, especially at higher levels in the social hierarchy.

3. WEALTH AND REPRODUCTIVE SUCCESS

It is now well established that in societies where there is heritable private property in land and/or animals, the availability or otherwise of inherited resources makes a major difference to individual reproductive success (e.g. [39,40]). In other words, the new ecological/institutional conditions change the nature of the reproductive strategies that will be successful. In this respect animals and land have rather different characteristics.

Animal herds are a special kind of property in that they reproduce themselves at timescales that are short in relation to human lifetimes. Herds can be divided between several children (usually sons) so long as each has a herd of minimal threshold size that makes it less vulnerable to major risks. Given a strong correlation between wealth and reproductive success, richer individuals will have to make less severe tradeoffs and generally, other things being equal, the natural increase of animals means that partible inheritance will continue to be successful over the generations, with the rich, over time, being massively more successful than those who can, for example, only endow a single child. In the case of the Gabbra pastoralists of east Africa, Mace [3] showed that the optimum strategy to maximize the number of grandchildren involved giving herds of a certain size to as many sons as possible, dependent on the wealth available. Sons not given herds were at a reproductive disadvantage. Clearly, for poor households there would be risks in only endowing a single son but in principle, for poor households, this would give greater reproductive payoffs than splitting a small herd between several. In fact, for very poor households it would make more sense to invest in daughters, for the bridewealth they attract, as Cronk [41] showed for the Mukogodo.

It has often been argued in the literature that pastoral systems tend to be egalitarian and to have wealth-levelling mechanisms, while wealth differences are likely to be unstable owing to the incidence of natural disasters that can decimate herds. However, as we have seen, this does not correspond to the results of Borgerhoff-Mulder *et al.*'s [15] analyses, and the literature they survey indicates that disasters actually tend to generate increased inequality, because wealthy

households are far more likely to survive them (cf. [42]) while poor households are likely to be pushed out of the pastoral system altogether. Moreover, live-stock transfers from rich households to poorer ones can be a basis for patron–client relations at least as much as levelling mechanisms. Despite the existence of an ideology of equality in pastoralist societies, there tend to be major wealth differentials, they are inherited and they have significant reproductive consequences.

Similarly, wealth in land is also associated with greater reproductive success, with less severe trade-offs for the rich. For example, Pettay *et al.*'s [43] study of natural selection effects on female life histories, based on data from farming families in 18th century Finland, found that there were highly significant differences between women from different wealth categories in their number of grandchildren: the least squares mean number of grandchildren for women from the Rich, Middle and Poor groups was, respectively, 15.77, 11.16 and 6.08. Equally important from the niche construction perspective is that the wealth stratification affects the selection pressures. Thus, for women in the Poor group, earlier age at first reproduction was more strongly selected than later age at last reproduction, while for women in the Rich group this was reversed. More generally, 'If the population is subdivided by lifelong access to resources, selection may lead to divergent evolution on life-history traits, as each wealth class has its own optimal life-history trait combination' ([43]; cf. [3]).

However, wealth in land, where land is an excludable and divisible resource for which it is worth paying the costs of defence, is different from wealth in animals because it cannot be expanded in the same way, thus constraints are even tighter. In rural Ireland in the nineteenth century, for example, though ownership of the land was often vested in distant Protestant landlords, poor Catholic farming families inherited tenancies. Because of the scarcity of land, only one child in each generation was allowed to inherit and only the heir could both marry and stay at home; any other siblings who remained had to stay single. Strassmann & Clarke's [44] study demonstrates the conditionality of this rule on ecological constraints, since the introduction of the potato, by making it possible to support more people per hectare than previous crops and also allowing the extension of cultivation to areas unsuitable for those crops, made partible inheritance and the creation of new landholdings a viable option for a while and led to increased local marriage rates, though it was followed by consolidation and the reversal of this trend.

In contrast to members of farming families, labourers had no possibility of owning land and no reason to delay marriage, though they still ended up having lower average reproductive success than women from farming families. Strassmann & Clarke postulate that the strict rules against downward mobility for non-inheriting sons and daughters without a dowry represented a strategy for maintaining the wealth of the lineage. Moreover, as they also point out, the fact that farms were passed on through the generations by genetically related males is in keeping

with the argument that maintaining wealth is the key to ensuring reproductive success, since a purely economic motivation cannot account for this. As with the Gabbra herd sizes, maintaining and transmitting a minimal holding size was critical. In fact, given the low probability of inheritance for most people in most families, dispersal, i.e. in this context emigration, gave the best fitness payoff.

Netting's famous study of an Alpine community [35] also shows that the introduction of the potato raised the local population ceiling and led to a period of population growth in what was otherwise a tightly constrained situation demographically; again it was accompanied by increased out migration, for which the possibilities had also increased with the growth of industrialization. Here too, 'inheritance formed the crucial link from the land supply to the reproductive potential of the people' [35, p. 226], and though inheritance was partible, a variety of mechanisms kept the number of households from expanding beyond what was viable in terms of size of holding, and resulted in great stability of family lines. There were laws preventing male in-migration and giving political rights only to male descendants of village families, while the dependence of marriage on the acquisition of sufficient resources to form a household led to late marriage and high rates of celibacy, reinforced by Catholic moral values (cf. [45]).

It is clear that any system of land inheritance must have mechanisms for restricting the number of heirs or wealth will be swiftly dissipated. Cuneiform documents from the 2nd millennium BCE state of Sippar show that land was inherited patrilineally and that inheritance was partible [46]. However, celibate sisters who were nuns/priestesses could also inherit an equal share, which then returned to male members of her family on her death. Harris [46, p. 132] suggests that this may have been a device invented by wealthy families to reduce the effects of partibility. These societies were also socially monogamous and Fortunato & Archetti [5] have shown that social monogamy can be a stable strategy reproductively advantageous to males where division of resources leads to a loss of their value, or where wives provide greater paternity certainty in exchange for exclusive transmission of wealth to their children. This is the reason, they argue, for the prevalence of monogamy in the historical societies of Eurasia because they were based on intensive agriculture in conditions of land scarcity, so that landownership provided a major productive and therefore reproductive advantage.

Systems of unigeniture, the transmission of wealth to one offspring only, take things a stage further. We have seen above that unigeniture is a sensible strategy where only a small amount of wealth is available for transmission and there is some minimal threshold below which transmission does not lead to improved reproductive success. What accounts for situations where a large landed estate could be divided into several lots giving improved reproductive success but unigeniture prevails anyway? Baker & Miceli [24] suggest that such a rule will exist when economies of scale are available and a fixed rule can prevent competition between heirs, but does not explain why heirs

with different interests do not contest the rule. Indeed, there is evidence that when competition for a viable amount of land reaches a certain level, this is precisely what happens (e.g. [47]).

Chu [48] provides a contrasting model, much more in keeping with the argument of this paper. Starting from the considerable historical and ethnographic evidence that family heads have often been explicitly concerned with ensuring the continuation of the family line, and also from the assumption that in traditional societies with limited if not non-existent capital markets, children who start with wealth stand a greater chance of themselves becoming rich, he creates a model of the division of inherited resources through the generations that minimizes the probability of lineage extinction and shows that primogeniture is a probable outcome. He proposes therefore that the policy of unequal division leads to the desired goal of lineage prosperity and is preferred by family heads, 'so that at least one of their children is more likely to stay (or become) rich, hence making their succession lines more firm' [48, p. 97]. It also emerges from his model that although unequal bequests increase inequality within a given generation they may actually increase upwards social mobility, in that they give a greater probability of occasional members of lower social groups becoming rich.

Voland's historical demographic analysis of the community of Krummhorn in north Germany in the eighteenth century supports these conclusions. In this agricultural community in a fully occupied landscape, farms were kept together by a system of unigeniture, in this case where the youngest son inherited the farm, and subsequent records demonstrate that elite farmers had much greater reproductive success than the general population over the long term: 'a prosperous farming couple of the eighteenth century had almost twice as many gene replicates in the local population 100 years after wedding than an average family' [49].

The predictions are also borne out by a recent study of resource competition and reproduction in Karo Batak villages in Indonesia by Kushnick [50]. He found that in those families with large landholdings, inter-birth intervals were longer following the birth of a son with at least one brother than in those families with no brothers, the opposite of the effect in landless families. First-born sons in landholding families also had much lower mortality than later ones; the difference was much slighter in landless families.

Similar points are made by Boone [40] in his study of the fifteenth century Portuguese nobility, and by Hill [51] in her evolutionary analysis of the situation of medieval religious women. Summers' paper on the evolutionary ecology of despotism [52] makes an argument on similar lines in many respects to that presented here, noting that aristocratic endogamy was a further means of ensuring the continuing existence of lineage land holdings (cf. the discussion by Smith *et al.* [20] about the importance of positive assortment in marriage partners for wealth transmission). In addition, as noted above, Boone & Kessler [42] show that over the long term, investing in higher status can also lead to greater fitness than

having more children if catastrophic events occur with any regularity and higher status individuals are more likely to survive them.

McNamara & Houston [53] provide a general framework for considering the reproductive consequences of different behavioural strategies when inter-generational effects are strong. In a simple model where individuals are genetically the same but in two quality states, the higher the correlation between the state of parent and offspring as high quality is passed on over the generations, the greater the reproductive value of high quality relative to low quality individuals in the long term. In the light of what we have seen above, such effects are likely to be relevant even in hunter-gatherer societies where only embodied and relational wealth are relevant, but much stronger in the case of the material capital represented by domestic animals and by land or other fixed assets, when they are the object of long-term investment and justify the potential payment of defence costs.

The effects of this situation are profound because the existence of the inter-generational transmission of quality means that the fitness of a strategy is given by 'the annual growth rate of numbers of descendants far into the future' [53, p. 72]. Thus we cannot simply look at the number of, say, grandchildren, to evaluate it. '... when there are strong inter-generational effects ... maximization of fitness does not necessarily maximize expected numbers of offspring or even grandchildren or great grandchildren' [53].

In the particular model case they illustrate, individuals are defined as either high quality (H) or low quality (L). Low quality individuals have one strategy available (L(1)): they leave on average 1 surviving offspring, and that offspring is low quality with probability 0.8, high quality with probability 0.2. High quality individuals have two strategies available: under H(1.5) 1.5 offspring survive on average, each high quality with probability 0.9, low quality with probability 0.1; under H(2.0) 2 offspring survive on average, each with probability 0.5 of being high or low quality. Strategy 1 involves taking action L(1) when low quality and H(1.5) when high quality; strategy 2 takes L(1) when low quality and H(2.0) when high quality. Suppose that at time 0 equal numbers follow each of the two strategies and all are in the high quality state (figure 2).

Because strategy 2 produces more offspring, there are less individuals following strategy S1 than strategy S2 to start with, though they are of higher mean quality. However, this difference in quality of individuals following strategy S1 (H(1.5) when they are high quality) does not win out over S2 (H(2.0) when high quality), in terms of the number of individuals following it, until the fifth generation. After that the success of strategy S1 goes on to far outstrip S2 into the future; in this case after 100 generations the relative number following S1 compared with S2 is 34851, even though the superior fitness of strategy S1 would not have been reflected in the number of grandchildren, or even great grandchildren.

As they go on to point out, a number of authors have considered wealth inheritance in the context of intergenerational effects on reproductive fitness (e.g. [7,54]), but the former simply assumes an

Figure 2. The relative number of offspring produced by the strategy of having less offspring but investing more in them (S1) compared with having more but investing less (S2). In the first time step S1 does markedly less well than S2; after that it begins to do better though the proportion of individuals following S1 does not exceed the proportion following S2 until the fifth generation. From [61].

equal allocation of wealth to offspring while the latter looks only at short-term impacts. The key point that McNamara & Houston's model explicitly demonstrates is that where there are strong intergenerational effects it pays to give continuing priority through the generations to maintaining high quality at the expense of immediate reproductive success (cf. [6]). These strong intergenerational effects change the nature of the selection pressures and where they act.

As we have seen, the best strategy for maintaining high quality over the generations when it comes to wealth inheritance will vary depending on the nature of the resources, but at least when the resource is land, it appears that a combination of social monogamy and unigeniture or other means of restricting inheritance will be an extremely successful strategy in many situations.

4. THE ARCHAEOLOGICAL RECORD

The problem with trying to trace evidence of these niche construction processes in prehistory on the basis of the archaeological record is that we have no direct evidence of reproductive success except in the most general terms, for example the greater reproductive success of farming compared with foraging strategies at the time of the expansion of farming into Europe, on the basis of the population growth this produced ([55,56]; cf. [45]). Less difficult, but still problematical, is the making of inferences about prehistoric property rights, from which inferences about inheritance may then be made. Hayden [29,30] argued that property rights in favoured fishing sites and raw material sources could be identified at a site on the Canadian Plateau in British Columbia and that the long span of time over which the pattern of differential resource use was present at the site indicated that the rights must have been inherited, a proposal entirely in keeping with what is known ethnographically about both the inequality present in the hunting-fishing-gathering societies from this region

and the private property rights over resources like favoured fishing locations that existed within them and provided the basis for the inequality.

Kuijt & Finlayson [57] have identified early granaries at the Pre-Pottery Neolithic A site of Dhra' in the Levant, *ca* 11 500–11 000 BP, at a time when cereals were being cultivated but not yet domesticated, and have shown that the earliest granaries were located in extramural locations between houses. A thousand years later, it appears that food storage begins to take place inside houses, while by 9500 cal BP, houses have dedicated storage rooms. The authors suggest that this is indicative of a shift from communal to private ownership. In the same region at 7000 cal BP there is evidence for the existence of property differentials on a much greater scale. At the site of Tel Tsaf, Garfinkel *et al.* [58] have shown that some individual courtyards with nuclear family-sized houses contained grain storage silos with a capacity 12–24 times greater than the annual grain needs of such a family. Moreover, the cultivated area required to produce such massive quantities of grain would have been beyond the capacity of a single family to cultivate and harvest, suggesting both differential landownership and a source of dependent labour, or at least some means of extracting surplus from other households.

Ethnographically, cattle are almost invariably an important form of property and source of wealth, more important for their milk yields, labour and use in social transactions than as a source of meat (*cf.* discussion in [59]). The fact that they may be communally managed does not mean that they are communally owned. The high percentages of cattle bones found on the sites of the earliest farming societies of Central Europe 7500–7000 BP [60], together with contemporary evidence for the human consumption of milk [61], provide strong evidence for the existence of private property in cattle (*cf.* [62]). The fact that they often appear to be communally consumed in feasts does not contradict this. When cattle are killed there is so much meat that it is hardly an exaggeration to suggest that feasting is virtually inevitable, and the political credit to be gained by powerful households from holding feasts is obvious.

Bogaard's [63] argument that the crop-growing system in these early farming societies depended on the intensive use of small areas of land also points to the existence of private property rights, while van der Velde's [64] analysis of settlement evidence of the earliest farmers in the Netherlands and western Germany pointed to the existence of long-term social patterns: particular households and groups of households seem to have continued through time, with continuing inheritance of status witnessed by the rebuilding of houses of the same type in the same places, and greater differentiation between houses over time suggesting increased inequality, a pattern associated with populations reaching local carrying capacities [65]. In some areas this was associated with the first appearance of cemeteries, which a number of authors have regarded as representing an ancestral claim to territory in the face of increasing competition, and there may be significant differentials in burial wealth [66].

Such arguments as these are also supported by other indirect lines of evidence. By applying the

phylogenetic comparative approach to cross-cultural data, Fortunato & Mace [67] showed that in societies speaking Indo-European languages an association of bridewealth with polygyny and of dowry with monogamy does not arise as a result of historical relatedness but because the practices of bridewealth and dowry, on the one hand, and polygyny and monogamy, on the other, evolved together, with the implication that there might be a functional relationship between them. Dowry with monogamy represents the most probable ancestral state at the root of the Indo-European tree and a statistical analysis of the most probable evolutionary path from this state shows that bridewealth with polygyny and dowry with monogamy represent relatively stable configurations whereas the converse combinations do not. As we have seen, monogamous marriage can be a stable strategy reproductively advantageous to males where division of resources leads to a loss of their value, or where wives provide greater paternity certainty in exchange for exclusive transmission of wealth to their children [5]. A connection between such postulated practices and early farmers in Europe is suggested by recent estimates of the date of the root of the Indo-European language tree to between 8000 and 10 000 years ago [68], which potentially links their spread to the spread of farming and farmers [69]. It is also in keeping with strontium isotope evidence for patrilocality among the earliest Central European farmers [70]. In short then, while such arguments about the existence of inheritance institutions related to material wealth remain speculative, inferences about their existence in the prehistoric past are not wholly beyond our reach.

5. CONCLUSION

The long-standing tradition within the social sciences of assuming that wealth and power are ends in themselves largely misses the point. They became the focus of human attention and competition in contexts, in particular of agricultural intensification and the scarcity of land, where the inheritance of property and the vastly increased importance of inter-generational effects that it produces changed the nature of reproductive competition. The emergence of private property rights has niche constructing properties that affect selection pressures on reproductive strategies in several related ways. First, it drastically changes the relative importance of the different types of inter-generational transfers that affect reproductive success and greatly extends the range of inequality (*cf.* [1]). Second, the wealth stratification introduced creates reproductive stratification in populations in terms of selection on the best reproductive strategies to follow; the strategies that are most successful for the wealthy are not the same as those that produce the best outcomes for the poor [6]. Third, the different characteristics of wealth in animals and land lead to different best reproductive strategies in cases where one or other is clearly dominant, tending to involve polygyny on the one hand and monogamy on the other. Fourth, the enhancement of the importance of inter-generational transfers means that in the case of

land and other relatively fixed resources greater long-term reproductive success can be achieved not by maximizing the number of grandchildren but by strategies that focus on keeping wealth intact through the generations, a strategy that has further benefits for success in intra-elite competition, where failure can be disastrous (cf. [25]). Despite appearances to the contrary, it is these factors affecting reproductive success that are responsible for the focus on wealth and power as apparent ends in themselves by social actors, once inter-generationally transmissible productive property rights come into existence. There are many indications that social actors themselves are aware of this (e.g. [48]), even though most social science studies have not been, because, in contrast to evolutionary approaches, they have been fixated on production and blind to reproduction.

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