McDONALD INSTITUTE CONVERSATIONS

Social inequality before farming?

Multidisciplinary approaches to the study of social organization in prehistoric and ethnographic hunter-gatherer-fisher societies

Edited by Luc Moreau

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with contributions from
Hervé Bocherens, Alberto Buela, Andrea Czermak, Christophe Darmangeat, William Davies, Mark Dyble, Kate Ellis-Davies, Ben Fitzhugh, Douglas P. Fry, Mietje Germonpré, Matt Grove, Emmanuel Guy, Brian D. Hayden, Rowena Henderson, Emmanuelle Honoré, Joe L. Jeffery, Charles A. Keith, Marta Mirazón Lahr, Noa Lavi, Robert H. Layton, Martina Lázničková-Galetová, Julia Lee-Thorp, Sheina Lew-Levy, Paul Pettitt, Rachel Reckin, Paul Roscoe, Mikhail V. Sablin, Rick J. Schulting, Patrik Söderberg, Duncan N.E. Stibbard-Hawkes, Ilga Zagorska, Gunita Zarina

Published by:
McDonald Institute for Archaeological Research
University of Cambridge
Downing Street
Cambridge, UK
CB2 3ER
(0)(1223) 339327
eaj31@cam.ac.uk
www.mcdonald.cam.ac.uk

ISBN: 978-1-913344-00-9

On the cover: *Rock art depictions at Wadi Sūra II rockshelter in Eastern Sahara, Egypt (photo Emmanuelle Honoré)*.

Cover design by Dora Kemp and Ben Plumridge.
Typesetting and layout by Ben Plumridge.

Edited for the Institute by James Barrett (*Series Editor*).

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Preface

I write this preface from the state of Wyoming in the US, a state where COVID-19 has not (yet) struck as hard as it has struck other parts of the world, but where we nonetheless have been under stay-at-home orders. Those orders have given me plenty of time to think about where we went wrong, which in the case of the US is a long list. Coincidentally, I also recently re-read Machiavelli's sixteenth-century book, *The Prince*, a manual of how to ruthlessly crush opponents while administering (apparent) generosity to acquire the 'love' of the masses.

It was in this context that I read the papers in this volume. In doing so, I was struck by two facts. First, inequality's origin, development and operation are difficult to understand and yet the actions that lead to inequality are easy to implement. This shouldn't surprise us: no American baseball player mathematically calculates the arc of a fly ball, but he's still able to position himself in the right place to catch it. You can be utterly uneducated and still know how to manipulate a system to maintain exert, and abuse power. Many world leaders today are proof.

Second, I think that the papers in this volume could be some of the most valuable published in anthropology in many years. Philosophers and social thinkers have tried to understand inequality for a century; indeed, efforts to understand it precede Machiavelli. We bemoan its existence, and yet we have felt unable to grasp it, and, unable to grasp it, unable to do something about it. We muddled through the useless ramblings of nineteenth- and early twentieth-century evolutionists, who, reflecting their colonial environment, often thought that inequality was a good thing, and, if not good, an inevitable thing. Marx tried to shake them out of that complacency, but his brilliance was largely wasted during his 'second coming' in the second half of the twentieth century with so much hand-wringing about how a theory intended to explain early capitalism should also apply to hunter-gatherers (because, it must… right?), and so much politically correct posturing that led to no action – and all but disappeared when the Berlin Wall (thankfully) came down and the Soviet Union collapsed. 'Intensification' and 'complexity', words that should be stricken from anthropology's vocabulary for their uselessness (and that are thankfully rare in this volume), masked what was really going on: exploitation, oppression, slavery… inequality in all its manifestations. Finally, I think, we have reached the point, through analyses of archaeological and ethnological data, that we might actually understand inequality.

We've passed a Rubicon. And this really matters.

The calamity that is COVID-19 has pulled back the curtain on modern society, exposing the weaknesses of its structure, laying bare the inequality between and within countries that Machiavellian leaders exploit and exacerbate for personal gain. Doing something about inequality is the challenge that will remain after COVID-19 dissipates.

These papers help by seeking the origin of inequality in a kind of society, that of nomadic hunter-gatherers, that we once considered 'the original affluent society', a classless society, or 'primitive communists'. Some argue that inequality must be there (as Marxist analysts argued in the 1980s) since it is present in our closest primate relatives, and therefore is in humanity's genetic foundation. Some see evidence of social and/or political inequality among Palaeolithic hunters, in the evidence for secret societies and in the violence of cave art. I am not convinced by this 'grimdark' vision of Palaeolithic society, and see an enormous gap between difference and inequality, between a situation where one person has more than another who nonetheless has enough and one in which society gives a person permission to enslave another.

Nonetheless, these chapters remind us that hunter-gatherers are not angels, and the same self-interest that guides an Iñupiaq man to become a *umialik*, or that gave privilege to those men allowed to gather in the torch-lit gallery of Lascaux, guides Machiavelli's anonymous prince. People have different skills, and for some, those skills are political. Under the right conditions, those individuals can consolidate power, convince others to go to battle, and make their personal aggrandizement seem reasonable to the people paying its price. Palaeolithic society had its Hitlers and Stalins, its Caesars and Trumps.

But it didn't have imperialism, or empires, or palaces, or wealth hidden in tax havens. So other chapters here look for the conditions under which those 'selfish' individuals can gain power. High population density (pressure), localized and hence controllable resources,

the ability to build a coalition, which requires a sufficient concentration of population and social institutions that are conducive to creating coalitions, lack of trust in institutions, including sharing networks, to provide in times of stress – these are the conditions that permit those with political skills to pursue self-interest through the manipulation of others.

These conditions are as relevant to understanding the world of today as they are to an understanding of the Palaeolithic world. Today, however, conditions can be manipulated, for example 'localized' in off-shore bank accounts. Population pressure is high and will become worse as the world approaches the projected population of 11 billion by 2100. And competition is worsened by a capitalist economy that encourages ever-increasing amounts of consumption and conversion of needed resources, such as food, into higher profit margin items such as crisps and alcoholic beverages. Information is a resource, and technology makes information more available but less trustworthy. Unbelievably expensive displays of potential force – multi-billion-dollar aircraft carriers, atomic weapons, a Space Force – signal a lack of trust in non-violent institutions to resolve the inevitable disputes that arise when people, or countries, pursue their self-interests with little regard for others. Building trust in institutions – in the UN, in voting, in the media, in government itself! – is an integral part of stopping and even reversing the arms race before it drives the world to the poor house.

Inequality is an old story, and one that we understand much better due to the efforts of anthropologists and archaeologists. It hasn't been easy to arrive at this point. But the really hard work – implementing our knowledge – still lies ahead for us. This volume, and our prehistoric hunting and gathering ancestors tell us what needs to be done. And it is the most important work anyone could be doing in the world today.

Robert L. Kelly
University of Wyoming

Appendices to Chapter 9

Responses of Upper Palaeolithic humans to spatio-temporal variations in resources: inequality, storage and mobility

William Davies

APPENDIX A.

Table 9.A1. *Immediate- and delayed-return systems (Woodburn (1982, 2005)). These are not binary opposites, but extremes of a continuum of variation; many hunter-gatherer groups contain elements of both systems (though Woodburn (1982: 433) argues that immediate-return strategies practised by delayed-return societies are limited and have a low social value placed upon them).*

Immediate-return	Delayed-return
People obtain a direct and immediate return from their labour: eat the food foraged on the same day, or soon after. Social groupings are flexible, and fluid in composition. People free to move from one camp to another (temporarily or permanently) without penalty or loss of vital interests.	People hold rights over valued assets, which represent a yield, a return for labour and time, or are effectively managed as 'delayed yields on labour' (1982: 433). Four main types of asset (generally found in combination):
• Relatively simple, portable, utilitarian, easily acquired, replaceable tools and weapons, made with real skill but not involving a great deal of labour (cf. Bleed's (1986) Maintainable technology). No *dependence* on sharing/ pooling of resources or equipment (e.g. weapons, nets). Valued assets are temporary, e.g. carcass of a large animal, and are not accumulated.	• Valuable (owing to manufacturing time, effort and expertise) technical production facilities that yield food gradually over months or years, e.g. boats, nets, fish weirs, stockades, traps (cf. Bleed's (1986) Reliable technology).
• Food is neither elaborately processed nor stored (cf. Binford's (1980) Foragers and Bettinger's (1991) Travellers), though portable storage is possible in small quantities. Nomadism is fundamental, with no fixed locations (dwellings, base-camps, hunting/fishing apparatus, ritual sites), resources or assets to constrain movement.	• Processed and stored food or materials, usually in fixed dwellings (cf. Binford's (1980) Collectors and Bettinger's (1991) Processors).
• No management or control of resources: all individuals have direct access, though limited by sexual division of labour, to the uncollected resources of their territories/ranges. Potential defence of some fixed resources, e.g. patches of predictable plant foods.	• Wild products that have been improved or increased by human labour (cf. Resource Management (Williams & Hunn 1982)).
• Systematically eliminate distinctions (except those between sexes and initiated/uninitiated) of wealth, power and status. More autonomy for women than in delayed-return systems.	• Female kin bestowed by their male relatives in marriage alliances.
• People not dependent on *specific* others for access to basic requirements. All interpersonal relationships (not just kinship) emphasize sharing and mutuality, though not necessarily long-term or binding.	• Binding commitments and dependencies between people (based on kinship or contract), to secure yields and manage assets. People are bound to close kin and affines in relationships that commonly involve the constant exchange of goods and services in fulfilment of obligations; bound to each other through material obligations and interpersonal responsibilities.
• Weaponry provides direct and immediate access to social control; not mediated through formal institutions or through interpersonal relationships. No formal heads of household, though some individuals may have influence on certain group decisions.	• Acephalous delayed-return societies show competition between heads of household (egalitarianism is horizontal, within social classes, and maintained by equal exchange of things of the same type – cf. Zubrow 2010) for wealth, prestige and status.
• Children generally have freedom to make choices: learning self-reliance.	• Intergenerational inequality; heirs controlled by their fathers (heads of household).
• Unrestricted access to food, water, other resources (shelters, tools/weapons, trading items) and ornaments. Equality of opportunity for individuals in access to resources (limited by sexual division of labour) is not always matched by equality of yield (those vary by skill, luck, persistence, capacity to work, etc.) (cf. Zubrow 2010). Flexible rules for acquisition of possessions: no-one depends on inheritance or formal transmission by preceding-generation close kin.	• Relationships and access to resources are not equal between household heads, their wives, female kin and junior male kinsmen.
Individuals can choose their associates during residence, foraging, trade and exchange, and in ritual contexts. This right is constantly exercised, limiting enduring bonds and inhibiting development of authority and intragroup dependency. Fission-fusion used to resolve intragroup tensions. Group members often eat when they wish (if food available); allocated resources from sharing will be consumed by whoever happens to be around.	Vertical control of food and other resources (including assets), and access to them, helping to differentiate group members. Food often consumed in communal meals (allocations can be controlled, even for the heirs of household heads). Restricted ability to move between groups without penalty.
Religion and ritual: consecrated sharing in the context of joint participation of the whole community, even if select individuals might act as channels for numinous forces. Ability to become healers or to learn and practise religious beliefs and rituals not restricted or controlled.	Cults and restricted knowledge; using secret material and intellectual property of initiates; sacred objects often concealed in the landscape, and protected by secrecy, deception and threats of violence against non-initiates. Male cults often more powerful and elaborated than female ones, even in societies that are egalitarian in secular contexts. Within initiates, sacred knowledge can be shared in a less-restricted fashion.

APPENDIX B.

Table 9.B1. *Effective Temperature and Net Primary Productivity values for ethnographic foraging groupings and estimates for 42 ka, 30 ka and 21 ka. 'Q1' = first quartile; 'Q3' = third quartile. Ethnographic data from Binford (2001) and Kelly (2013).*

	Effective Temperature (ET): °C							**Net Primary Productivity (NPP): grammes carbon per sq. m per year**						
Ethnographic	***N***	**Mean & SD**	**Min**	**Q1**	**Median**	**Q3**	**Max**	***N***	**Mean & SD**	**Min**	**Q1**	**Median**	**Q3**	**Max**
Polar	*17*	9.7 ± 0.8	8.5	9.0	9.5	10.3	11.6	*13*	158.4 ± 101.3	45	89	115	209	333
Sub-polar/cold forests	*35*	11.0 ± 0.8	9.0	10.5	10.9	11.25	12.7	*21*	402.9 ± 180.9	144	245	354	533	772
Pacific Northwest Coast	*18*	11.6 ± 0.8	10.5	11.1	11.7	12.3	12.7	*14*	795.7 ± 95.1	633	729.25	825	855.75	943
Plateau (forests)	*11*	12.7 ± 0.5	12.1	12.4	12.6	13.3	13.3	*8*	343.5 ± 77.4	259	284.5	319	389.25	464
Plains	*10*	12.9 ± 1.3	11.3	11.6	13.1	14.1	14.6	*9*	534.9 ± 242	283	397	432	706	1045
Great Basin	*19*	13.0 ± 0.9	11.7	12.4	12.9	13.6	15.0	*14*	250.7 ± 150.2	45	163.75	210.5	306	583
California	*32*	13.8 ± 0.7	12.7	13.3	13.8	14.4	15.0	*14*	564.9 ± 202.2	26	478.75	567	697.25	812
42 ka:														
Europe	*2424*	11.8 ± 1.2	7.7	11.1	11.9	12.6	14.7	*2424*	245.2 ± 97.1	2	179	248	307	624
Cantabria	*7*	10.6 ± 0.6	9.8	10.1	10.8	11.0	11.2	*7*	63.3 ± 84.8	0	0	0	118	207
Southwest France	*6*	12.3 ± 0.2	11.9	12.4	12.4	12.4	12.5	*6*	311.8 ± 30.5	273	290.5	310.5	335	350
Moravia	*2*	12.1 ± 0.2	12.0	12.0	12.1	12.1	12.2	*2*	283.5 ± 10.6	276	279.75	283.5	287.25	291
30 ka:														
Europe	*2293*	11.8 ± 1.1	7.6	11.1	11.7	12.6	14.5	*2293*	231.5 ± 92.2	1	169	237	290	595
Cantabria	*6*	10.3 ± 0.6	9.6	9.7	10.1	10.7	11.1	*6*	65.0 ± 52.8	0	20.25	84	93	127
Paviland	*1*	N/A	10.2	N/A	N/A	N/A	10.2	*1*	N/A	134	N/A	N/A	N/A	134
Southwest France	*7*	12.2 ± 0.2	11.8	12.1	12.2	12.3	12.4	*7*	292.9 ± 19.4	260	282.5	298	304.5	318
Moravia	*4*	11.8 ± 0.1	11.6	11.7	11.8	11.8	11.9	*4*	266.0 ± 13	257	257.75	261	269.25	285
Sunghir	*1*	N/A	11.4	N/A	N/A	N/A	11.4	*1*	N/A	272	N/A	N/A	N/A	272
21 ka														
Europe	*1792*	11.2 ± 1.1	7.6	10.4	11.1	12.1	14.1	*1792*	215.7 ± 99.9	1	153	216.5	271	731
Cantabria	*4*	10.0 ± 0.2	9.7	9.9	10.1	10.1	10.1	*4*	122.3 ± 198.8	0	0	36.5	158.75	416
Southwest France	*4*	11.0 ± 0.05	11.0	11.0	11.0	11.1	11.1	*4*	288.3 ± 3.5	284	286.25	288.5	290.5	292
Moravia	*1*	N/A	10.9	N/A	N/A	N/A	10.9	*1*	N/A	194	N/A	N/A	194	194

APPENDIX C: DEMOGRAPHY.

Table 9.C1. *Modelled/Estimated Upper Palaeolithic regional populations and densities (see below table for notes).*

Details	Occupation area (sq. km)	Site N	Metapopulation				Density (persons per 100 sq. km)				Regional group N
			Mean	Range	Median	Interquartile range	Mean	Range	Median	Interquartile range	
Hahn (1977):											
Central & Eastern Europe Aurignacian	[5,000,000–10,000,000]	N/A	500,000–1,000,000					10.0–20.0			
Straus (1986):											
Eastern Asturias (Magdalenian)	1250	N/A	200–250 (scaled up to 2000–25,000)					16–20			
Biraben (1988):											
France:											
Châtel.-Aurig-Gravettian	*c.* 550,000–700,000	209 (410)	*c.* 8000–10,000					1.14–1.82			
Aurignacian-Gravettian	*c.* 550,000–700,000	?	*c.* 9000					1.29–1.64			
Solutrean	*c.* 700,000	66 (520)	15,000–20,000					2.14–2.86			
Magdalenian	*c.* 550,000–700,000	301 (480)	15,000–20,000					2.14–3.64			
Delpech (1999: 36):											
c. 21–22 ka (*c.* 18,000 uncal. BP)	100,000	N/A	750				0.75				
c. 17–19 ka (14,000–16,000 uncal. BP)	600,000	N/A	49,500				8.25				
c. 15.4–17 ka (14,000–13,000 uncal. BP)	1,500,000	N/A	258,750				17.25				
Rozoy (2001; 1996):											
Final Magdalenian:											
Perigord – Vienne + Quercy	35,000	*c.* 154	6000 (6500)				17.14 (18.57)				
Pyrenees	35,000	87	N/A (2500)				N/A (7.14)				
Massif central	25,000	63	N/A (1500)				N/A (6.0)				
Provence-Languedoc	15,000	>25 (23)	2500 (1000)				16.67 (6.67)				
Saone-Alpes	20,000	39	N/A (1500)				N/A (7.5)				
Pincevent-Ardenne	15,000	36	1200–1500 (1000)				8.0–10.0 (6.67)				
Bocquet-Appel & Demars (2000):											

Table 9.C1 *(cont.).*

Details	Occupation area (sq. km)	Site N	Metapopulation				Density (persons per 100 sq. km)				Regional group N
			Mean	Range	Median	Interquartile range	Mean	Range	Median	Interquartile range	
Aurignacian: southwest France	65,700 (57,800)	159	3421				5.21 (5.92)				
Rest of France	545,800 (486,400)	60	1303				0.24 (0.27)				
Britain, Low Countries, Germany	831,200 (585,300)	32	706				0.08 (0.12)				
Gravettian: southwest France	65,900 (57,800)	119	4429				6.72 (7.66)				
Rest of France	561,600 (486,400)	61	2254				0.4 (0.46)				
Britain, Low Countries, Germany	950,400 (585,300)	29	1088				0.11 (0.19)				
Solutrean/Badegoulian (LGM): southwest France	75,300 (57,800)	136	5541				7.36 (9.59)				
Rest of France	579,400 (486,400)	83	3396				0.59 (0.7)				
Britain, Low Countries, Germany	296,100 (245,000)	0	0				0 (0)				
Magdalenian: southwest France	65,900 (57,800)	194	10,046				15.24 (17.38)				
Rest of France	561,600 (486,400)	294	15,271				2.72 (3.14)				
Britain, Low Countries, Germany	950,400 (585,300)	284	14,860				1.56 (2.54)				
Kretschmer (2015); Maier et al. (2016); Maier & Zimmermann (2017); Schmidt & Zimmermann (2019):											*Median (Q1–Q3):*
Portugal: earlier Gravettian	12,493				156	179–131			1.25	1.43–1.05	3.6 (4.2–3.0)
Later Gravettian	18,798				159	194–102			0.85	1.03–0.54	3.7 (4.5–2.4)
LGM	15,883				221	429–88			1.39	2.7–0.55	5.1 (10.0–2.1)
Southern Spain: LGM	17,395				242	469–97			1.39	2.7–0.56	5.6 (10.9–2.3)
Southeast Spain: LGM	8128				113	219–45			1.39	2.69–0.55	2.6 (5.1–1.1)
Eastern Spain: LGM	7183				100	194–40			1.39	2.7–0.56	2.3 (4.5–0.9)
Northeast Spain: LGM	53,63				75	145–30			1.4	2.7–0.56	1.7 (3.4–0.7)
Northern Spain: Aurignacian	18,973				264	134–818			1.39	4.31–0.71	6.2 (19.3–3.1)
Earlier Gravettian	21,270				265	305–223			1.25	1.43–1.05	6.2 (7.1–5.2)

Table 9.C1 *(cont.).*

Details	Occupation area (sq. km)	Site N	Metapopulation				Density (persons per 100 sq. km)				Regional group N
			Mean	Range	Median	Interquartile range	Mean	Range	Median	Interquartile range	
Later Gravettian	15,900				135	164–86			0.85	1.03–0.54	3.1 (3.8–2.0)
Iberia: Upper-Final Magd.	57,000				2990	1750–3550			5.3	6.2–3.1	69.5 (40.7–82.6)
Pyrenees: Aurignacian	2809				39	20–121			1.39	4.31–0.71	0.9 (0.5–2.9)
Upper-Final Magd.	18,900				80	70–160			0.4	0.8–0.4	1.8 (1.7–3.6)
Southwest France: Aurignacian	31,430				437	221–1356			1.39	4.31–0.71	10.3 (31.9–5.2)
Earlier Gravettian	60,201				793	1010–313			1.32	1.68–0.52	18.4 (23.5–7.3)
lLater Gravettian	32,920				279	340–178			0.85	1.03–0.54	6.5 (7.9–4.1)
Franco-Cantabria: LGM	135,574				1887	3659–755			1.39	2.7–0.56	43.9 (85.1–17.6)
Early Magd.									0.16	0.004–0.31	
Middle Magd.									0.18	0.11–0.32	
Upper Magd.									0.48	0.3–0.56	
Final Magd.									0.48	0.3–0.55	
(Southwest France:) Upper-Final Magd.	26,600				1850	1180–2080			7.0	4.4–7.8	42.9 (27.4–48.4)
Narbonne/Aude: Aurignacian	4600				64	32–198			1.39	4.31–0.71	1.5 (4.7–0.8)
West Central France: Aurignacian	3080				43	22–133			1.39	4.31–0.71	1.0 (3.1–0.5)
Central-southwest France: Upper-Final Magd.	33,200				210	130–390			0.6	0.4–1.2	4.8 (3.1–9.1)
Burgundy: Earlier Gravettian	25,308				333	425–132			1.32	1.68–0.52	7.8 (9.9–3.1)
Later Gravettian	14,951				127	155–81			0.85	1.04–0.54	2.9 (3.6–1.9)
Jura/W. Alps: Upper-Final Magd.	28,900				260	150–410			0.9	0.5–1.4	6.0 (3.4–9.6)
Paris Basin: Upper Seine valley: LGM	16,205				226	437–90			1.39	2.7–0.56	5.2 (10.2–2.1)
(Paris Basin:) Upper-Final Magd.	10,700				240	170–380			2.2	1.6–3.6	5.5 (4.0–8.9)
South Rhône: Aurignacian	5792				81	41–250			1.39	1.39–0.71	1.9 (5.9–1.0)

Table 9.C1 *(cont.).*

Details	Occupation area (sq. km)	Site N	Metapopulation				Density (persons per 100 sq. km)				Regional group N
			Mean	Range	Median	Interquartile range	Mean	Range	Median	Interquartile range	
Earlier Gravettian	9693				121	139–101			1.25	1.43–1.04	2.8 (3.2–2.4)
Later Gravettian	11,853				100	123–64			0.84	1.04–0.54	2.3 (2.9–1.5)
Southern France: LGM	19,114				266	516–106			1.39	2.7–0.55	6.2 (12.0–2.5)
Provence: earlier Gravettian	6507				81	93–68			1.24	1.43–1.05	1.9 (2.2–1.6)
Later Gravettian	0				0	0			0		0
Provence/Liguria: LGM	6017				84	162–33			1.4	2.69–0.55	1.9 (3.8–0.8)
Britain: Upper-Final Magd.	12,700				160	120–260			1.3	0.9–2.0	3.7 (2.8–6.1)
Belgium: Aurignacian	7276				218	153–308			3.0	4.23–2.1	5.1 (7.2–3.6)
Earlier Gravettian	19,731				328	489–194			1.66	2.48–0.98	7.6 (11.4–4.5)
Rhine-Meuse: Upper-Final Magd.	19,800				230	130–440			1.2	0.7–2.2	5.3 (2.9–10.3)
Upper Danube: Aurignacian	4654				140	98–197			3.0	4.23–2.1	3.3 (4.6–2.3)
Earlier Gravettian	20,361				187	313–174			0.92	1.54–0.85	4.4 (7.3–4.1)
Later Gravettian	0				0	0			0	0	0
Swabian-Franconian Alb: Upper-Final Magd.	21,700				460	140–310			2.1	1.4–5.3	10.6 (7.1–26.5)
Northwest Czech republic: Aurignacian	1216				10	7–15			0.84	1.24–0.59	0.2 (0.4–0.2)
Middle Danube: Danubian/Moravian Aurignacian	19,720				166	117–244			0.84	1.24–0.59	3.9 (5.7–2.8)
Earlier Gravettian	56,723				292	421–152			0.51	0.74–0.27	6.8 (9.8–3.5)
Later Gravettian	23,692				172	459–128			0.73	1.94–0.54	4.0 (10.7–3.0)
Central Europe: LGM	22,159				32	53–30			0.14	0.24–0.14	0.8 (1.2–0.7)
Southern Poland (Kraków): Aurignacian	2865				24	17–35			0.84	1.24–0.59	0.6 (0.8–0.4)
Upper Tisza: Aurignacian	2678				33	11–72			1.23	2.71–0.39	0.8 (1.7–0.2)
Middle Tisza: Aurignacian	2095				26	8–57			1.23	2.71–0.39	0.6 (1.3–0.2)
Prut: earlier Gravettian	10,753				224	290–182			2.08	2.7–1.69	5.2 (6.8–4.2)

Table 9.C1 *(cont.).*

Details	Occupation area (sq. km)	Site N	Metapopulation				Density (persons per 100 sq. km)				Regional group N
			Mean	Range	Median	Interquartile range	Mean	Range	Median	Interquartile range	
Later Gravettian	5696				41	110–31			0.72	1.93–0.54	1.0 (2.6–0.7)
LGM	22,392				33	46–31			0.15	0.21–0.14	3.7 (4.5–2.4)
Eastern Central Europe: Upper-Final Magd./ Epigravettian	18,200				170	110–270			0.9	0.6–1.5	4.0 (2.6–6.2)

Notes:

Hahn (1977):	Based on site and intra-site structure sizes, artefact/faunal remains densities, and ethnographic comparisons. ≥2500 people assumed to have lived in western Germany (based on Lone & Ach valleys, Wildscheuer and Lommersum); if missing evidence is considered, the same area did not have more than 25,000 people. Local group sizes of 20–30 people.
Straus (1986):	For southernmost (warmer) part of eastern Asturias (10,000–15,000 sq. km): 200–250 people in an autonomous regional group within a fraction of that territory (1250 sq. km today: slightly larger in Lateglacial?). Calculation is based on 80–100 red deer herds of 100 individuals each, supporting 8–10 specialist 25-person bands.
Biraben (1988):	Dupaquier found it hard to distinguish Châtelperronian, Aurignacian and Gravettian, owing to temporal overlap. Demic increases attributed to the Solutrean & Magdalenian, in part owing to technological developments. Estimate (a) was derived from site numbers in the *Atlas Archéologique Universel* (1978) (numbers multiplied by factor of 10); that in (b) was derived from site numbers in *La Préhistoire Française* (1976). Number of sites over duration of technocomplex is scaled by a Restitution Coefficient (logarithmic logistic curve): weighting of earlier technocomplexes was increased to avoid over-dominance of most recent Palaeolithic.
Delpech (1999):	Estimating LGM-Lateglacial ungulate productivities (and resultant human population densities) for the region stretching from north of the Pyrenees and across to the east of Poland (mostly the North European Plain).
Rozoy (1996 & 2001):	Site N, mean meta-population & population density values taken from 2001 paper, with 1996 ones in parentheses. 1996: Based on prey productivity (boar & red deer) and energy requirements. Cantabrian estimate taken from Straus (1986) for an autonomous regional group from southernmost areas in eastern Asturias, plus 1500–2500 people from the second Iberian group. Estimates for sites on plains to north of the Ardennes have been merged, as it is unclear what their distributions mean demographically. Rozoy identified six distinct population groups in Middle-Upper Magdalenian, separated geographically; each regional group could comprise 1500–2000 people, spread over 30–50 bands of 50–60 people; territories of 50,000 to 200,000 sq. km. 2001: rescaled earlier calculations to account for Delpech's (1999) population density estimates. Only three French regions specifically mentioned, and re-scaled using Delpech's (1999) density of *c.* 17 persons per 100 sq. km.
Bocquet-Appel & Demars (2000):	Based on archaeological site data (numbers/densities, sizes, occupation duration, etc.). Division between Viable areas (including now-submerged land) and Coinciding Surfaces (i.e. above modern sea-level: perhaps more useful in obtaining population densities, given that very few submerged archaeological sites have been found?). Demographic modelling incorporates ethnographic studies of climatically similar hunter-gatherers.
Maier & Zimmermann (2017); Maier (2017); Maier et al. (2016); Schmidt & Zimmermann (2019):	Integration of climatic, ethnographic and archaeological data for four main phases (earlier and later Gravettian, Solutrean/Badegoulian (LGM) and Magdalenian). Archaeological sites are plotted on maps, analysed with Thiessen polygons and largest empty circles (to measure site densities), and combined with other data (e.g. raw material provenancing patterns (exchange assumed to reflect aggregation phases in fission-fusion cycles) and ethnographic group size data from selected foraging groups (direct counts of numbers per group). Focus on median and interquartile range values. Median aggregation group size from extant hunter-gatherers taken to be 43 people.

Table 9.C2. *Characterizing two colonizing strategies (Beaton 1991: 216).*

	Transient explorers	**Estate settlers**
Demography:		
Budding threshold	Low	High
Group composition	Stable	Slightly fluid
Inbreeding	High	Low
Fecundity	Low	High
Extinction probability	High	Low
Economy:		
Different ecological zone tolerance	High	High
Estate	Unconstrained	Bounded
Archaeology:		
Site forms	Very similar	Varied
Tool inventory	Generalized, conservative	Specialized, inventive
Range of activity/site	Repetitive	Varied
Strategy	Forager/pursuer	Collector/searcher
Colonizing logic:		
Diet breadth	Narrow	Wide
Geometry	Lineal	Bow-wave/radial
Ecology	Patch-similar	Cross-patch

These modelled pioneer/transient explorer (highly mobile) groups (Table 9.C2) share many characteristics with Bettinger's (1991) 'Travellers': briefly occupied and widely spaced settlements, low population densities and high sensitivity to demographic change, and the major subsistence costs being travel, search and scouting. Such groups would live well below the environmental carrying capacity, ensuring their competitive fitness was low. Bettinger's 'Processors' exist closer to the environmental carrying capacity (thus competitive fitness is high), and exploit a broad spectrum of resources (the major subsistence costs are procurement and processing of resources), have groups rich in females, and live at high population densities for extended periods in closely spaced settlements. Such economies might reflect more intensive, post-dispersal residential occupations seen in all phases of the Upper Palaeolithic, with lower motility (*sensu* Weig 2015) and restricted (e.g. circulating/tethered) mobility. The durability and nature of any resource 'hot-spots' would determine whether they would generate contests rather than scrambles (Boone 1992), and underpinning any value attached to them would be knowledge exchange and network structure.

Upper Palaeolithic refugia (Table 9.C3) would represent the opposite process to dispersal, whereby preferred resources and conditions contracted and/or shifted spatially, forcing demographic reorganization and possible local extirpation of groups. Whether populations were expanding/dispersing or contracting, it is not self-evident that resource selectivity was narrow or broad spectrum, respectively (*contra* Beaton 1991; Bettinger 1991). There might have been situations where relatively unspecialized diets (tracking familiar resources in selected patches/biomes) would have provided more reliable food for dispersing populations, and refugial conditions might have arisen among Processor groups specializing in a restricted number of food taxa.

Evidence for highly predictable and defensible/divisible resources that would sustain 'Political networks' (see Fig. 9.5: G) is at best ambiguous for the

Table 9.C3. *Population Events for MOIS-2 Western Europe (after Gamble et al. 2005). Similar events cannot yet be identified in MOIS-3, owing to restricted numbers of reliable dates, sigma values spanning climatic fluctuations, and uncertainties about the specific hominin authors of some technocomplexes. Solutrean assemblages would fall within Population event 1, while sites such as Maszycka cave (Population event 2) and Pincevent (Population event 3) would have fallen within expansionary phases. The Ahrensburgian of Stellmoor fell within Population event 5. [See main text for more discussion.]*

Population event	**Settlement pattern**	**Phylogeography**	**GRIP stratotype**	**GRIP ice-core years (ka) BP**
1: Refugium	Dispersed	Low population size	LGM – GS-2c	25 – 19.5
2: Initial expansion	Pioneer		GS-2b – GS-2a	19.5 – 16
3: Main expansion	Residential	Founder effect and expansion	GS-2a – GI-1e	16 – 14
4: Stasis	Nucleation		GI-1d – GI-1a	14 – 12.9
5: Contraction			GS1	12.9 – 11.5

Upper Palaeolithic. The remaining three networking options (see Fig. 9.5: E, F, H) seem likelier, but are difficult to map directly onto technocomplexes. This is because the networking criteria used by Fitzhugh et al. test our expectations for Upper Palaeolithic demographies: were dispersing/colonizing groups more likely to have had open, exogamous, networks (Fig. 9.5: E), or ones intermediate between open and closed (Fig. 9.5: F)? Such strategies would have enabled reduction of the risks of dispersing into unfamiliar landscapes, e.g. evidence of early modern humans interbreeding with Neanderthals in Eurasia (Fu et al. 2014, 2015). Dispersing groups that moved as discrete, closed, networks, where endogamy and lack of information exchange with other groups were normal, would encounter problems of demographic sustainability (cf. Prüfer et al. 2014; Sikora et al. 2017). It is conceivable that such groups might have been forced into endogamy/inbreeding and closed interactive networks by the lack of other groups in the areas they were dispersing through (i.e. 'empty' landscapes), or through encountering groups with closed, territorial networks; such situations would have rendered these groups particularly vulnerable to major environmental deteriorations. As more residential 'infill' occupation of landscapes occurred after initial dispersal (Table 9.C3), one might expect interaction costs to decline as populations became more stable, allowing more intensive use of environmental resources (derived from greater adaptive depth and detailed local knowledge) and a wider range of marriage systems.

An individual would have had different motility potentials across their lifespan or between seasons/years, which may or may not have spatio-temporally coincided with those of other group members. Various activities (resource processing and storage, ceramic technology, funerary practices, etc.) might also serve to restrict mobility, at least temporally, for some individuals. 'Scouting' or 'walkabouts' by individuals with fewer ties to a location (e.g. unmarried, no children) might have served to track preferred resources in unoccupied landscapes, rather than population pressure pushing whole bands gradually forward in a wave-of-advance (Beaton 1991; Davies 2001).

APPENDIX D: SUNGHIR CASE STUDY

Table 9.D1. *Summary information for the Sunghir remains (56.176°N, 40.502°E). Data from Trinkaus et al. 2014; Trinkaus & Buzhilova 2012, 2018; Alexeeva et al. 2000; White 1993; Bosinski 2015. Dates from Marom et al. 2012; Dobrovolskaya et al. 2012; Nalawade-Chavan et al. 2014; Trinkaus et al. 2014, 11. Date corrections (CalPal2007_HULU) given at 2σ (95 per cent) (www.calpal.de). aDNA from Sikora et al. 2017.*

Specimen	14C date	Estimated age at death	aDNA	Grave goods	Notes
Sunghir 1 (grave 1)	OxA-X-2464-12: 28,890 ± 430 (hydroxyproline) [CalPal: 32,290–34,362 cal. BP]; KIA-27006 (femur): 27,050 ± 210 (ultrafiltration) [CalPal: 31,462–32,118 cal. BP].	35–45 years (Trinkaus et al. 2014) [cf. late 40s/early 50s according to Trinkaus & Buzhilova (2012: 655)]	Male (Y-DNA haplogroup C1a2); mtDNA haplogroup U8c.	Variable staining with ochre on the body; especially rich on the cranium. ≥2936 subrectangular, rounded and subrectangular/oval beads/pendants; 'tens' (Trinkaus et al. 2014: 17) of perforated arctic fox canines, twelve on the forehead. A small pear-shaped schist pendant (painted red, with a small black dot on one side) on chest and 25 ivory rings/'bracelets'. A few lithic tools, some of which were located between the femora.	Clear burial pit. Adult male buried in a full set of inner and outer garments, as well as headgear. Perimortem wound (10 mm long, 1.1–2.2 mm wide and 6.5 mm deep) to first thoracic vertebra, caused by a sharp, thin object entering the body adjoining the left clavicle: no evidence of healed bone. Very worn teeth, especially on upper molars (less on the lower molars): the cause of this non-masticatory specific wear is not known. Calculus present on teeth. Microwear on molars suggests a significant plant (starch) consumption, as well as meat. High concentrations of zinc suggest a diet rich in vertebrate protein. Osteoarthritis in thumbs, midcarpals and wrists: in part related to activity levels and joint overloading (not simply age-related). Faint Harris lines on distal radii and partial ones on tibiae: remnant adolescent stress?
Sunghir 2 (grave 2)	OxX-2395-6: 30,100 ± 550 (hydroxyproline) [CalPal: 33,308–35,280 cal. BP]; OxA-15753 (tibia fragments): 25,020 ± 120 (ultrafiltration) [CalPal: 29,475–30,503 cal. BP].	*c.* 12 years	Male (Y-DNA haplogroup C1a2); mtDNA haplogroup U2.	Few bones show ochre-staining; concentrated on the skull, shoulders and left ilium. 1 massive ivory lance (2.47 m long and several kg) along his right side (and continuing along the left-hand upper body of Sunghir 3). An ivory disc, with latticework carving, standing upright on its edge in the soil: perhaps mounted over the tip of a now-decayed (wooden?) lance. 4903 ivory beads, of the same forms (but roughly 2/3 smaller) as seen in grave 1), plus a string of very small and thin beads (*c.* 1 mm thick) beneath the pelvis; ≥40 perforated arctic fox teeth on top of the head, mixed in with ivory beads; the remains of a decorated belt (>250 pierced arctic fox canines). An ivory pin at his throat (fastening for a cloak?), and an ivory indeterminate animal figurine on his chest. A large ivory mammoth sculpture was under his left shoulder, and Sunghir 4 was laid beside his left arm. ≥8 ivory 'bracelets' on his arms. A small tubular bead (from a bird bone?) was found in his upper left torso.	Grave 2: two immature individuals buried head-to-head in an elongated burial pit. Left forearm and hand bones of Sunghir 2 appear to be missing (no adornments in that area of the body either). Possible perimortem trauma in middle of left ilium: angular edges to the hole (fatal, if a wound from the front?). Very little tooth-wear (little more than polish): weak chewing and/or soft food? Weakly developed muscle insertions on head and body. Flat upper face and nasal bones slope sharply downwards: unlike faces of other Sunghir individuals. Calculus present on teeth. Microwear on a premolar and molar implies significant plant (starch) consumption, with lower meat consumption than seen Sunghir 1 and 3. Concentrations of zinc are also lower than Sunghir 1, 3 and 4, implying a lower consumption of vertebrate protein. At least one stress event documented in the teeth (linear enamel hypoplasias): at least two months in duration between age of about 2.5 and 3 years (subsequent stress periods between age of 3 and 5, but little sign of stress after that age). Weak evidence of stress-related growth disruption in long bones: one faint Harris line in proximal end of right fibula. Bone remodelling occurred after the age of five? A void in one thoracic vertebra: possibly a localized benign cyst or a parasitic infection.

Table 9.D1 *(cont.).*

Specimen	14C date	Estimated age at death	aDNA	Grave goods	Notes
Sunghir 3 (grave 2)	OxX-2395-7: 30,000 ± 400 (hydroxyproline) [CalPal: 33,190–35,142 cal. BP]; KIA-27007 (humerus): 26,000 ± 410 (ultrafiltration) [CalPal: 30,071–31,831 cal. BP]; OxA-15751 (tibia fragments): 25,430 ± 160 (ultrafiltration) [CalPal: 29,640–30,912 cal. BP]; OxA-15754 (tibia fragments): 24,830 ± 110 (ultrafiltration) [CalPal: 29,255–30,463 cal. BP].	*c.* 10 years	Male (Y-DNA haplogroup C1a2); mtDNA haplogroup U2.	More extensive ochre-staining than seen for Sunghir 2: concentrated on the skull, shoulders, left ilium (with a thick layer of ivory beads) and right leg. 5274 ivory beads, plus another *c.* 115 preserved in the ochre on the ilia and 6–12 mixed with the hand bones; roughly 2/3 size of those from grave 1. No pierced arctic fox canines, nor a pendant on the chest. ≥13 ivory 'bracelets' on his arms. 2 pierced antler batons, one decorated with rows of drilled dots (White)*, at his side. Smaller ivory lances than seen alongside Sunghir 2 (scaled down?). 3 ivory discs (one small and two much larger) with a central hole and carved latticework, like that adjacent to Sunghir 2. The small disc was to the left of his head, while the other two were at his sides, accompanying the pointed ivory shafts (one of whose points was inserted into the central perforation of one of the larger discs; a *c.* 15 cm long linear array of microflakes from the disc to the lance tip might indicate armatures.	Relatively short femora (in comparison to the humeri and tibiae), which have very pronounced anterior curvature/bowing. Unlikely to derive from rickets, as symmetrical, so thought to be congenital. Sunghir 3 is more robust than Sunghir 2, even though younger at time of death, and his muscle insertions are also more robust. Seems to have been an active member of the group, with indications in the skeleton that his mobility was not constrained. More tooth wear than seen in Sunghir 2. Microwear studies of his molars suggest high carnivory (higher than seen in Sunghir 1 and 2), and this is supported by high concentrations of zinc: a diet rich in vertebrate protein. There is evidence in the teeth for at least three separate stress events between the age of 1.5 and 5.6 years. Stress seems to have been generally persistent for his first five years of life, varying in intensity not presence. Harris lines in the femora (7 lines in each) and tibiae (2 lines in each) likewise suggest that Sunghir 3's systemic stress continued until his death (reflecting either serious resource fluctuations, or his general frailty). High levels of calcium in the bones might reflect this individual's systemic abnormalities.
Sunghir 4 (grave 2)	OxX-2462-52: 29,820 ± 280 (hydroxyproline) [CalPal: 33,518–-34,646 cal. BP].	20s/30s	Male (Y-DNA haplogroup C1a2); mtDNA haplogroup U2.	Bone surface is highly polished (intentionally, or from repeated handling?), and medullary cavity filled with ochre. Broken proximal and distal ends are irregular (resemble dry bone breaks), though also appear burnished (from handling?). Spatially associated with Sunghir 2.	Very robust human femoral diaphysis, with missing proximal and distal ends (from lesser trochanter to mid-distal diaphysis). A smaller individual than Sunghir 1, and isotopic signature (e.g. very low levels of calcium) in the bone implies a different geographic origin for him, and/or a different postmortem history. Otherwise, the bone appears healthy.
Sunghir 5	OxA-X-2666-52: 26,042 ± 182 (amino acids) [CalPal: 30,288–31,692 cal. BP].	30s/40s (similar to Sunghir 1?)	Poor endogenous aDNA yield.	Associated with a large flat stone, abundant ochre, an arctic fox canine and an ivory rough-out/blank for a bead (latter two might derive from the cultural layer, rather than have been specifically deposited with the skull).	Isolated cranium: disturbed burial (ice-wedge and solifluction evidence immediately adjacent)? Found in cultural layer above grave 1 (sq. P-157). Healed minor traumatic lesion over right orbit. Some (age-related) periodontal degeneration.

Table 9.D1 *(cont.).*

Specimen	14C date	Estimated age at death	aDNA	Grave goods	Notes
Sunghir 6 (cultural layer)	OxA-31755: 884 ± 23 (ultrafiltration) [CalPal: 703–943 cal. BP]; OxA-X2653-36: 925 ± 29 (hydroxyproline) [CalPal: 761–945 cal. BP].	Younger adult (in 20s)?	Male (Y-DNA haplogroup I2a1b2); mtDNA haplogroup W3a1.		Partial mandible from cultural layer above grave 2; date indicates historical age. No lesions: healthy bone.
Sunghir 7		Adolescent/ young adult?			Now lost. Partial femur from between graves 1 and 2, in the cultural layer. Possibly female?
Sunghir 8		16–17 years (mid to late adolescent)?		Unclear if grave goods were incorporated in the burial (no artefacts were found).	Very fragmentary, and now lost: cranial fragments and a crushed femur were recovered *c.* 200 m south of grave 2. Probably from a grave dug into sediments below cultural layer. Possibly female.
Sunghir 9					Skeleton; now lost. Found in a quarry southeast of Graves 1 and 2, in 1972.
Sunghir 10 (grave 2bis)		Adult		Partially covered in ochre. 3 perforated schist pendants; ivory beads; perforated arctic fox canines, small bone tubes, a bone awl; a finely worked biface; 18 cm-long worked mammoth tusk, a small ivory ring; a worked fossil mollusc shell; 2 reindeer antler 'clubs'.	Buried in an extended position; very deteriorated remains. Found within the cultural layer (hence its poor preservation?). Immediately overlies grave 2 (Sunghir 2 and 3).

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Social inequality before farming?

Archaeological investigations over the past 50 years have challenged the importance of domestication and food production in the emergence of institutionalized social inequality. Social inequality in the prehistoric human past developed through multiple historical processes that operate on a number of different scales of variability (e.g. social, economic, demographic, and environmental). However, in the theoretical and linguistic landscape of social inequality, there is no clear definition of what social inequality is. The lifeways of hunter-gatherer-fisher societies open a crucial intellectual space and challenge to find meaningful ways of using archaeological and ethnographic data to understand what social inequality exactly is with regard to variously negotiated or enforced cultural norms or ethoses of individual autonomy. This interdisciplinary edited volume gathers together researchers working in the fields of prehistoric archaeology and cultural and evolutionary anthropology. Spanning terminal Pleistocene to Holocene archaeological and ethnographic contexts from across the globe, the nineteen chapters in this volume cover a variety of topics organized around three major themes, which structure the book: 1) social inequality and egalitarianism in extant hunter-gatherer societies; 2) social inequality in Upper Palaeolithic Europe (*c.* 45,000–11,500 years ago); 3) social inequality in prehistoric Holocene hunter-gatherer-fisher societies globally. Most chapters in this volume provide empirical content with considerations of subsistence ecology, demography, mobility, social networks, technology, children's enculturation, ritual practice, rock art, dogs, warfare, lethal weaponry, and mortuary behaviour. In addition to providing new data from multiple contexts through space and time, and exploring social diversity and evolution from novel perspectives, the collection of essays in this volume will have a considerable impact on how archaeologists define and theorize pathways both towards and away from inequality within diverse social contexts.

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Published by the McDonald Institute for Archaeological Research,
University of Cambridge, Downing Street, Cambridge, CB2 3ER, UK.

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Cover design by Dora Kemp and Ben Plumridge.

ISBN: 978-1-913344-00-9