McDONALD INSTITUTE CONVERSATIONS

Towards a Broader View of Hunter-Gatherer Sharing

Edited by Noa Lavi & David E. Friesem

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With contributions by
Olga Yu. Artemova, Ran Barkai, Nurit Bird-David, Adam H. Boyette, Hillary N. Fouts, David E. Friesem, Peter M. Gardner, Barry S. Hewlett, Robert K. Hitchcock, Emmanuelle Honoré, Jean Hudson, Robert L. Kelly, Noa Lavi, Jerome Lewis, Sheina Lew-Levy, Alan J. Osborn, Spencer R. Pelton, Magalie Quintal-Marineau, Erick Robinson, Kenneth Sillander, Penny Spikins, Gilbert B. Tostevin, Bram Tucker, George Wenzel & Thomas Widlok

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

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Contributors

Olga Yu. Artemova
Institute of Ethnology and Anthropology, Russian Academy of Sciences, 119991, Leninsky prospect 32a, Moscow, Russia.
Email: artemova.olga@list.ru

Ran Barkai
Department of Archaeology and Near Eastern Cultures, Tel-Aviv University, Tel-Aviv, 69978, Israel.
Email: barkaran205@gmail.com

Nurit Bird-David
Department of Anthropology, University of Haifa, Mt. Carmel, 31905 Haifa, Israel.
Email: n.bird@soc.haifa.ac.il

Adam H. Boyette
Max Planck Institute for Evolutionary Anthropology, Department of Human Behavior, Evolution, and Culture, Deutscher Platz 6, 04103 Leipzig, Germany.
Email: adam_boyette@eva.mpg.de

Hillary N. Fouts
Department of Child and Family Studies, University of Tennessee, Jessie W. Harris Building, Knoxville, TN 37996, USA.
Email: hfouts@utk.edu

David E. Friesem
McDonald Institute for Archaeological Research, University of Cambridge, Downing Site, CB2 3ER, Cambridge, UK.
Email: df360@cam.ac.uk

Peter M. Gardner
Department of Anthropology, University of Missouri, 112 Swallow Hall, Columbia, MO 65211, USA.
Email: GardnerP@missouri.edu

Barry S. Hewlett
Department of Anthropology, Washington State University, Vancouver, WA 98686, USA.
Email: hewlett@wsu.edu

Robert K. Hitchcock
Department of Anthropology, University of New Mexico, MSC01 1040, Albuquerque, NM 87131-0001 USA.
Email: rhitchcock@unm.edu

Emmanuelle Honoré
McDonald Institute for Archaeological Research, Downing Street, CB2 3ER Cambridge, UK.
Email: eigh2@cam.ac.uk

Jean Hudson
Department of Anthropology, University of Wisconsin, Milwaukee, 3413 N. Downer Ave. Sabin Hall 390, Milwaukee, WI 53211, USA.
Email: jhudson@uwm.edu

Robert L. Kelly
Department of Anthropology, University of Wyoming, Laramie, WY 82071, USA.
Email: RLKELLY@uwyo.edu

Noa Lavi
Department of Anthropology, University of Haifa, Mt. Carmel, 31905, Haifa, Israel.
Email: noalaviw@gmail.com

Jerome Lewis
Department of Anthropology, University College London, 14 Taviton Street, WC1H 0BW London, UK.
Email: Jerome.lewis@ucl.ac.uk

Sheina Lew-Levy
Department of Psychology, Robert C. Brown Hall RCB 5246, Simon Fraser University, 8888 University Drive, Burnaby, BC V5A 1S6 Canada.
Email: sheinalewlevy@gmail.com

Alan J. Osborn
Department of Sociology and Anthropology, University of Nebraska-Omaha, 383G ASH, Omaha, NE 68182 USA.
Email: aosborn2@unomaha.edu

Spencer R. Pelton
Transcom Environmental, 331 N. 3rd St., Douglas, WY 82633, USA.
Email: spencerpelton@gmail.com

Magalie Quintal-Marineau
Centre Urbanisation Culture Société, Institut national de la recherche scientifique 385 Sherbrooke Street E., Montreal, Canada H2X 1E3.
Email: magalie.quintalm@ucs.inrs.ca

Erick Robinson
Department of Sociology, Social Work, and Anthropology, Utah State University, 0730 Old Main Hill, Logan, Utah 84322-0730, USA.
Email: Erick.Robinson@usu.edu

Kenneth Sillander
Swedish School of Social Science, University of Helsinki, P.O.Box 16, 00014 Helsinki, Finland.
Email: kenneth.sillander@helsinki.fi

Penny Spikins
Archaeology PalaeoHub, University of York, Wentworth Way, Heslington. York YO10 5DD, UK.
Email: penny.spikins@york.ac.uk

Gilbert B. Tostevin
Department of Anthropology, University of Minnesota, 395 H.H. Humphrey Center, 301 19th Ave. S Minneapolis, MN 55455, USA.
Email: toste003@umn.edu

Bram Tucker
Department of Anthropology, University of Georgia, Athens, GA 30602 USA.
Email: bramtuck@uga.edu

George Wenzel
Department of Geography, McGill University, 805 Sherbrooke Street W., Montreal, Canada H3A 0B9.
Email: george.wenzel@mcgill.ca

Thomas Widlok
African Studies, University of Cologne, Albertus-Magnus-Platz, 50923 Köln, Germany.
Email: thomas.widlok@uni-koeln.de

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Noa Lavi & David E. Friesem,
Cambridge, October 2019

Chapter 10

Studying sharing from the archaeological record: problems and potential of scale

Robert L. Kelly, Spencer R. Pelton & Erick Robinson

The subject of this monograph – sharing of food, information, tools, land and knowledge – is an important topic to anthropology because routine sharing is unique to the hominin lineage. Accordingly, it has produced such a voluminous literature that Kelly devoted virtually an entire chapter (6) to it in *The Lifeways of Hunter-Gatherers* (Kelly 2013b). The lion's share of that literature, however, comes from ethnographic observations and data; far fewer studies come from archaeological sources. This does not mean archaeologists are less interested in the subject; in fact, tracing the origins of sharing is of keen interest (Stiner et al. 2009), but the subject is more difficult to study in an archaeological context. While ethnographers can witness food or information transfers in real time, archaeologists must reconstruct sharing based on objects, such as animal bones, stone tools, or pottery, and we do so long after the fact and from a record whose temporal resolution would dismay ethnographers, who must sometimes wonder: Can archaeologists contribute anything to the study of sharing among hunter-gatherers (or anything at all to anthropology beyond a voyeuristic antiquarianism)?

We begin with what some may find a contentious claim: cultural (or social) anthropologists and archaeologists think differently (Kelly 2017). Briefly, cultural anthropologists often take seemingly 'small' behaviours and correctly show them to be a portal into a very complex world. This is what Mauss (1966) had in mind when he described 'total social facts'. Archaeologists, on the other hand, take disparate data (ceramics, faunal remains, settlement patterns, etc.) drawn from chronological sequences covering often vast stretches of time and seek the primary factors lying behind trends in the data. Cultural anthropologists seek complexity; archaeologists seek simplicity. This is why comparative ethnographic studies (e.g. Ember & Ember 1992) often draw archaeologists' approval and cultural anthropologists' ire: because comparative studies ignore detail in favour of broad patterns. Archaeologists and cultural anthropologists often talk past one another, or, like members of two different cultures, misunderstand one another. This volume contains, and should contain, both sides of that conversation (compare, for example, this chapter with Bird-David, this volume).

The cultural difference between the fields is partly a product of a difference in scale. Ethnographers observe behaviour moment-by-moment in personal interviews and observations of daily life, and a long-term study might go on for 50 years. Archaeologists record behaviour from material objects in large, compressed and coarse chunks of time – decades if we are lucky, but sometimes centuries, millennia, or for Palaeolithic archaeologists, even longer. This ability to see long-term history is, in fact, the strength of archaeology.

Both approaches are valid paths of anthropological inquiry, and, in fact, need one another. We achieve a more complete understanding of complex human behaviours, such as sharing, when we analyse them at different scales, both spatial and temporal. Human behaviour transpires moment-by-moment *and* across millennia. The two scales are linked: century or millennial patterns that archaeological data are best at revealing are the cumulative result of many individuals' quotidian actions (actions that archaeology usually cannot see). Archaeologists need to understand the everyday aspect of human behaviour (with all its potential for individual agency) to make sense of the patterns they reveal. Cultural anthropologists, on the other hand, must understand that coarse-grained archaeological patterns are not simply 'poor' data but reveal the effects of factors at play (e.g. climate change, population density) that are not easily visible at the day-to-day scale, where many factors conspire to confound the easy interpretation of individual behaviour. Both fields yield different but complementary

knowledge on the various conditions and contexts of culture; neither field corners the market on understanding human behaviour.

Archaeological studies of sharing

Despite the archaeological record's limitations, some archaeologists have tried to replicate the ethnographer's scale in the study of sharing at archaeological sites. Waguespack (2002) refit caribou and Dall sheep remains between two Nunamiut houses at the Palangana site, occupied in the 1880s, in Alaska's Brooks Range to look for evidence of food sharing. Based on bone refits, Waguespack argued that the distribution of caribou bones reflected a form of sharing known as tolerated theft (now often called 'tolerate scrounging') where low utility remains are shared with neighbours not so much to ensure reciprocity in the future but to alleviate the instantaneous potential for conflict that could erupt between the haves and the have-nots.

Waguespack's analysis was possible because when Lewis Binford excavated the site in the early 1970s he also collected oral accounts about its use from informants. Therefore, Waguespack knew that only four families occupied the site for a short period, that one of the two excavated houses was occupied by a man, Palangana, and his family and the other by another man, Kapkana, and his family. She also knew that the two men were friends and that Palangana was an excellent hunter while Kapkana was an excellent toolmaker. In other words, her work proceeded with far more ethnographic-scale data than most archaeologists have.

Enloe (2003, 2004) also used refitting to show sharing of reindeer among households at the Upper Palaeolithic site of Pincevent, along the Seine in central France. Pincevent is a remarkable site because it has been so extensively and carefully excavated, contains numerous, clearly distinguishable, short-term households of nomadic hunters, and because it lies in a geomorphic context that resulted in gentle burial of those houses – with their associated hearths, lithic and faunal scatters – beneath floodplain silts. Because of these conditions, Enloe was able to track the movement of pieces of the same animal between houses, and thus document the sharing of game at this site.

Finally, O'Brien (2013a, 2013b) similarly showed the sharing of antelope at the protohistoric Shoshonean Eden-Farson site in western Wyoming. The antelope assemblage at this site appears to result largely from a communal kill. Unlike Enloe, he could not refit broken bones or find members of bilateral pairs (e.g. femurs whose size and condition suggest they came from the same animal) between houses. Instead, O'Brien focused on the spatial distribution of antelope elements between the households. He found no differences among the households in terms of elements or animal size; although families shared single animals between houses, there appears to have been no bias in the cuts of meat consumed at or moved between houses.

Besides these three, there are really no studies of individual- or family-level sharing based on archaeological data. Why? Archaeologists try to emulate what ethnographers do when they study sharing, and that means, to the extent possible, they look for and tabulate individual instances of food sharing between households. The problem is that such studies require the extensive excavation of sites that are 'fine-grained' assemblages, those where multiple occupations and/or natural processes have not distorted the link between behaviour and material remains. This kind of site is rare; most archaeological sites contain multiple, mixed occupations, are disturbed to one extent or another by post-depositional processes (e.g. rodents, rivers), have poor bone preservation, or are deeply buried and thus not amenable to extensive horizontal excavation. Pincevent, Palangana, Eden-Farson: these are exceptions rather than the rule in archaeology. While we applaud the work at them, they provide so few data points that they are of little use analytically. If we had, say, 30 Eden-Farson sites spread across Wyoming's prehistory we might be able to use a tight analysis of each site to look at relationships between measures of sharing and other variables, say, climate or population density. But we don't have 30 Eden-Farsons and we probably never will.

If archaeologists cannot witness instances of food sharing across a dimension that helps anthropology understand sharing-like behaviours, what can they contribute? To answer this question we must return to archaeology's strength: broad patterns in material culture across space and/or time. To employ this strength we must translate the understanding of sharing that we receive from ethnographic accounts into data that archaeologists can witness. This is not easy, perhaps especially for the archaeology of nomadic hunter-gatherers. What archaeologists see are distributions of things across time and space, and for nomadic hunter-gatherers there is always the question as to whether those things moved through exchange, which is a form of permission-granting behaviour (e.g. the sharing of use rights), or through direct acquisition during a move. Fortunately, we can often sort these out. In the US Great Basin, for example, obsidian projectile points in the Carson Desert of western Nevada must have been imported since there are no geologic sources of obsidian in the region. Obsidian appears in

lithic assemblages primarily as projectile points, and the waste flakes show that these artefacts entered as complete tools, and not as raw nodules of material or even partially worked cores (Kelly 2011). The obsidian artefacts must indicate trade of some kind because: (a) the geologic sources lie far outside any reasonable annual territory that would have included the Carson Desert, and (b) if the points were fashioned from sources encountered during long-distance moves then foragers would most likely have discarded them before reaching the Carson Desert because obsidian points generally break on their first use (Cheshier & Kelly 2006).

The obsidian points perhaps indicate 'sharing', and provide evidence of a social link between the participants of those relationships. By sourcing points of known ages, we observed a shift, one that occurred about 650 years ago, from a predominant use of southern to a predominant use of northern sources. This may mark a shift in who the foragers of the Carson Desert were sharing with, that is, to whom they were giving permission to use the resources of 'their' land (and presumably vice versa; Kelly 2011). Why this shift occurred is unknown.

Working in the Late Woodland and Mississippian archaeology of the Ohio River Valley of the central US, Nolan & Cook (2010) tried to link sharing to external variables. To do so, they had to scale up from ethnographic observations of individuals to groups. Although they were working with the archaeology of maize agriculturalists, their approach is useful to the study of prehistoric hunter-gatherers, and, in fact, employs a model drawn from hunter-gatherers, one they labelled the Winterhalder-Kelly model.

The Winterhalder-Kelly model

We know from copious ethnographic data that hunter-gatherers commonly share meat from large game but not plant food (in fact, this is one of the few universals one can derive from hunter-gatherer ethnology). Winterhalder (1986) constructed a model to account for this difference based on variance in returns from large-game hunting versus gathering, and the degree of correlation in foragers' returns. Large game hunting is usually risky in the sense that there is a chance, often high, that the hunter will come home empty-handed. Contrast this with plant gathering: the forager generally knows beforehand how much he or she will gather. In addition, if three men go hunting individually, there is a high chance that only one of them will be successful; if three women go tuber-gathering, they will each return with about the same. Thus, and in more general terms, hunters of large game have high variance in their day-to-day returns, and low correlation with other hunters in those returns. Plant collectors have low variance in their day-to-day returns, and high correlation with other collectors.

Winterhalder used these basic facts of large-game hunting and plant gathering to model sharing behaviour of meat versus plants. Winterhalder is not an archaeologist, but he does think like one: he looks for the general pattern rather than the many factors that complicate the ethnographer's world. Using the framework of human behavioural ecology, which privileges the returns from foraging as a measure of success, he argued that if foragers aim to maximize their daily return rates and to minimize their risk of a serious shortfall, then they should share foods with high variance in returns and a low degree of correlation among foragers' efforts; but they should not share foods with low variance in their returns and high correlation among foragers' efforts. As it happens, the former generally describes large-game hunting and the latter describes gathering. To keep one's daily average intake of meat as high and as even as possible, foragers should share meat; but they should not share plant foods since variance in returns is most likely a result simply of variance in a forager's effort (leaving aside forager illness or child-care needs – complicating factors the results of which would be dealt with through sharing).

Winterhalder was operating with the idea that sharing builds up debts: I share with you today when you are in need with the expectation that you will share with me tomorrow when I am in need. It turns out that sharing is more complex than that (see Tucker, this volume), but debt-building is certainly part of what sharing is about. Large game hunting is highly variable, but when it's successful it results in a surfeit of food. Plant gathering is not highly variable; poor returns result from laziness (and there's no profit in sharing with a lazy person since there's a low expectation of return at a later date).

Winterhalder's model used variance over time in forager's returns and the degree of correlation in their returns as a way to model expectations of *individual* food sharing. However, we can think of his variables as variance in resource availability over time and correlation between any social entities in the overall returns from food-getting. Doing so, Kelly (1995; 2013b) scaled Winterhalder's model up from individuals to *groups* to describe sharing-like behaviours of land and other resources between social entities (be they foraging bands, agricultural villages, or clusters of settlements). In this case, Kelly scaled up the predicted behaviours from individual to group-level actions, and included social-boundary defence,

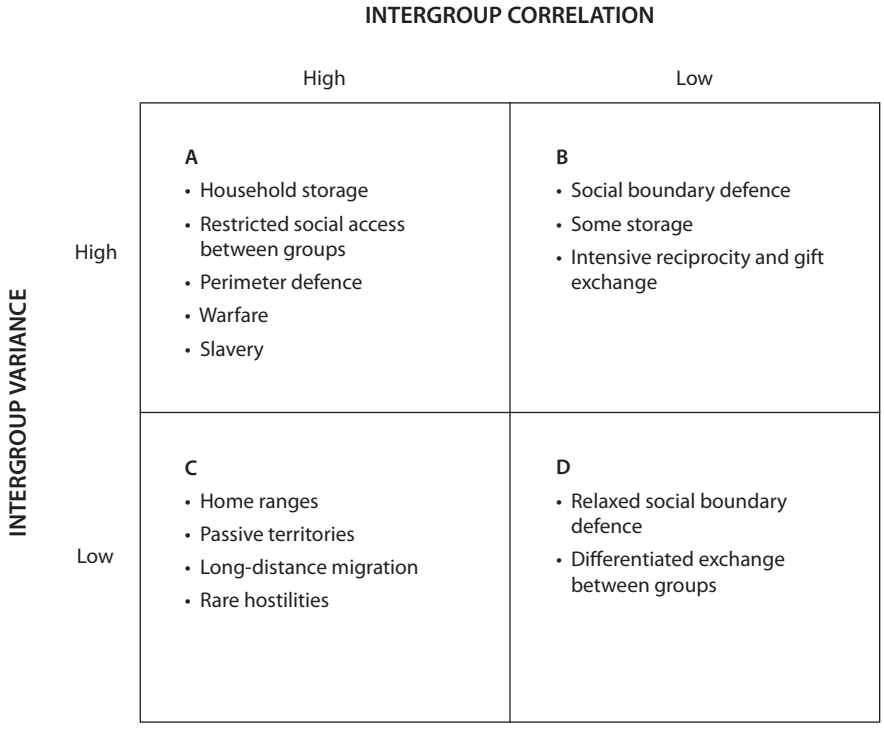

Figure 10.1. *The Winterhalder-Kelly model of sharing relations between groups of foragers (Kelly 2013b, fig.6-8).*

territoriality, warfare, exchange, and storage (Fig. 10.1). It is perhaps best to look at sharing (admittedly the preferable option!) as one of a range of behaviours whereby individuals acquire resources (e.g. where one party won't share, aggression is a possible outcome).

The crucial variables in the Winterhalder-Kelly model are the amount of variance between villages or regions in the returns to food getting and the degree of correlation between villages' or regions' return rates. In box A of Figure 10.1, the amount of variance for villages is high – the good years are very good, and the bad years are very bad. However, the correlation among villages is also high – when one village is doing poorly, so are the others; and in years when one village is doing well, all do well. This means there isn't much potential for sharing: when your village needs the resources of another, that village can't afford to share what they have. This is when more aggressive solutions arise: warfare or slavery (you control a slave's production and consumption), strict territoriality (perimeter defence), and household or perhaps village level storage of food from year to year.

In box B, villages still suffer high year-to-year variation in resources, but those villages are not in sync; when one does poorly, another might have a good year. Under these conditions, villages have the potential to share with one another, for one has resources when another does not. This leads to social boundary defence, some negotiation of who can share with who, a way of admitting people into one's social network (and thus putting off the threat of violence) but at the same time keeping them at arm's length, so to speak. This situation should result in reciprocity and exchange of gifts, trade goods whose purpose is not directly economic but which serve as a reminder of a social connection (see Osborn & Hitchcock, this volume).

Where variance in a group's returns is low, as in boxes C and D, we expect little need for sharing (similar to plant gathering). In box C, village returns are correlated, as in box A, but the low variance tells us that hostilities should be rare. When bad times occur, long-distance migration might be the most viable option; territories will exist, but they will be passive and not as contested as in box A, since the need to raid one's neighbours will not be as high. Box D describes an Eden-like situation that, understandably, is rare: there is little need to share due to the low variance, but low correlation means that the occasional shortfall can be met by neighbours – and the social reinforcement of such might be signalled by relaxed social boundary defence and exchange of a village's particular goods (a certain kind of pottery, perhaps, for another village's particularly good chert) for economic rather than social purposes.

Nolan & Cook (2010) used the Winterhalder-Kelly model to explore how human behaviour might have changed as a function of changes in the temporal variance and spatial correlation in precipitation (measured by the Palmer Drought Index), a crucial variable for maize horticulturalists. They found that the model predicted social behaviours, including warfare, the extent of regional ceramic styles (as a measure of who was socially linked with who), and village size.

Sharing in the prehistory of Wyoming, USA

We also take a broad-brush approach in looking at Wyoming's prehistory, all 13,000 years of it, in terms of sharing. Note that the indigenous people of Wyoming were all foragers; there was no agriculture until Europeans arrived in the later nineteenth century. Figure 10.2 compiles several data sets whose analysis is currently on-going: (a) a summed probability distribution of ~5000 radiocarbon dates from the state, calibrated and taphonomically corrected (See Kelly et al. 2013; Zahid et al. 2016), alongside a measure of the frequency of groundstone artefacts in dated contexts (data on 80 metates compiled by Pelton from Wyoming state site records), (b) a nearest neighbour analysis of site distances (Robinson et al. 2018), and (c) a measure of the distances that obsidian artefacts move from their geologic sources by time period (from Wunderlich 2014; n = 568).

Elsewhere we have argued that a human population appears in Wyoming about 13,000 years ago and grows at a rate of about 0.04 per cent, reaching carrying capacity about 6000 years ago (Zahid et al. 2016; Fig. 10.2). Nearest neighbour analysis (Clark & Evans 1954) provides a simple first-order measure (r) enabling us to understand whether this population growth occurred within the context of dispersed or clustered social groups (Robinson et al. 2018; Fig. 10.2b). There is noise in the dataset for sites more than 9000 years old due to small sample size. Nonetheless, the general trend suggests increasingly clustered groups from 11,000–9000 years ago ($r = 1.2$ to $r = 0.4$), more randomly distributed groups from 9000–7500 years ago, then a period with clustered spatial organization from 7000–4500 years ago. As population declines from 4500–2000 years ago, settlements become more randomly distributed, suggesting that people were inhabiting a wider variety of landscapes again.

The period of 7000–4500 years ago marks the first fluorescence of pithouses in the archaeological record of this region (Smith 2003). Pithouses provide evidence for increasing investment in specific places and reduced mobility, if only on a temporary and seasonal basis. As in the children's game of musical chairs, pithouses suggest hunter-gatherers grabbed the landscape's best places and perhaps exerted some control over them. The increase in pithouses is accompanied by an increase in groundstone artefacts (Fig. 10.2a). These artefacts point to an increase in the use of tubers and/or seeds, marking an expansion of the diet breadth. Optimal foraging models suggest this trend is expectable: as population density increases, we expect foragers to encounter high-ranked resources less frequently and consequently, for diet to expand and include lower-ranked foods such as tubers and especially seeds (Kelly 2013b). Groundstone helps make those resources more edible (e.g. by removing seed coats that make seeds difficult for humans to digest).

Population begins a slow decline after about 4500 years ago, reaching a nadir about 2000 years ago. Elsewhere, we have shown that the growth and decline of human population in Wyoming is tightly linked to available moisture (Kelly et al. 2013) and we expect such environmental changes are at play throughout the state. As population declines, foragers abandon the mobility strategy that entailed pithouses and groundstone tools, and sites are less clustered. After 2000 years ago, population again grows, reaching a zenith about 1200 years ago. As that population grows, groundstone again increases in frequency, and pithouses, too, make a short-lived return about 1200 years ago, when population reaches perhaps its highest point in Wyoming's prehistory. Population then declines sharply toward the present beginning around 1200 years ago, most likely in response to the aridity of the Medieval Climate Warming. (Although some of the decline may be due to the edge-effect of summed probability distributions, European-introduced disease, and a reduction in the use of radiocarbon dates in favour of European trade goods to date protohistoric sites, the data probably still point to significant population decline after 1200 years ago.) Groundstone and pithouses both decline in frequency as population declines after 1200 years ago.

The 13,000-year long story here is, at one level, a simple one in which hunter-gatherers used a combination of mobility and technology to cope with changes in the availability of foods, changes that were jointly linked to both climate and human population density (which, as we showed previously, are linked themselves; see Kelly et al. 2013). Foragers maintained a nomadic lifeway with widely spaced settlement, relying heavily on high-ranked game during the initial period of population growth, 13,000 to 7000 years ago. We imagine that as local population pressure increased, some families moved to unoccupied land. But as population grew, it eventually reached the

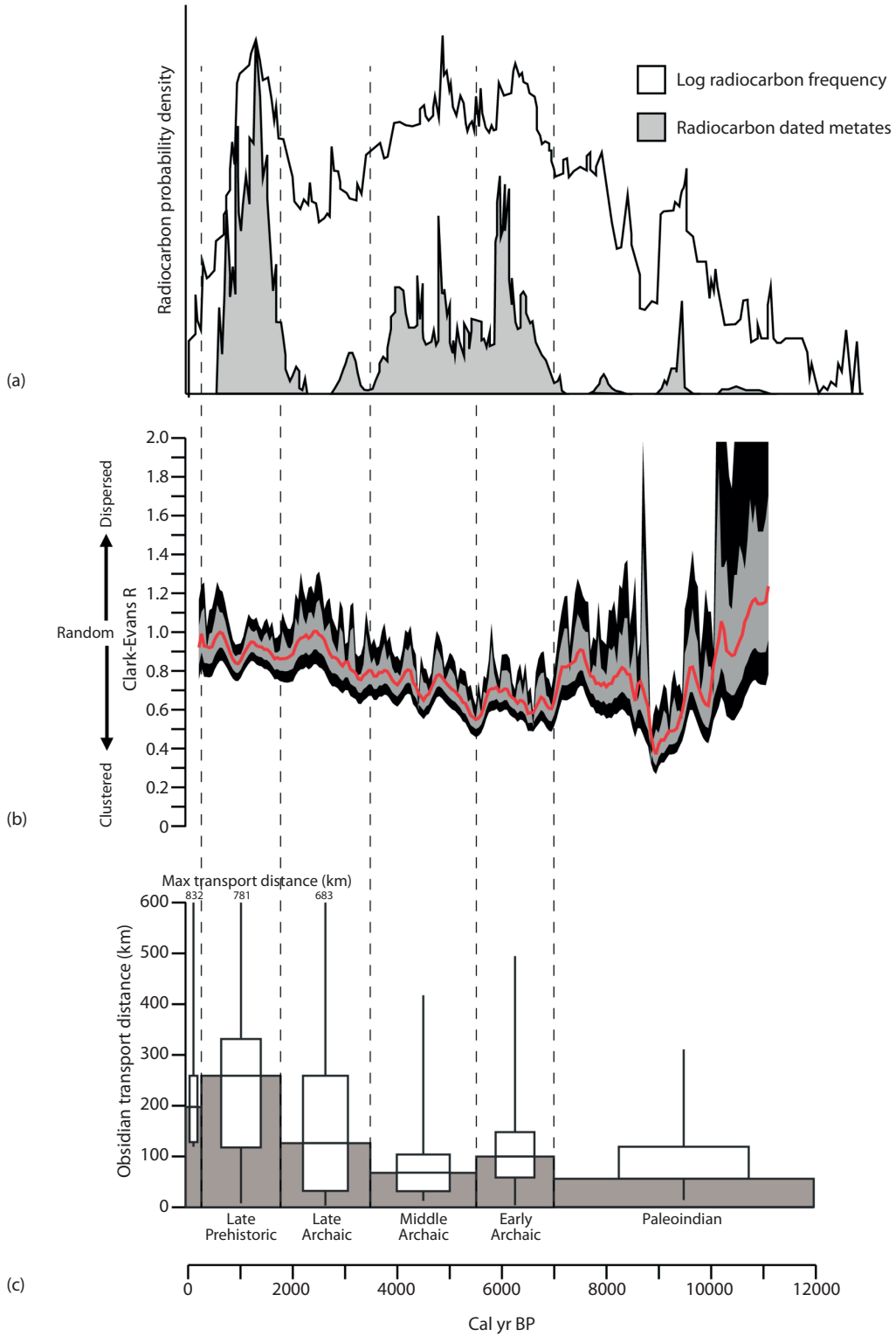

Figure 10.2. *(a) Summed probability distribution of ~5000 radiocarbon dates from the state, calibrated and taphonomically corrected (see Kelly et al. 2013; Zahid et al. 2016 for methods), and the frequency of groundstone in dated contexts, (b) a nearest-neighbour analysis of the distance between radiocarbon-dated sites, with mean, 68, and 95% confidence intervals, and (c) box plots of the average distance that obsidian artefacts move from their geologic sources by time period (data from Wunderlich 2014).*

Table 10.1. *Obsidian Frequencies by Wyoming County and Time Period.*

County	Protohistoric	Late Prehistoric	Late Archaic	Middle Archaic	Early Archaic	Early and Late Palaeo	Total	%
Bighorn	17	67	27	1	0	1	113	19.9
Crook	0	4	5	0	1	0	10	17.6
Fremont	0	1	4	0	0	1	6	10.5
Hot Spring	0	7	0	1	1	0	9	15.8
Lincoln	5	15	28	4	18	0	70	12.3
Natrona	2	3	0	0	0	0	5	0.9
Park	34	25	29	25	3	0	116	20.4
Sublette	0	13	3	4	22	0	42	7.4
Sweetwater	5	19	1	5	0	1	31	5.5
Teton	0	27	41	45	21	31	166	29.2
Total	63	181	138	85	66	35	568	100
Median distance moved (km)	197	259	126	68	99	55		

current foraging strategy's carrying capacity during the late Early Archaic and Middle Archaic periods (about 7000 to 3500 years ago). Foragers then shifted their strategy, relying less on mobility (as evidenced by pithouses) and more on technology (as evidenced by groundstone) to continue to live as foragers in the Wyoming landscape. Certain regions, notably southwest Wyoming, appear to have been more amenable to this strategy than others (Smith 2003).

Sharing at some level played a role in this adaptive scheme, and the Winterhalder-Kelly model anticipates the trend: as subsistence moved toward a heavy reliance on seeds and tubers, foragers relied more on intensification of their resource gathering efforts, and less on outside contacts and support. Evidence for this comes from the distribution of obsidian artefacts.

Since we can trace them to their geologic sources, obsidian artefacts tell us something about social connections across a landscape. Geological sources of obsidian are rare in Wyoming; in fact, the only sources lie in far northwestern Wyoming (Obsidian Cliff, Cougar Creek, Park Point, Grassy Lake and Jackson Hole); other obsidian artefacts come from sources in Idaho (Bear Gulch, Big Southern Butte, Malad, Brown's Bench and Timber Butte), and one source in Utah (Wild Horse Canyon). Our database consists of 568 pieces of obsidian (Table 10.1), slightly more than half (54 per cent) of which are formal tools (see also Smith 1999), mostly bifaces and projectile points, with the other half split between waste flakes (23 per cent) and unknown (24 per cent). All but 15 pieces (from Natrona and Crook counties) are from western Wyoming, which is expected given the lack of geologic sources outside the state's northwestern corner; this also explains the abundance of obsidian in Park and Teton counties, which lie in the state's northwest. In addition, there are only two obsidian artefacts from an Early Palaeoindian context, and 33 from Late Palaeoindian contexts (combined for analysis here).

Obsidian artefacts moved the shortest median distance during the Middle Archaic period (68 km), from about 5500 to 3500 years ago, and the greatest median distance in the Late Prehistoric period (259 km), about 1800 to 300 years ago (Fig. 10.2c). Obsidian also moved long distances during the protohistoric period (median = 197 km) but this may be due to the greater mobility that horses allowed. An earlier study of obsidian use in Wyoming, Montana, and Idaho found that the diversity of sources used is very high during the Late Prehistoric period, and declined sharply during the protohistoric and historic periods (Scheiber & Finley 2011).

Southwest Wyoming is particularly interesting because it is where Middle Archaic pithouses – the evidence of reduced residential mobility – are most common (Smith 2003). Note there are few obsidian artefacts in Middle Archaic contexts in the four southwest Wyoming counties (Fremont, Lincoln, Sublette and Sweetwater; there is no obsidian recorded for Uinta county sites in the database); most (82 per cent) Middle Archaic obsidian comes from sites in Park and Teton counties, where geologic sources are located. Obsidian did not move very far during the Middle Archaic. Scheiber & Finley (2011) also found low counts of obsidian in Middle Archaic contexts for southwest Montana and Idaho as well, and they found a decline in the diversity of sources represented in southwest Wyoming Middle Archaic sites.

Reducing residential mobility in the Middle Archaic of southwest Wyoming would have reduced

the likelihood of encountering and trading with people from northwest Wyoming, people who would have had greater direct access to obsidian sources. But that very fact also points to a contraction of social relations, and a reduction in the broader arena of sharing behaviour, for example using the territory that 'belonged' to others (i.e. those who saw themselves as holding the privilege to grant the right to use a given tract of land). As we noted above, the Winterhalder-Kelly model anticipates this.

The distance obsidian moved during the Late Prehistoric period increased, as did the diversity of sources represented (Scheiber & Finley 2011). This is intriguing because the Late Prehistoric witnessed an increasing population, and then a sudden loss of carrying capacity (and people) during the Medieval Warming (*c*. 1150–600 cal. BP), which presumably reduced foraging returns across the region and, through severe drought, made some areas unliveable at times (see Mann et al. 2009).

The Middle Archaic was also a time of drought and population decline, and the adaptive response to it was to grab a good spot on the landscape and reduce social ties, or sharing. Although pithouses make a brief appearance at the beginning of the Late Prehistoric period, they soon disappear, and evidence suggests foragers used high elevations (> 3000 m) more intensively (e.g. Morgan et al. 2012), and eventually participated in warfare. In fact, the Late Prehistoric presents us with the strongest evidence of warfare throughout the region's entire chronology (Kelly 2013a). Thus, the Late Prehistoric shows a different adaptive response to competition for lifespace and food than that of the Middle Archaic: foragers at once rapidly increased their populations and expanded their shared access to obsidian. Why was the response to competition in the two periods so different?

One possibility is that the larger Late Prehistoric world of North America was different from that of the Middle Archaic. North America in the Late Prehistoric contained several large, socially complex entities, notably in the Midwest (e.g. Cahokia and other Mississippian communities) and the southwest (e.g. Chaco Canyon and its descendants). These could have spurred trading networks across the country (obsidian from Wyoming's Obsidian Cliff appears in Hopewell contexts as far east as Ohio so such trading networks already existed before Mississippian communities did). Those trading networks may have provided support by far distant social groupings, perhaps an expected outcome of the vast geographic scope of some effects of the Medieval Warming. Additionally, competition in the Middle Archaic may not have been as strong as in the Late Prehistoric due to lower overall numbers of people, who resolved competitive pressures by reducing their residential mobility and localized their sharing (which in southwest Wyoming did not entail obsidian since there are no local geologic sources). In the Late Prehistoric, population density may have been simply too high relative to the effects of the Medieval Warming, and resulted in more frequent violent encounters with close neighbours (box A, in Fig. 10.1) and the need for support from more far-flung groups. What we do not yet know is the precise timing of these changes, such as the use of high elevations, the onset of warfare, and the shift in obsidian use, relative to the onset of the Medieval Warming. The Late Prehistoric was also a time of great social movements, with new ethnic entities (e.g. Avonlea, and possibly ancestors of the Shoshone) moving into the high plains and Rocky Mountains (Kornfeld et al. 2010), new groups who could have increased tension by introducing different customs and languages to the region. Such population shifts point to a response predicted by box C (long-distance migration), perhaps produced by low, but less variable returns, but widespread correlation in how poorly all foraging groups were doing during the Medieval Warming. How these social movements, environmental changes, and related shifts in the broader area of sharing are interrelated is a direction for future research.

Conclusions

Archaeology and (social/cultural) anthropology contribute different pieces to the anthropological puzzle. There is no point in asking that each do the same, and, in fact, doing so would lessen the capacity of each to contribute its strength to the field. Ethnographic observation leads us to understand the factors that condition quotidian patterns of sharing while archaeological study shows how those patterns play out over long spans of time and space, and how they link to environmental or social variables.

We know from ethnographic data that the degree of variance and correlation in foraging returns affects sharing behaviours among individuals, and we can hypothesize that the same models account for long-term patterns of sharing of food, land, and information between villages and regions. There is a cost and benefit to every act of sharing, and foragers – anyone in fact – considers them in deciding whether to be generous or stingy. Our goal as anthropologists and archaeologists is to figure out how and why people make the decisions that they do, and to understand the consequences of those decisions. In this regard, we need both the long-term and short-term scales of archaeology and anthropology.

References

Cheshier, J. & R.L. Kelly, 2006. Projectile point shape and durability: the effects of thickness:length. *American Antiquity* 71, 353–63.

Clark, P.J. & F.C. Evans, 1954. Distance to nearest neighbor as a measure of spatial relationships in populations. *Ecology* 35, 445–53.

Ember, C. & M. Ember, 1992. Resource unpredictability, mistrust, and war: a cross-cultural study. *Journal of Conflict Resolution* 36, 242–62.

Enloe, J., 2003. Food sharing past and present archaeological evidence for economic and social interactions. *Before Farming* 1, 1–23.

Enloe, J., 2004. Hunter/gatherer food sharing: ideology and ecology, in *Hunters and Gatherers in Theory and Archaeological Research*, ed. G. Crothers. (Center for Archaeological Investigations, Occasional Paper 31.) Carbondale: Southern Illinois University Press, 211–40.

Kelly, R.L., 1995. *The Foraging Spectrum: Diversity in Hunter-Gatherer Lifeways*. Washington, DC: Smithsonian Institution Press.

Kelly, R.L., 2011. Obsidian in the Carson Desert: mobility or trade?, in *Perspectives on Prehistoric Trade and Exchange in California and the Great Basin*, ed. R.E. Hughes. Salt Lake City: University of Utah Press, 189–200.

Kelly, R.L., 2013a. From the peaceful to the warlike: ethnographic and archaeological insights into hunter-gatherer warfare and homicide, in *War, Peace, and Human Nature: The Convergence of Evolutionary and Cultural Views*, ed. D. Fry. Oxford: Oxford University Press, 151–67.

Kelly, R.L., 2013b. *The Lifeways of Hunter-Gatherers: The Foraging Spectrum*. Cambridge: Cambridge University Press.

Kelly, R.L., 2017. Foreword, in *Foraging in the Past*, ed. A. Lemke. Boulder: University of Colorado Press.

Kelly, R.L., T. Surovell, B. Shuman & G. Smith, 2013. A continuous climatic impact on Holocene human population in the Rocky Mountains. *Proceedings of the National Academy of Sciences* 110, 443–7.

Kornfeld, M., G.C. Frison & M.L. Larson, 2010. *Prehistoric Hunter-Gatherers of the High Plains and Rockies*. Walnut Creek: Left Coast Press.

Mann, M.E., Z. Zhang, S. Rutherford, R.S. Bradley, M.K. Hughes, et al., 2009. Global signatures and dynamical origins of the Little Ice Age and medieval climate anomaly. *Science* 326(5957), 1256–60.

Mauss, M., 1966. *The Gift; Forms and Functions of Exchange in Archaic Societies*. London: Cohen & West.

Morgan, C., A. Losey & R. Adams, 2012. High altitude residential occupations in Wyoming's Wind River Range. *North American Archaeologist* 33, 35–79.

Nolan, K.C. & R.A. Cook, 2010. An evolutionary model of social change in the middle Ohio Valley: was social complexity impossible during the Late Woodland but mandatory during the Late Prehistoric? *Journal of Anthropological Archaeology* 29, 62–79.

O'Brien, M.J., 2013a. Evaluating the contemporaneity of households at the Eden-Farson site. *International Journal of Osteoarchaeology* 25, 653–64.

O'Brien, M.J., 2013b. *The socioeconomic organization of communal hunting: an archaeological examination of Shoshone collective action*. PhD dissertation, Department of Anthropology, University of New Mexico, Albuquerque.

Robinson, E., H J. Zahid, B.F. Codding, R. Haas & R.L. Kelly, 2018. Spatiotemporal dynamics of prehistoric human population growth: ideal distribution models and radiocarbon summed probability distributions. *Journal of Archaeological Science* 101, 63–71.

Scheiber, L. & J.B. Finley, 2011. Obsidian source use in the greater Yellowstone area, Wyoming Basin, and central Rocky Mountains. *American Antiquity* 76, 372–94.

Smith, C., 1999. Obsidian use in Wyoming and the concept of curation. *Plains Anthropologist* 44, 271–91.

Smith, C., 2003. Hunter-gatherer mobility, storage, and houses in a marginal environment: an example from the mid-Holocene of Wyoming. *Journal of Anthropological Archaeology* 22, 162–89.

Stiner, M., R. Barkai & A. Gopher, 2009. Cooperative hunting and meat sharing 400–200 kya at Qesem Cave, Israel. *Proceedings of the National Academy of Sciences* 106, 13207–12.

Waguespack, N., 2002. Caribou sharing and storage: refitting the Palangana site. *Journal of Anthropological Archaeology* 21, 396–417.

Winterhalder, B., 1986. Diet choice, risk, and food sharing in a stochastic environment. *Journal of Anthropological Archaeology* 5, 369–92.

Wunderlich, R.G., 2014. *Analysis of the Colorado and Wyoming sourced obsidian database.* Masters thesis, Department of Anthropology, University of Wyoming.

Zahid, H.J., E. Robinson & R.L. Kelly, 2016. Agriculture, population growth, and statistical analysis of the radiocarbon record. *Proceedings of the National Academy of Sciences* 113, 931–5.