A Paleolithic Reciprocation Crisis: Symbols, Signals, and Norms

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Abstract Within paleoanthropology, the origin of behavioral modernity is a famous problem. Very large-brained hominins have lived for around half a million years, yet social lives resembling those known from the ethnographic record appeared perhaps 100,000 years ago. Why did it take 400,000 years for humans to start acting like humans? In this article, I argue that part of the solution is a transition in the economic foundations of cooperation from a relatively undemanding form, to one that imposed much more stress on human motivational and cognitive mechanisms. The rich normative, ceremonial, and ideological lives of humans are a response to this economic revolution in forager lives; from one depending on immediate return mutualism to one depending on delayed and third-party reciprocation.

Keywords Behavioral modernity · Evolution of norms · Forager economics · Human cooperation and mutualism · Human cooperation and reciprocation · Human symbolic behavior

Becoming Human

Over the last three to four million years, hominin lives have been transformed. Early australopithecines probably did not differ greatly from their *Pan* relatives in technological sophistication, foraging style, ecological impact,

communication skills, or social complexity. By the mid to later Pleistocene that was no longer true. Hominins had expanded out of Africa. A suite of morphological changes¹ beginning over 2 mya strongly suggests that they had access to much richer foods (mya = millions of years ago; kya = thousands of years ago); perhaps through cooking; perhaps through hunting and power scavenging; perhaps both. There is evidence of the control of fire from about 800 kya (Alperson-Afil et al. 2007; Gowlett and Wrangham 2013). As large game was added to the diet, foraging became more collective and coordinated.² When armed only with short-range spears and other close-range, attritional weapons, hominins can kill medium to large game, and drive predators from their kills, only in groups. Their life history strategy was no longer ape-like: mid-Pleistocene hominins lived longer than apes, with longer periods of juvenile dependency (Kaplan et al. 2000; Robson and Wood 2008; Thompson and Nelson 2011). They probably depended on cooperative reproduction, both in requiring assistance at the birth itself, and in provisioning and crècheing infants (Hrdy 2009). We do not know the extent of their soft material technology (though if *Homo erectus* grandmothers were provisioning infants with gathered resources, they must have made containers of some kind), but their stone toolmaking was skilled; perhaps depending on skills so sophisticated that they could be learned only with the aid of social transmission (Stout 2002; Stout and Chaminade 2009; Hiscock 2014, this issue).

However, while erectines and their immediate successors were no longer ape-like, in all probability their foraging and social lives were quite different from those of the *H. sapiens* foragers known from history and ethnography

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¹ Smaller teeth and jaws; a larger brain.

² Henry Bunn has argued that organized hunting dates to 1.5 mya or earlier (Bunn 2007; Bunn and Pickering 2010).

(“ethnographic foragers”). For one thing, there is no evidence that they lived ideological lives. That is, there is no evidence that their lives were structured by ritual or by supernatural belief; for example, no trans-human figurines have been found. There is no evidence that 800 kya hominins marked or adorned themselves; or that music and dance were important in their lives. While some of these activities would be archaeologically cryptic, others would leave a signal, if they were regular features of hominin life. If (for example) ochre was routinely used to alter the appearance of clothes and bodies 800 kya, we would probably find its traces. The same would be true if they routinely carved or decorated stone tools, or regularly made figurines out of stone, bone, or ivory. Late erectines did not bury their dead (or otherwise ritually dispose of them). Nor did they provide them with grave goods, though there is fragmentary evidence that by perhaps 500 kya, hominins were not simply abandoned where they fell. Paul Pettitt (2011b) suggests that the concentration of *H. heidelbergensis* bones in the *Sima de los Huesos* (pit of bones), between 500 and 400 kya, results from bodies being deliberately shifted to that point.

There is also a near-consensus that their toolkits were more restricted than (almost all) ethnographic foragers. Ecologists talk about alpha and beta diversity: alpha diversity is the species richness of a given community; beta diversity measures the species change as one moves to an adjacent community. To the extent that we can judge from surviving traces, the alpha and beta diversity of mid-Pleistocene technology was low. Until quite late in the Pleistocene (perhaps until around 300 kya) the stone tools were mainly Acheulian hand axes and Oldowan-style flakes and cores (though some of these are further worked). Other hard materials were shaped and used at most rarely.³ Perhaps as a consequence, those hominins exploited a narrow range of resources, and a more restricted set of habitats (see, e.g., Roebroeks 2006). In particular, until around 100 kya, they seemed to be large- and medium-game specialists; Neanderthals continued that specialization (Stiner 2002; Richards and Trinkaus 2009; Stiner et al. 2009, 2011). That said, there are serious evidential and conceptual problems in assessing tool diversity. Evidentially, ethnography does not reveal a tight correlation between rich stone-tool technology and rich soft-materials technology. Moreover, it is difficult to determine when reported tool diversity reflects stable design differentiation amongst the users rather than archaeologists’ classificatory practices. Even so, there seems to be a remarkable expansion of artifact diversity beginning roughly 100 kya.

In current terminology, ancient foragers became “behaviorally modern” as their technical competence and

artifact diversity, their ecological penetration, and their ideological preoccupations approached those known from history and ethnography. The arrival of behavioral modernity was once thought to be remarkably recent, and abrupt: *H. sapiens* and only *H. sapiens* became behaviorally modern around 50 kya. This is a very recent date, given that very large-brained hominins have been alive for half a million years, and that our own species, and the equally large-brained Neanderthals, have been around for 200,000 years or more. Identifying the origins of behaviorally modern foragers in the paleoanthropological record is controversial and murky, but there is some consensus emerging that the technical, ecological, and ideological components of modernity emerge in the period of 120–80 kya. If behaviorally modern hominins really did (and do) live very differently from these earlier very large-brained hominins, and if this transition really did occur sometime around 100 kya, we need to explain why and how behaviorally modern hominins evolved from large-brained but narrow-niched hominins, and we need to understand how the components of behavioral modernity relate to one another.

There are two broad approaches to explaining behavioral modernity. One focuses on the social world of Paleolithic hominins, with the idea that behavioral modernity is a response to increasing social complexity in the later Pleistocene (Powell et al. 2009; Sterelny 2011). An alternative centers on individual agents (e.g., Wynn and Coolidge 2007). The transition to behaviorally modern foraging worlds was the result of a genetic change that led to a change in the intrinsic cognitive capacity of latish Pleistocene *H. sapiens* (perhaps rapidly sweeping to fixation in a small founder population). Different versions of this idea suggest latish Pleistocene upgrades to language; to theory of mind; or to working memory. Ethnographic foraging worlds are different from those of the mid-Pleistocene, because late-Pleistocene foragers were intrinsically more cognitively sophisticated than their predecessors. “Intrinsically” matters here. Life in more complex social worlds has cognitive consequences for those born into one.⁴ So views about the direction of causation are crucial. At issue is whether the cognitive differences between ethnographic foragers and those that lived in the mid-Pleistocene explain behavioral modernity or are explained by behavioral modernity.⁵ I shall

⁴ See, e.g., Heyes (2012), showing the profound effects on human brains of exposure to such social learning tools as scripts and numerals.

⁵ Of course more complex hybrid views are possible. But see Hauser (2009) for an admirably explicit bottom-up research program, the aim of which is to specify the forms of human social life made possible by the intrinsic features of human cognition. This debate is often tied to debates about the supposed intrinsic cognitive differences between *H. sapiens* and Neanderthals, on the grounds that only *H. sapiens* experienced the transition to behavioral modernity; an increasingly controversial archaeological claim.

³ Backwell and d’Errico (2008) claim to have evidence of bone tools about 1.5 million years old, but even if they are right, it is striking that bone was so rarely used until around 100 kya.

defend a version of the social complexity approach to behavioral modernity, suggesting a link between the changing ideological life of hominins and changes in the organization of human cooperation in the period 120–70 kya. Behavioral modernity is linked to the changing nature of human cooperation. But before I develop that idea, I shall first explain my skepticism about genetic forcing models.

Genetic Forcing Models of Modernity

Genetic forcing models are problematic for two reasons. If a particular cultural trait (technological diversity and innovation; the use of material symbols) reflects a distinctive kind of mind, we would expect to see that trait persist once it is established. Hominin social worlds would change through a series of pulses, each pushing social complexity or technical capacity to a new platform. But we do not see anything like that over the last 200,000 years. As Peter Hiscock and others have noted, the archaeological symptoms of behavioral modernity appear and then disappear from the material record. Jewelry (shells, teeth, ostrich eggs, and the like) have a patchy historical distribution from about 75 kya (Hiscock and O’Conner 2006). They do not have a punctuated, threshold-crossing distributional pattern. The same is true of disposal of the dead. It is not true that once the structured disposal of the dead is first found in the record, most skeletons are then found in ceremonial circumstances. Mortuary practices seem to have a patchy and unstable onset (Hayden 1993; Vermeersch et al. 1998; McBrearty and Brooks 2000; Pettitt 2011a, b). The same is true of innovations in utilitarian technology. Microlith technology is often seen as one mark of behavioral modernity, because microliths have to be attached to a shaft as points or barbs, and hence show that their users make compound tools with adhesives. There are very old microliths in the hominin record (probably over 200 kya), but this technology does not persist once established (Hiscock and O’Conner 2006). So, the first problem: the material traces of modernity are much less stable than we would expect, if those traces are the social reflections of a distinctive and genetically canalized set of enhanced cognitive capacities.⁶

The second problem with genetic forcing models is with their task analysis. There is no obvious connection between the supposed new cognitive capacities and the expanded material culture of the transition to behavioral modernity.

Richard Klein (2008, 2009) is one defender of the genetic forcing model; he has suggested that behavioral modernity signals the arrival of full language. But as Henshilwood and Dubreil (2011) point out, there is no obvious explanatory connection between full mastery of a richly expressive recursive language, and a more diverse material culture. Why would agents need enhanced language to make bone tools; shell necklaces; or to organize space into (say) family hearths? It is true that the highly skilled artisans of the late Pleistocene almost certainly depended on rich social learning to acquire the skills to make and use their technology (Stout 2011; Stout and Chaminade 2012). Moreover, improved language, improved theory of mind, and improved working memory would all contribute to enhancing the bandwidth and fidelity of social transmission. But the expanded technology of the later Pleistocene seems mostly to be a change in alpha and beta technological diversity; not a change in the skill demands on peak technology (Wadley 2011). Levallois stone tooling work making blade-like implements dates back more than 200,000 years, and it is highly skilled, as it is very difficult to create long, reasonably thin and sharp stone tools (Bar-Yosef and Kuhn 1999; Foley 2001; de la Torre 2011; Hiscock 2014, this issue). Similarly, there is evidence that Neanderthals made glues 200,000 and more years ago that depended on precise control of temperature (Koller et al. 2001).

Enhanced language is not the only suggestion. Wynn and Coolidge (2007) very plausibly claim that human cultural and cognitive evolution depended on enhanced memory, the control of distraction, and the capacity to focus on complex, multi-stage tasks. But it is much less obvious that the late Middle Stone Age (MSA) (of, say, 80 kya) shows an improvement in these capacities, in comparison with, say, ancient members of *H. sapiens*. Lyn Wadley’s experimental recreation of MSA compound tool technology makes a persuasive case for the idea that earlier MSA toolmaking requires planned, carefully controlled routines (Wadley 2010, 2011). In short, the peak utilitarian technologies of the first behaviorally modern foragers do not seem to depend on enhanced cognitive capacities.

The same is true of material symbols: ochre, shell beads, and the like. Despite claims to the contrary, ritual and material symbols do not depend on especially sophisticated cognitive capacities: capacities beyond those already present in mid-Pleistocene large-brained foragers. There is considerable misdirection in the literature on this issue: “symbolic behavior” is over-played and overinterpreted. A sizable fraction of archaeologists suggest that behavioral modernity is most fundamentally a transition in the ideological life of humans, to a world of norms, conventions; to symbolically-mediated and governed social interaction (Henshilwood and d’Errico 2011). One problem is that

⁶ Of course, it would still be possible to suggest that the genetic change was necessary but not sufficient for modernity. But this would rob the explanatory strategy of its interest, both because of the lack of a positive case for the idea, and because attention would shift to identifying the extra factors, presumably to do with social complexity.

these views often depend heavily on a tiny fragment of the material residue of a group. For example, Henshilwood and d'Errico (2011) place considerable weight on the presence of engraved ochre at the Blombos Cave rock shelter site; a site that dates to 100–75 kya, with deep occupation layers, probably showing persistent use over many thousands of years. These physical traces are striking. The output seemed to be patterned in a planned way: each line seems to be executed carefully, and all the lines are cut in a single session with the same tool. The overall combinations are regular: it seems very unlikely that their placement is independent of one another. They have no plausible prosaic function, yet the carving seems to have been planned, purposeful activity. The ochre substrates seem to have been carefully chosen, and the surfaces prepared prior to engraving. Yet these fragments of incised ochre are rare; upwards of 1,500 fragments of ochre have been found at this site, of which 14 or so are incised. That is a troubling number. It is too rare for engraving ochre to have been a routine feature of life, but not so rare that we can view the finds as idiosyncratic innovations with no social upshot. Incised ochre is enigmatic: common enough not to be the idiosyncratic output of an unusual individual; too rare to be a staple of daily life.

So one problem with theories of behavioral modernity centered on symbolic behavior is that they rest heavily on finds whose significance is obscure. But more important is the overinterpretation of the cognitive demands of symbolic behavior. Thus Clive Gamble, Robin Dunbar, and John Gowlett write as if mechanisms of bonding and affiliation depend on agent recognition of bonding and affiliation mechanisms (Gamble et al. 2011; Gowlett et al. 2012): as if singing around the campfire builds bonds of trust and intimacy only if those by the fire realize that fact about one another (see, e.g., Gamble et al. 2011, pp. 124–125). If anything, the opposite is true. Likewise, Paul Pettitt (in discussing funeral practices rather than material symbols) offers a richly meta-representational interpretation of norms and conventions. On his view, conformity to social norms depends on three levels of intention.⁷ If he were right, this might explain their relatively late emergence in human social life. It is true that once the cognitive and communicative capacities are in place, norms could be taught to the young in a richly meta-representational way: “you would not want your grandmother to think you do not know how to behave like a gentleman.” But clearly that is not the only way norms can be learned. For example, a child can pick up norms of disgust by social referencing; a pathway no more

cognitively complex than a young monkey learning to fear snakes from its mother's fear.

On similar lines, Henshilwood and Dubreuil suggest that the early Still Bay shell beads show that those *H. sapiens* had a capacity for perspective taking (Henshilwood and Dubreuil 2011). To prepare and wear beads, agents need to picture themselves as others see them. Not so. Perhaps I cannot see my own necklace when I am wearing it. So I cannot tell from my own visual experience how it looks to you. But, first, most obviously, I can model it on another, seeing how it looks on them. And there are many other possibilities. One option is that beads are chosen and valued through a less perspectival representation of their traits: symmetry; the number or rarity of the shells; perhaps the care of the workmanship. Moreover, necklaces need not be worn by their makers. Necklaces might be nuptial offerings, or a token of entry into adulthood. Finally, beads can be used as bracelets, or to decorate clothes. In short: jewelry and other appearance-altering technologies can be used without meta-representational capacities. Concern for appearance or workmanship does not depend on being able to represent multiple perspectives, nor on inhibiting one's own viewpoint. In appreciating, say, the fine quality workmanship on a foliate spear point, an elegantly symmetrical hand ax, or the rich red of ochre painted onto a hide shield, agents can use their own responses as guides to those of their fellows.

So understanding the visual impact of material symbols need not depend on especially advanced theory of mind capacities. The same is true of many of the supposed social functions of material symbols; their “meaning” (on the multi-functionality of material symbols, see Wiessner 1983, 1984). Humans do not just inhabit particular social milieu; they identify as members of the groups to which they belong, and often with the specific role and status they have within the group. One difficult issue in charting hominin social evolution is identifying the origins and elaboration of group and role identity. The archaeology of material symbols is important here, because ethnography shows that material symbols—styles of clothing, jewelry, tattoos, and other body marks—often display and signal role and identity. To the extent that these leave traces, they are clues to the normative world of vanished agents; to the conventions, norms, and expectations that regulated interactions within a group, and the ways that one group presents itself to others. However, material symbols can function as insignias, as badges of status or membership, without those functions being articulated or explicitly represented by the agents in question. So, for example, a mark of local identity and belonging can begin more or less accidentally. A high prestige individual innovates, putting on his baseball cap backwards. Conformist learning, prestige-biased learning, unconscious imitation establishes a

⁷ “I want you to believe that you must behave how we want” (Pettitt 2011a, p. 153).

local tradition badging the group, a tradition which then stabilizes through the responses of both outsiders and insiders. Dress can be a conventional signal of sex or status independently of the conscious intent of agents; many agents dress in ways typical of their social role out of habit and to avoid appearing odd. Indeed, conventions of social distance and food taboos seem so natural to insiders that they are not seen as conventional at all. Conventions—including those of material symbol use—do not have to be understood as conventions in order to regulate behavior. Modeling work makes the same point: Skyrms (2010) shows that conventional signals can become established and be used stably through trial-and-error learning.

Indeed, the point can be put more strongly than this. Paul Seabright (2010) argues that the success of large-scale social worlds, with their specialization and division of labor, depends on “tunnel vision,” a failure to focus on all the ways coordination and mutual dependence could go wrong. If the risks of incompetence, deceit, and ill luck were psychologically salient to us, risk-averse responses would sabotage many systems of exchange and coordination. Many norms and conventions of social role and identity likewise depend on tunnel vision. They function *because* they are not seen as norms and conventions of social role and identity, not *despite* their not being so seen. This is most obviously true of religious rituals, if these really do function, as many suppose, to build cooperative communities and mark their limits. Rituals, including religious rituals, have affective power through their sensory and physical impact, not just their ideological content. But to the extent that their content is causally potent, it depends on belief or something like belief; a cognitive attitude that would be eroded if the participants understood their own religion as a conventional, historically accidental marker of local identity.

Tunnel vision is important to the functional role of other norms as well, for part of norm internalization is coming to see norms as objective natural facts or external standards; not as decisions or agreements, which are contingent and which could then be matters of discussion and revision. This is part of the idea that true norms are authority-independent (Joyce 2006). Once conventions are established and entrenched, to children being born into a culture, conventions seem like natural facts. Agents do not think to themselves that they should avoid eating spiders or beetle larvae because they thereby signal their ethnolinguistic identity to insiders and outsiders alike; rather, such vermin are inedible, so eating them is disgusting. In brief: the emergence of behavioral modernity may have involved a new ideological life of norms and conventions mediated by the use of material symbols. But if so, that new ideological life did not depend on the prior evolution of a new and especially powerful set of cognitive capacities. No such

novel capacities were needed to learn, and respond to, material symbols. You do not have to be newly intelligent to be newly convention-ridden.

Demographic Expansion and Social Complexity

The obvious alternative to genetic forcing is social complexity. Social complexity changes over time, and history shows simplification, not just gain in complexity (Currie et al. 2010). If the signals of behavioral modernity are responses to complexity, it is no surprise that they come and go. The leading version of this idea links modernity to demography: behavioral modernity is a response to a larger social world. Size helps a group preserve and extend its informational resources. Loss of crucial skills to unlucky accident is buffered if information is stored in many minds; social learning is more reliable if naive subjects have access to many models; loss can be restored if the band is part of a meta-population linked by movement in and out; cognitive resources can be amplified if a larger population allows for greater variance in skill level, and if the next generation have a tendency to use as their models high-end outliers (Henrich 2004; Powell et al. 2009; Richerson and Boyd 2013). There are economic effects of an expanded population as well. Specialization increases tool diversity: an agent that specializes in (say) fishing or targeting waterfowl has an incentive to invest time and effort in making and mastering specialist equipment. Larger groups, with their larger customer base, support specialization more easily, perhaps initially a specialist fire-keeper, as Ofek (2001) suggests. Specialists are probably also more likely to successfully innovate, having both the time, the skill, and the interest to do so. Larger groups (even when mobile) deplete their most favored resources more quickly, and hence are likely to have incentives to broaden their resource base. So it is no surprise that the idea that behavioral modernity is a signal of population growth is gaining considerable acceptance (Lycett and Norton 2010; Premo and Kuhn 2010; Kuhn 2012).

That said, the model faces two problems. One is empirical: as Richard Klein has pointed out, there is no direct, convincing empirical support for demographic expansion in the period 120–70 kya (Klein 2009, 2013). Indeed, Klein argues that foraging data indicate low population densities, for hominins around the time of transition were able to exploit resources that disappear quickly if intensively harvested (Klein and Steele 2013). The second is that the model explains only one aspect of modernity: the expansion of utilitarian technology. This second issue will be the major focus of this article, but let me first outline the empirical challenge.

The demographic model turns on local group size, and on the aggregation and interaction of groups in a landscape.

But demographic information is typically meager, patchy, and indirect (guessed from data about site number, site size, perhaps effects on the local ecology, and from genetic patterns in descendant population).⁸ It is especially meager prior to the emergence of behaviorally modern humans. Indeed, this somewhat understates the problem, for we need to distinguish between *objective* and *experienced* demography. The objective demography of group size and density determines the resource impact of humans on their landscape and largely determines the rates at which humans encounter one another and other animals. But the sociocultural organization of human populations—their experienced demography—is enormously salient to the effect of overall population size on informational resources. Thus ethnographic foragers typically live in bands of 20 or so adults. But their sphere of interaction is quite fluid. In some circumstances (for example, when food is scarce), these bands dissolve into family-size units. In others, bands can aggregate: sometimes to exploit windfall resources or periods of seasonal plenty; sometimes they aggregate around permanent water in dry seasons. Even when bands remain separate, they can be linked by territorial overlap, trade, and kinship. The capacity to retain informational resources will in part depend on the frequency with which bands are in contact, and the extent to which they are porous, with relatively free movement between bands (Kuhn 2012). So the size of a forager's social world in part depends on social practice, in part on objective demography; and most of our evidence,⁹ meager though it is, is about objective demography.

The problem of evidence is real. But this article is centered on a different issue. If the threshold model were right, until that threshold was crossed, cryptic transformative technologies, error-intolerant technologies, and specialist equipment could not be stable parts of the hominin toolkit. The informational resources needed to make and use such technologies were not reliably maintained, and nor were there standing incentives to invest in such technologies. While this model offers a very natural explanation of the latish Pleistocene expansion of the technological toolkit (and of the Australian contraction of technology), it is much less persuasive as an account of the appearance of material symbols or ritual behavior in the record. By the late Pleistocene, with its impressive cave art, material symbol production was impressively skilled, and may well

have depended on specialization. But early forms of material symbol technology are not technically demanding, and hence do not seem to depend on the kind of informational resources only large and interconnected groups can maintain. To the extent that a technology is simple and error tolerant; to the extent that it is in regular use by all or most members of a group; and to the extent it can be reverse engineered from persisting samples, a technology is less vulnerable to accidental loss. If individuals within a band use ochre, shells, animal teeth, or ostrich egg shells as decorations, they provide models to the entire group. These are not secret or transformative technologies, but rather ones which could be readily reverse engineered. Moreover, unlike a demonstration of a difficult or subtle skill, they persist over time. A wheel might not carry the idea of a wheel—making a wheel is hard—but a strung shell or shark tooth really does carry the idea of a bead or pendant. So does engraved ochre, despite the rarity of these fragments. Likewise, though all groups experience the death of members, the organized disposal of corpses in archaeologically visible ways came late to the human lineage. It became gradually more common only over the last 120,000 years. It is deeply implausible that this pattern is explained by an informational constraint: that a group could only retain funeral practices as stable traditions once there were enough humans in one place to collectively remember what to do when someone dies. How hard is it to bury the dead in some chosen spot?

In sum, then, while there is a clear connection between demographic expansion and an expanded utilitarian toolkit, it is less clear how that expansion explains the appearance of material symbols in the archaeological record. An alternative possibility is that material symbols are a response to size-dependent social stresses. Steven Kuhn and Mary Stiner have suggested that material symbols function as social markers in a larger social world (Kuhn and Stiner 2007a, b). As group size, or more likely the meta-group size, expands, face-to-face mechanisms and personal familiarity no longer suffice for social navigation. Individuals mark themselves to advertise their ethnolinguistic identity (if these symbols advertise in-group/out-group boundaries), to indicate social role, marital status, family or clan membership. On their view, material symbols indicate a retreat from a social world of intimacy and experiential knowledge of one another.

Perhaps so, but if these signals are to others within their own band-metaband aggregates, these ethnolinguistic units would have to be surprisingly large for numbers to overwhelm our capacity to keep track of individuals and their history. Kim Hill has recently reported that the members of the Ache metaband community (of close to a thousand individuals) had no problem tracking one another as individuals, despite considerable dispersion over time and space.

⁸ Arguably, there is genetic data about the size of the population from which living humans descend, and that data shows a latish Pleistocene bottleneck. But the fact (if it is a fact) that we all descend from a human population of about 10,000 that lived about 70 kya does not tell us that there were only 10,000 sapiens living 70 kya.

⁹ Not quite all. The frequency with which we find exotic materials, and the distance of materials from their sources, gives us some information about exchange networks.

He reports that they could recognize photos of band members who lived over a hundred kilometers away, and who they had not seen for many years, and locate them in social space (Hill 2012). Hill's results fit well with Robin Dunbar's work on human group size: he gives an army battalion (often around a thousand men) as about the largest group in which individual tracking is possible. Moreover, if you know your friends, allies, and kin by personal recognition, even without the aid of cues and signals, you automatically know that alien groups you encounter are alien. The fact that there is no one in them that you know tells you that. Ethnographic foragers sometimes are in close association with strangers (Murphy and Murphy 1986), but this is not typical (see Boehm 2012), so unless the forager band complexes of 70 kya were much larger than those typically described in ethnography, ancient foragers could track one another by individual recognition, and would know one another's personal histories.

I shall argue that the expansion of material symbols in the transition to behavioral modernity signals increasing threats to social peace. Size was one of those threats. The larger the social group, the more probable it is that dangerous conflicts will emerge. The more individuals you meet, the more likely it is that you will encounter one you find intolerable. As has often been noted, conflict is dangerous in forager societies, because there are no institutional mechanisms to restrain escalating conflict. So disputes and dislikes can very easily escalate to lethal violence (Seabright 2010; Boehm 2012). As the metapopulation expands and the landscape becomes more packed, it will be less easy to avoid conflict by groups fissioning or by individual families moving away to unoccupied space. It is likely that as social networks expand, active measures to maintain social peace become more important. Material symbols—beads, shells, ochre markings on bodies and garments—are not themselves peacemaking technologies. But peacemaking is probably one important effect of ritual and ceremony, and ethnography shows that ceremonies and rituals typically involve amplifying and altering individual appearances. Importantly, shared ceremonial and ritual activities can help make peace, even if they are not about peace: collective, communal activities build affiliative bonds by building affiliative emotions. My suggestion is that conflict management became more urgent as agents' experienced networks became larger, and this in turn made the ceremonial lives of groups more important to their continued stability. But it was not just size.

From Mutualism to Reciprocation

Size probably did matter, but I shall argue that the economic organization of forager social lives changed too, and those changes transformed the bases of cooperation.

Behavioral modernity involved a shift from immediate return mutualism to cooperation based on reciprocation, and, more generally, to an economic life with longer planning horizons. Reciprocation-based cooperation is more cognitively and motivationally demanding than mutualism, and is more apt to generate conflict. So as the economic organization of forager lives changed, they evolved a set of social tools for limiting conflict costs: (1) an elaborated kinship system; (2) explicit norms; (3) rituals, ceremonies, myths.

Famously, forager lives are cooperative, with a lot of sharing and mutual support. Sharing and mutual aid almost certainly have a very deep history indeed: the 2-million-year-old signal of a much improved diet in hominin lives is a signal of cooperation as well, especially if it signals much improved access to meat through some mix of power scavenging and hunting. Without high velocity weapons (or poison darts), hunting and power scavenging are collective, cooperative mutualisms (Tomasello et al. 2012). Foraging parties consisting of all or most of the adults¹⁰ of the band would drive scavengers from the prey, or make a kill, and divide the spoils immediately. Chimps and other great apes live almost completely in the now; they consume the resources they need on contact and capture. Early- to mid-Pleistocene hominins already had evolved a delayed return economy: they did not live wholly in the present. There was a gap between investing time and effort in preparation and planning, and return on this investment. These agents spent time and energy making spears and hand axes prior to forming hunting parties, and the hunts themselves were likely to be arduous and time-consuming. Perhaps there was a further delay as the carcass was removed to a safer place for division and processing. Nonetheless, the return on their investment was likely to be rapid. For example, hand axes are general-purpose tools, likely to be used for a range of daily tasks. Moreover, the gains from cooperation were immediate, and shared immediately, in public, in the presence of all or most of those who contributed to the communal effort. Cooperation of this form is mutualistic; it does not depend on a favor today being returned next week, perhaps by a third party, perhaps in a different currency.

I suggest that beginning perhaps around 120 kya, a trend developed that slowly changed the economic basis of forager cooperation, from one based on immediate return mutualism to one based on delay and reciprocation. Reciprocation and exchange became more important, and with increasing delays between investment and return. This is a change in relative importance: immediate return

¹⁰ Or perhaps the adult males: at issue here is whether the male-female division of foraging labor is a sapiens invention, or whether it originated deep in the hominins (O'Connell 2006).

mutualism continued to be part of the forager world in the later Pleistocene, and almost certainly there was reciprocity-based cooperation in the Middle Pleistocene.¹¹ No single factor was responsible for this change; rather, it was the accumulated result of several factors; factors whose importance almost certainly varied very considerably in space and time. The result though was a forager economy with more specialization and division of labour; exploiting a broader range of resources, and with a more extensive material culture (including, one presumes, more use of soft materials). Those economic changes changed the basis of cooperation from mutualism to reciprocity, a change that made monitoring of the costs and benefits of cooperation much more difficult, and thus much increased the risks of conflict. My hypothesis is that the expansion of material symbols from roughly 120 kya is the archaeological signature of increasing social investment in conflict management; perhaps partly as a response to social density but more directly as a response to increasing stresses on face-to-face mechanisms of cooperation.

The Projectile Revolution

MSA hunters of 400 kya depended on short-range weapons: the German spears were javelins rather than stabbing spears, but they were heavy; they are not distance weapons. Dating the shift to higher velocity, longer distance weapons (bows, javelin + woomera combinations) is difficult (poison dart technology, even more so), but it probably began something like 70 kya (Shea 2009; Lombard and Phillipson 2010; Shea and Sisk 2010). But once projectile technology is in use, the band will tend to fissure into small teams rather than foraging as a unit. Bow-and-arrow hunters typically operate in groups of two or three, as small parties are less conspicuous and threatening to potential prey. With this change, a standard-size forager band of twenty or so will support a number of hunting parties. These will certainly hunt with varying success on any particular day, and almost certainly will have varying success over time. So weapons which facilitate small-group hunting help propel a shift from mutualism to reciprocity. The same is true of any shift of typical targets from larger to smaller game: from (say) horse-sized targets to gazelle-sized targets. Without high velocity weapons, large prey are dangerous and (perhaps more importantly) hunters will probably need multiple strikes to kill. Gazelles are not dangerous; they are more numerous and more vulnerable to a single strike. But

they are timid and fast. The optimal hunting party will be smaller.

Specialization and the Division of Labor

As noted above, larger population sizes tend to result in extending the resource base, as the most favored resources become less available. Different resources require different skills and are often best harvested with different equipment. At any given time, they too will be harvested with different success rates. Instead of the group as a whole succeeding or failing together, different agents will succeed to differing degrees at different times. So demographic expansion tends to shift economies towards exchange and reciprocity by encouraging specialization and a division of labor. From the perspective of the overall reliability of the flow of resources to the group, that is advantageous, reducing variability. But it shifts the basis of cooperation towards reciprocity, and away from an easy commensurability of give and take. No doubt favor trading has always involved some element of weighing one good against another. But in the final phases of the Pleistocene, this weighing problem became more challenging. As shellfish, fish, and birds come onto the menu, what you are apt to get back becomes increasingly different from what you gave out. Being fair and monitoring fairness becomes increasingly difficult in a barter economy as the range of goods in circulation increases. One marker of behavioral modernity (and of the broad-spectrum revolution that followed it) was just such an expansion of both the food resource base and of the material substrate of technology. Bone, shells, teeth, and horn were added to the hard-material technology. It would be surprising if there were no expansion of soft-material technologies too. To the extent that different agents tended to specialize in supplying this broader range of resources, exchange became more important and less easily weighed.

Should We Stay or Should We Go?

Expanding the resource base and increasing specialization effects the organization of mobility, too. There are many intermediates between the simple collective mobility of small forager bands chasing their favored middle-size game through a landscape, and peasant farmers rooted to their lands (for one distinction, see Djindjian 2012). As foragers target a broader range of resources, and as different agents tend to specialize in different targets, agents have different tipping points for when it is time to move on; since resources deplete at different rates. Tension probably appeared first with the male/female division of reproductive labor. Moving on is more difficult for women, burdened as they are with infants and toddlers. If a sexual

¹¹ E.g., reproductive cooperation probably dates back to *H. erectus*-grade hominins, perhaps 1.7 million years, and female support of one another's reproductive effort comes in many different forms (Hrdy 2009).

division of labor evolved early, that would reinforce a gendered difference of tipping points on movement; for the primary targets of female foraging are closer to the base of the food web, and hence deplete more slowly. But as the toolkit expands, the cost of movement increases for everyone. It is one thing to carry a spear and a few favorite hand axes. It is another if you have fishing nets, baskets, a grinding stone, a container of hot coals. Storage technologies—drying or smoking meat, storing grains or tubers—likewise discourage moving on. The result was probably a shift to more temporally and spatially expanded forms of fission–fusion organization. Hunting parties and parties targeting predictable but ephemeral resources like fruiting nut trees might make longer trips, before rejoining base camp. A flexible social and economic organization of this kind can help the group as a whole manage the differing cost-benefit trade-offs between staying put and moving on more efficiently and with lower conflict costs. But that is only if cooperative motivations are maintained through these trips despite the loss of daily intimacy, and only if the resource-gathering parties are rewarded for the resources they inject. Those rewards will be through reciprocation, and probably will not involve a like-for-like return. Delay and incommensurability are both potential sources of tension.

Planning Depth

A shift to a more extended fission–fusion structure accentuates the trend to a delayed return economy, as does any form of food storage. So too does the expanded technical base. The up-front cost of investing in technology increases both through an increased cost of some individual items of kit (for example, in making composite tools), and through an expansion of the total toolkit. Tools like grindstones are only worth making if used regularly, and on substantial amounts of grain. Soft technologies like nets and baskets also take time and effort to make and carry. The more kit foragers have, the less often they use any particular item, and hence the investment time horizon is stretched, as the total investment in technology increases.

To sum up: behaviorally modern foragers relied more on reciprocation; they often lived in temporally extended fission–fusion bands; they invested more in technology; they probably began to develop some storage skills. In general, their lives became more sensitive to their expectations about the future, including their expectations about others' actions.

Metaband Structure

So far, I have focused on changes within the band itself. One aspect of behavioral modernity is the increasing

importance of relations between bands. Trade is one such relationship, and trade does seem to become more important in the last 100,000 years of the Pleistocene, with sites containing increasing proportions of exotic materials (McBrearty and Brooks 2000; Ambrose 2006).¹² Perhaps more importantly, ethnographic forager bands are embedded within ethnolinguistic units, and often the bands within these units are linked to one another by kinship, alliance, and mutual obligation, often mediated by formal norms (as in the Kung San Hxaro system; Wiessner 1982). This extended network of alliance and obligation helps foragers manage risk, because it gives them the capacity to move if their particular territory is hard-hit by environmental disturbance (Cashdan 1983; Marlowe 2005).

We do not know for sure how ancient this metaband structure is, but Clive Gamble argues persuasively that it was a precondition of the active migration of *H. sapiens* out of Africa. He suggests that by the time humans moved out of Africa, this band-metaband structure was in place, making stable social relations possible despite individuals being dispersed in space, across a landscape, seeing one another infrequently (Gamble 2008). The idea is that after 60 kya, humans colonized Australia, including arid Australia; the high northern latitudes; oceanic islands; deserts; the Americas. Colonization of this kind is not mere, blind, incremental creep along a favorable resource channel, spreading along a coastline or up a river valley. Rather, it requires genuine, intentional, there-and-back voyaging, whether to islands of habitability in deserts and tundras, or across actual oceans. This pattern of landscape occupation depends on coordination and cooperation of a particular kind: cooperation that does not depend on face-to-face, intensively managed, contingent partnerships. Deliberate there-and-back voyaging depends on cooperation and good will across agents dispersed in space and time. The picture, then, is that humans (often) were living in expanded, meta-fission/fusion social worlds; living most of the time in small groups dispersed through large territories, but in groups which reaggregated in favorable seasonal or wind-fall conditions. Band-scale dispersal and amalgamation depends on noncontingent affiliative relations, ones that do not depend on daily management. When these meta-groups reassemble at (say) permanent water in a drought, agents need to have ongoing relationships already sorted, even if the people in question have not seen one another for months or years.

¹² As a rough rule of thumb, exotic materials are stone or other materials whose original sources are 50 km or more from the sites at which they are found.

Norm, Ritual, Symbol

Let us sum up these considerations. The idea is that human foragers experienced a set of changes that expanded the time horizons of cooperative activity; changes that made the rewards for cooperation more dependent on reciprocation; changes that increased the cognitive challenge of tracking rewards and losses; changes that stressed the existing motivational supports for cooperation; changes that expanded the circle of cooperation to other groups, and individuals within them, individuals and groups who were not strangers but not seen on a daily basis either. Trade might have expanded the circle of exchange still further, across ethnolinguistic groups. As population size expanded, and as ethnolinguistic groups extended their reach through landscapes, at some point interactions between full strangers must have become more frequent. These brought both the possibilities of trade and exogamy, but also even more serious possibilities of conflict. For many reasons, then, reciprocation management became central to social life.

Reciprocation-based cooperation can be stable. But the cognitive and motivational demands of reciprocation-based cooperation are much tougher than those of immediate return mutualism, especially if the time horizons are long, and if reciprocation involves trade-offs across many different goods. Even if agents were ideal strong reciprocators, motivated themselves to be fair, and expecting others to be fair, monitoring cooperation is much more challenging in a delayed-return, reciprocation-based, broad-spectrum economy. The monitoring problem becomes more difficult, the more returns are delayed; the more they depend on future favors; the more they depend on indirect return from third parties; the greater the range of products in play. Monitoring also becomes more difficult as network size and network heterogeneity rises. But foragers are not perfectly fair-minded: they will have a tendency to deceive themselves about what they owe others, and to deceive themselves about what others owe them. So they will have to control their natural temptations to be stingy and to cheat; their even more natural tendency to suspect that others have been stingy and cheated. So there are changes both to monitoring and to motivation, and these generate potential conflict points.

Material symbols become visible in the record, I suggest, in response to both the monitoring problem and the motivation problem. First, motivation. One response to stress on cooperative motivation is to invest more in activities that help sustain and maintain affiliative bonds. Shared, coordinated activity, as in ritual, ceremony, song, and dance is a peacemaking activity; it is socially bonding. When it goes smoothly, shared coordinated activity builds affiliative bonds independently of its purported content.

Initiation ceremonies are not ostensibly peace-making rituals, but they still build connections between initiates. Harvey Whitehouse has argued that human ritual life tends to fall into two broad categories. Some are regular but not very intense. Others are rare, but very intense, because stressful or challenging. One possibility is that sharing high-intensity rituals builds stable bonds: being in the same initiation cohort (for example) might link individuals firmly enough to maintain cooperative defaults, even without frequent reinforcement, because their shared experience is extreme (see, e.g., Atkinson and Whitehouse 2010). This mechanism can be reinforced by others. In particular, the stability of these dispersed social networks probably depended on the invention of kinship systems.¹³ Kinship systems provide agents with these bankable, storable relations; a framework of semi-stable relationships. Of course kin alliances and affiliations can break down, but they are relatively stable, and they require less active management. You need to invest less to maintain affiliative relations with kin; people are more likely to be willing to aid a relative they have not seen for 5 years than a friend they have not seen for 5 years (see Roberts and Dunbar 2011; Curry et al. 2012).

These mechanisms also help alleviate the monitoring problem too. For the ethnographic record suggests that norms can act as pricing mechanisms, setting default expectations about the division of the profits of cooperation, avoiding the costs of negotiating every division on its own merits. Norms about roles and responsibilities reduce negotiation and conflict costs, by setting well-established, widely respected default expectations about (say) what kinds of product should be shared, and how the shares should be divided. Thus Michael Alvard and Daniel Nolin describe a complex set of norms that regulate the division of captured whales; a system that ensures that those that invest in the technology are rewarded even if they are not part of the capture team (Alvard and Nolin 2002). Likewise, Alan Barnard describes the bushmen's "parliament of bows"; hunters hunt with borrowed but identifiable arrows, and the arrow-owner, not the hunter that makes the kill, supervises distribution (Barnard 2011, p. 77). These are wonderfully eye-catching examples, but Michael Gurven's overview shows that norms of division are common in pre-state societies (Gurven 2004).

Norms and rituals are rarely directly visible to archaeological inspection. But if ethnography is any guide, there is an intimate link between the material symbols of a group, and their norms and rituals. The hypothesis is then

¹³ Forager kinship systems are often inclusive, counting everyone in the ethnolinguistic group as kin through some connection, including ones which are entirely fictional, like name-sharing (see, e.g., Lee 1986).

that preserving the social peace as economic and demographic complexity increases is norm and ritual hungry, hence it is symbol hungry too. That is why we find material symbols becoming archaeologically visible from about 120 kya; they are signals of a more complex economic life, and the potential conflicts that complexity breeds. I suggest that funeral practices (rituals which sometimes are archaeologically visible) fit this picture of a transition to reciprocation-based social lives. As I noted earlier, it would be bizarre to suggest that the apparent absence of death rituals before 120 kya reflects either emotional indifference or cognitive constraint. Paul Pettitt argues that funeral behavior has three functional roles (Pettitt 2011a, b). One is simple and utilitarian. Corpses rot, attracting pests, pathogens, and scavengers. There is a lot to be said for their safe disposal. A second function is to manage separation and grief; to deal with the emotional stresses death imposes. A third is to renegotiate the new social environment. All of these were salient before the transition to behaviorally modern life. Indeed, perhaps in those still smaller social worlds, death would be felt still more keenly. Yet while the pattern is noisy, funeral practices emerge slowly and late in human evolution. Actual burial of the dead seems to begin with *H. sapiens* in the Middle East at about 120 kya, and Neanderthal burials begin a bit later.¹⁴ But origins are halting and unstable, and most later hominin fossils are not from burials. But where we do find burials, we also often find more than mere disposal of bodies: often there is some kind of apparently ritualistic post-mortem action on corpses.

So despite the fact that loss would have been understood and felt as keenly before the origins of burial, something changed about death over the last 120,000 years. One change: in a world of reciprocation, individuals die with debts and credits, and that adds a problem and a stress point in renegotiating the social environment. A second: social networks are more dispersed, and so the loss of an individual, with its emotion and social consequences, had to be worked through with those not around at the moment of death. Death was socially protracted, as news filtered out to those in the person's network. Once these factors prompt the elaboration of coping-with-death practices, they might well acquire secondary functions along the lines suggested by Whitehouse. Funeral practices become a form of intense, stressful, but rare ritual, helping bond the extended community.

In conclusion: behavioral modernity, and especially the elaboration of material symbol use in the transition to behavioral modernity, is a response to a more complex, exchange-based economy, and the cognitive and social

challenges posed by that economy, not just a response to larger social worlds.

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¹⁴ Grave goods are later still; there are no clear examples earlier than 30 kya, so not until after Neanderthals are extinct.

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