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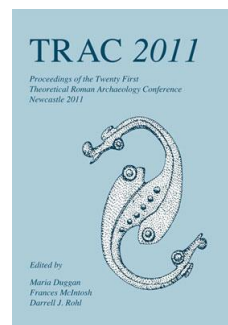
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route of transmission, but also in the need for a host to replicate. To the analogies of genetic transmission (that is, within eukaryotes (plants, fungi and animals) whose cells contain a nucleus holding genetic information), and virus replication, we can add genetic transmission in bacteria. Bacteria are single-celled organisms that replicate by dividing in two (a form of vertical transmission resulting in two bacteria that contain an identical genome), and can also acquire genes by lateral gene transfer from other bacteria or dead cells (Lane 2005: 119). A cultural species such as a pot, a tool or recipe can accumulate memes from other cultural bodies just as it can be reproduced by a precise copying.

This is not the place to examine routes of cultural transmission (see Shennan 2002 for detailed a discussion). What must be remembered, however, is that eukaryotes, viruses and bacteria, which all carry and transmit genes and rely on different forms of transmission to replicate, all follow the same evolutionary mechanism of natural selection. Natural selection acts on variation between individuals; individuals whose characteristics are better suited, even slightly, to the environment than others of their species have a better chance of surviving to reproduce and pass on their favourable characteristics to their offspring. The variation selected by nature spreads to dominate the gene-pool, and over time this can result in significant changes to the species or even new species. It is this selection aspect of the cultural-biological analogy that shall be tested in this paper. For memes to share the evolutionary mechanism of genes, they must conform to three conditions. Memes, like genes, must be inheritable, having the capacity to be replicated. Then they must be variable, allowing different versions of the meme (and gene) to be selected. Finally, memes must have differential fitness; memes that are better suited than others to their cultural (and natural) environment will be preferentially selected (Dennett 1995: 343). If these three conditions are met, then evolution is inevitable.

Roman cemeteries in Britain provide useful data with which to test whether cultural selection conforms to the same algorithmic process exhibited by natural selection. Let us examine one cemetery in particular—Pepper Hill cemetery in north Kent (Biddulph 2006a). From 1997 to 1998 Oxford Archaeology undertook an archaeological investigation at Pepper Hill, Southfleet in Kent ahead of construction of High Speed 1. The site lay south of the Roman town and religious complex at Springhead (*Vagniacis*). Excavation revealed almost the entire plan of the cemetery which developed alongside a road that took inhabitants, pilgrims and other traffic into the town (Figs 1 and 2). A total of 558 graves or other funerary-related features were encountered. Springhead's inhabitants could either be buried unburnt in a grave (inhumation), burnt on the pyre, with the remains deposited in a pit (cremation), or burnt on a pyre built above a grave; as the pyre and the body burned, the remains dropped into the grave below (*bustum*). Some 360 inhumation graves were encountered, compared with 150 cremation graves, and just ten busta. The frequencies of cremation and inhumation changed over time. In the mid first century (c. A.D. 50–70), inhumation, representing 56% of burials, was more common than cremation (21%). By the late first/early second century, the proportions were roughly equal. Cremation overtook inhumation in the mid second century (A.D. 130–70)—59% against 34%—but in the late second century (c. A.D. 170) its proportion (12%) dropped well below that of inhumation (82%). There were no further cremation burials from the third century onwards; inhumation alone survived. With the conditions for evolution in mind, can we see the mechanism of cultural selection at work at Pepper Hill?



Figure 1: Plan of Pepper Hill Roman cemetery.

Pottery

Let us begin with pottery, which was the commonest grave good type. A total of 455 ceramic vessels were found in 231 graves. Seventy-seven of the vessels were cinerary urns, containers of cremated remains. These largely comprised the sorts of utilitarian jars normally identified with a kitchen or other domestic use—narrow-necked jars, cooking-jars, storage jars and lid-seated jars. Bowls were occasionally used, but these were large and robust and jar-like. Over half the urns were made in the ubiquitous local sandy grey ware. The local coarse shelly ware and a grog-tempered fabric from west Kent were also recorded. Both fabrics were usually available as storage jars.

Ceramic vessels other than cinerary containers were deposited in some 230 graves. Selection was biased towards forms (beakers, cups, flagons and flasks) invariably interpreted as drinking-related vessels. These accounted for almost 60% of the ancillary vessel assemblage by vessel count. The category was dominated by beakers and flagons. Cups formed a minor category, with only seven vessels represented. This is unsurprising, since cups did not hold a significant place in local potters' repertoires, with most examples at Pepper Hill and Springhead deriving from continental sources. Open forms (bowls, dishes and platters), usually

regarded as eating-related, contributed around 30%. Platters and dishes appeared most frequently, and these were followed by bowls. Cooking or storage vessels (jars) took a 10% share. There was also variety of rare and exotic forms: so-called infant feeders, an unguentarium, and a samian ware mortarium. As with cinerary urns, most ancillary vessels were produced locally. Almost 80% of vessels were either in sandy grey wares, fine reduced ‘Upchurch’ ware, other fine grey ware, or oxidised and white-slipped wares, and made in the Thameside region. Regional or imported wares were available, though, and these included samian and other fine wares, and Verulamium-region white ware (made in Brockley Hill and other sites around Verulamium, but also in the City of London, with clay imported from the Verulamium region (Seeley and Drummond-Murray 2005)).

In terms of vessel type selection, in the first 20 years of the cemetery’s use (*c.* A.D. 50–70), vessels were split between flagons, beakers, and platters/dishes (Table 1). The remainder were jars. From about A.D. 70 to 130, the proportions of beakers and platters/dishes increased slightly, while that of flagons decreased. The drop was met by the introduction of bowls and miscellaneous forms. Between A.D. 130 and 170, the proportions of beakers and dishes continued to increase very slightly, while the quantity of flagons dropped further. The assemblage was now joined by cups. The period from *c.* A.D. 170 to 260 once again saw a slight increase in beakers and dishes, and a fall in the proportion of flagons. The other vessel classes (jars, miscellaneous, cups and bowls) were also present. Just seven vessels (beakers, flagons and dishes) belonged to the final period of the cemetery, A.D. 260–400. It is reasonable to question how representative they are of vessel selection, and therefore this phase is omitted from the analysis below.

Table 1: Percentages of ceramic grave goods by phase, based on quantification by vessel count (actual counts in parentheses).

	Beakers	Bowls	Cups	Flavons	Jars	Misc.	Platters/ dishes	Total %	Total no. vessels
A.D. 40–70	25 (10)	--	--	45 (18)	8 (3)	--	22 (9)	100%	40
A.D. 70–130	27 (26)	7 (7)	--	31 (30)	7 (7)	5 (5)	23 (22)	100%	97
A.D. 130–170	29 (17)	4 (2)	9 (5)	22 (13)	10 (6)	2 (1)	24 (14)	100%	58
A.D. 170–260	33 (12)	6 (2)	6 (2)	19 (7)	3 (1)	3 (1)	30 (11)	100%	36

How can we explain this pattern in evolutionary terms? The meme for vessel choice is variable. Beakers, jars, flagons, dishes, cups and others were all available in the meme-pool. Each could be chosen to be deposited alone, or in combination with additional vessels of the same or different types. Springhead’s inhabitants also had the choice of types that rarely made it to the grave, such as mortaria. All vessel types that were available to the inhabitants existed as information in the brain and had the potential to be chosen for burial. The meme for vessel choice could therefore be expressed in many forms. In mid-first century grave 11231, for example, the meme was expressed as a jar, beaker, flagon and platter. In mid-second century grave 1387, the meme was manifested as a beaker only, and grave 890, dated to the late second century, contained a beaker, two flagons and a dish. The vessels can be regarded as phenotypes of different versions, or alleles, of the same meme in the same way that A, B or O blood types

are the result of mutations or alleles of the genes that code for blood type (Coyne 2010: 133).

Which versions were expressed depended on the prevailing cultural or memetic environment. And the prevailing environment at Springhead favoured forms—beakers and flagons, dishes or platters—that were connected with another meme, the idea of dining. Other cemeteries that served the town—for instance the seven graves found during excavations along High Speed 1 (Seager Smith *et al.* 2011, 117–8), or a small group of burials uncovered during earlier fieldwork (Philp and Chenery 1997: 8–12)—contained pottery assemblages that were strongly associated with flagons and beakers and to a lesser extent dishes or platters. The composition fits the general pattern seen in assemblages of contemporaneous cemeteries across south-eastern Britain, which were similarly dominated by dining forms. It is little wonder that these were the forms deposited at Pepper Hill. Inhabitants choosing the pottery hardly needed to think about which vessels were appropriate; the choice had been made for them simply by conforming to tradition, or following the practices evident from earlier burials. In contrast, the cup allele of the pottery-deposition meme had a better chance of emerging in the graves of higher-status individuals. Cups were much better represented in high-status graves in Essex and near Springhead compared with lower-status funerary assemblages, and thus appear to be strongly associated with society's elite (Biddulph 2005: 36). The reason seems obvious. The memetic environment, which more readily incorporated wine-drinking traditions, favoured the selection of cups. Beakers were preferred in memetic environments, such as the culture in which Pepper Hill belonged, that favoured local brews consumed in larger measure—ale and mead. There are exceptions, of course. The St Pancras cemetery that served the Roman city at Chichester (Down 1971) contained a higher proportion of cups (10% of ancillary vessels by count) compared with Pepper Hill (2%). In fact the memetic environment was sufficiently susceptible (the city's status as a port (giving greater access to wine and other Mediterranean goods), civitas capital, and home to the region's elite no doubt helped) to allow cups to be incorporated within local potters' repertoires. At Pepper Hill, the only cups were in imported samian wares.

But what gave certain dining forms a selective advantage in the first place? The choice presumably adhered to religious requirements. Individuals accompanied by the correct forms were better prepared for the afterlife. But how did the idea of the 'correct' forms emerge? Vessel selection tends to be attributed to provide sustenance to the deceased for the journey to the afterlife (Philpott 1991, 237). This can be questioned given that grave groups at Pepper Hill did not always provide a 'balanced' meal and, indeed, many graves contained no pottery whatsoever. The treatment of pottery, including vessel inversion or deliberate mutilation, such as perforated sides and bases, also seems to rule out this interpretation. Alternatively, the pottery may have allowed the deceased to take part in funerary feasting. Grave 254 at Pepper Hill contained, in addition to a conventional ancillary vessel group, a mass of smashed pottery that was biased towards dining and may be evidence of a grave-side feast, whose remains were subsequently interred with the deceased. But perhaps we need not search too hard for an explanation. The dining-vessel version of the pottery deposition meme broadly replicates the vessel choices seen in elite burials of late Iron Age and early Roman graves (Biddulph 2005), for example Stanway, Colchester (Crummy *et al.* 2007), and Folly Lane, Verulamium (Niblett 1999). No doubt a propensity for cultures to add food and drink to occasions of celebration and commemoration also contributed to the success of dining forms. The 'correct' vessels were therefore those that were deposited by tribal leaders and enabled the deceased or mourners to dine. This choice could then be adapted to fit religious requirements ('I want a flagon and dish because my chief was buried with them' becomes 'I want a flagon and dish because they're

what I need for a good afterlife'). That is not to rule out other influences, suggested by associations of grave goods with factors like age (e.g. Brougham, where cups were strongly associated with children (Cool and Evans 2004, 362)), or sex (e.g. Lankhills, Winchester, where crossbow brooches were associated with males (Booth *et al.* 2010, 536)). Analysis of the Pepper Hill assemblage, however, did not reveal any obvious correlations (Biddulph 2006b). In any case, any meaning imposed on the vessels at the point of deposition was itself subject to variation on which cultural selection could act. The choice of vessels was then replicated through imitation of, for example, parent or other influential adult, and survived from one generation to the next.

What of the main changes in the composition of the funerary assemblage over time? We recall that beakers and platters/dishes increased their shares of the assemblage over time, while the share of flagons decreased. It is worth noting that the proportions of these forms are much higher in the cemetery than in non-funerary groups in Springhead, and the frequencies of forms also show a different profile in terms of their rise and fall through time (Seager Smith *et al.* 2011, table 15). This suggests that cultural selection, rather than chance or drift, acted on the funerary assemblage (at least to a larger extent) to bring about its evolution. That does not mean that the funerary assemblage did not respond to selection pressures originating in the non-funerary sphere. For example, the trends recorded at Pepper Hill may have been driven by a change from communal to individual dining, which required fewer multiple-serving vessels, notably flagons. Possibly the meanings assigned to the vessels changed and the proportions of vessels with it. Whatever the pressures, the mourners placing a beaker or dish in a grave would have been quite unaware that they were responding to a selection pressure for more beakers and dishes and fewer flagons. If we average the date range of each phase (thus the first phase, dated A.D. 40–70, becomes A.D. 55), the main period of cemetery use was between A.D. 55 and A.D. 215, a period of 160 years. Beakers increased their frequency from 25% of ancillary vessels in A.D. 55 to 33% in A.D. 215, while platters/dishes increased from 22% to 30%, a difference for each of eight percentage points. Flagons decreased from 45% to 19%, a difference of 26 percentage points. Beakers and dishes therefore increased their frequencies by 0.05 percentage points each year, while the frequency of flagons decreased by 0.2 percentage points each year. Changes at this scale would have been imperceptible to the mourners, but, once the conditions for evolution were in place, they were inevitable. As fashions in, say, personal dining, or prevailing meaning ascribed to vessel choice began to change, the vessels that better fitted this new environment—beakers and platters/dishes—were preferentially selected. As the selection pressure continued, grave groups changed in composition, increasingly favouring beakers and platters/dishes.

Just as selection was acting on vessel types, selection may also have ensured that the meme for not depositing pottery was successful too. The meme was strongly associated with the inhumation variant of the burial rite meme; at Pepper Hill, unfurnished inhumation graves were more common than unfurnished cremation graves. The lack of pottery could simply be attributed to poverty, but as individuals practising inhumation were more likely than those practising cremation to express the 'no pottery' meme, they were therefore more likely to pass the meme to others of the same or subsequent generations until the idea of depositing pottery was generally considered inappropriate for the inhumation rite.

What about fabric choice? Most vessels were made in coarse sandy grey wares, which dominated the funerary assemblage throughout the cemetery's use. White wares and the oxidised groups—orange- or red-surfaced wares and white-slipped red wares—were also important, though none of these ware groups matched the proportions attained by grey wares.

Fine wares, including samian imported from Gaul, made relatively small contributions to the assemblage, although the proportion of samian markedly increased during the second century. Cultural selection appeared to have played a part in the profile of the assemblage, just as it had for vessel forms. Oxidised wares, white wares, and fine wares were generally better represented in the cemetery than they were in the town (Seager Smith *et al.* 2011, table 13), suggesting that orange or white coloured pottery had a selective advantage in the funerary environment. It is likely, however, that memetic drift had the greater responsibility here.

In the natural world, evolution can occur through genetic drift. This is where the frequencies of genetic variations increase or decrease in the population by chance. The conditions for drift may arise where there are variations that are neutral in terms of the fitness of the organism carrying the genes. Natural selection cannot act on the variations, since they produce no selective advantage and cannot affect the rate of reproduction. Drift may also come into play when a population carrying a particular variant or allele has become geographically isolated, thereby increasing the frequency of that variant in the gene pool, or joined by a larger population lacking the allele, thus reducing its frequency (Coyne 2010: 133–5). The frequencies of alleles or variants of the meme for ware selection have a greater likelihood of being affected by drift because the traits of fabric and colour were largely neutral to the burial rite. Most ancillary vessels deposited at Pepper Hill had been made locally and were in coarse reduced fabrics, just as the town's pottery was. The fabrics found in the cemetery were there because they dominated pottery supply to the area (the meme-pool). The same is true for all other cemeteries in the region and doubtless across Roman Britain. The Cranmer House funerary assemblage from Canterbury is dominated by fabrics made in Canterbury (Pollard 1988), while a cemetery at Great Dunmow in central Essex is dominated by fabrics made in central Essex (Wickenden 1988).

That is not to say that mourners did not ever choose between a platter in a fine, burnished fabric or one gritty to the touch and decide on the fine one because it looked nicer, but overall the selection pressure on fabric was very weak. The frequencies of individual fabrics recorded at Pepper Hill reflected the fortunes of potters or industries and what was available in any given time. Grog-tempered pottery was present in the earliest phase of the cemetery (*c.* A.D. 50–70), but disappeared thereafter when production of the fabric ceased. Verulamium-region white ware was relatively common in the early Roman period, but declined significantly in the second century along with supply to north Kent. South Gaulish samian, the principal samian ware in the first century, gave way to Central Gaulish samian in the second century, which was in turn replaced by East Gaulish samian ware in the late second and early third century, all in accordance with the peaks and troughs of manufacture in Gaul. In most cases, forms were available in alternative fabrics and so the changing frequencies of fabrics had little effect on the frequencies of forms.

It is true that the proportion of white wares and fine oxidised wares is higher in the cemetery than in the town—20% of all ancillary vessels by vessel count, compared with 8% across the Springhead assemblage by sherd count (Seager Smith *et al.* 2011, table 13) (the quantification methods are not strictly comparable, but it nevertheless gives us an idea of the difference)—but this is less to do with a strong selection pressure for white and orange pottery than that fact that the commonly-selected flagon was mainly available in white and orange wares.

I suggest that the frequencies of individual samian wares were determined by drift, but selection was acting on samian as a whole. Lower-status settlements in south-eastern Britain, such as farmsteads and small nucleated settlements, tended to see lower amounts of samian (or

none at all) compared with larger roadside settlements and urban centres (Willis 2005, section 7.2.8), but their associated cemeteries typically contained proportions much closer to those higher-status settlements (e.g. Little Canfield, Essex: Biddulph 2007). For many inhabitants of lower-status settlements, samian must have been regarded as primarily a funerary ware, so strong was the association between the ware and burial (Biddulph 2012). In high-status burials, for instance as those in a walled cemetery close to Pepper Hill, or underneath tall mounds at Bartlow, Cambridgeshire, samian was over-represented, either comprising proportionately more samian vessels than was usually present in sites like Pepper Hill, or being the only ceramic present (Biddulph 2005). Objects in other materials—glass and metal—were preferred for those graves. The conclusion is that samian was regarded as a special ware appropriate for elite individuals, or as a sign of status. Both factors are likely to have driven its selection.

Other material

We have inevitably concentrated on pottery, because it is the commonest grave good at Pepper Hill, but it is worth remarking on some of the other objects deposited. In the later and early second centuries A.D., brooches were deposited unburnt in inhumation graves or worn, along with other items of jewellery, as indicated by iron stains on bone, by the deceased on the pyre. A few brooches were deposited unburnt in cremation graves. Shoes also accompanied the deceased on the pyre, but rarely appeared in inhumation graves. In the second and third centuries, shoes and jewellery (except brooches which were now rarely deposited) were found unburnt in inhumation graves and to a lesser extent in cremation graves. Deposition on the pyre had ceased by this time. The same is true for the deposition of animal remains. The burnt bones of chickens, sheep, pigs and cattle were recovered from later first century and second century graves. Unburnt animal bone was recovered only from second century cremation graves. Overall, the evidence points strongly to the declining importance of pyre goods over time, and the increasing importance of grave goods (Table 2). How did this change arise?

As usual we must identify what cultural selection is acting on. The meme for the deposition of personal dress items is variable with regard to the funeral stage and type of object. Alleles (placement on the pyre, unburnt in the cremation grave, or unburnt in the inhumation grave) had the potential to be expressed throughout the later first to third centuries, but differential frequencies are apparent, with an initial bias towards the pyre, switching later to a bias towards unburnt objects in inhumation graves. We could reasonably see this change as a process that began with a random mutation that found favour and quickly spread virus-like through the population, and the phenomenon has been noted elsewhere in southern Britain (Philpott 1991: 171), suggesting that the trends observed at Pepper Hill formed part of a wider cultural shift. H E M Cool (2006: 53) suggests that the pattern has ritual, rather than utilitarian, implications. What it might imply is a change in religious belief, in particular belief concerning the afterlife. If shoes were worn for the journey to the afterlife, or they were required, along with personal items, for an existence in the afterlife, then in the second century, the journey no longer began at the pyre, but the grave.

Table 2: The changing pattern of deposition of grave goods and pyre goods. Quantification by count of features.

	Early Roman		Middle Roman	
	Pyre	Grave	Pyre	Grave
Animal bone	23	--	10	4
Beads	1	3	--	1
Coins	--	--	--	1
Cu objects	18	2	2	3
Fe objects	8	2	2	3
Glass	5	4	--	2
Hobnails/shoes	3	4	--	10
Pottery	9	122	--	71
Total no. cremation graves	61		34	
Total no. inhumation graves	132		43	
Total no. funerary features	225		79	

Inhabitants of Pepper Hill had to adapt their funerary practices to the changing cultural (or religious) climate. And they did so pretty quickly. Individuals that had the allele for depositing unburnt personal objects were better prepared for the afterlife, and the variant rapidly increased its frequency in the population, so that in a matter of decades the deposition of unburnt personal items allele had replaced the allele for depositing objects on the pyre, and eventually the idea of placing objects on the pyre was not being passed on. If the pyre was no longer sending the soul to the other world in the rising smoke (cf. Gräslund 1994, 20), then there was little value in continuing the cremation tradition. As a result, the proportion of cremation burial declined rapidly in the late second century. In contrast, the inhumation variant of the burial rite meme fitted the new beliefs better and increased its chances of being transmitted to Springhead's inhabitants and surviving to the next generation.

Speciation

Let us return to pottery. The grave groups encountered at Pepper Hill would have been familiar to inhabitants across the Roman Empire, not least Gaul, Germany and provinces along the Danube. The range of vessel types offered at Pepper Hill find their matches in cemeteries in those regions, for example Carnuntum in Austria (Ertel 1999), Garulata Rusovce in Slovakia (Krásková 1976), Valladas, Saint-Paul-Trois-Châteaux (Drôme), in southern France (Bel 2002), and Remagne in Belgium (Fremault 1966). Flagons, dishes, beakers, cups, and bowls are as much part of the funerary assemblages there as they are in south-eastern Britain. The evidence points strongly to the empire-wide adoption of Roman culture. Closer examination of

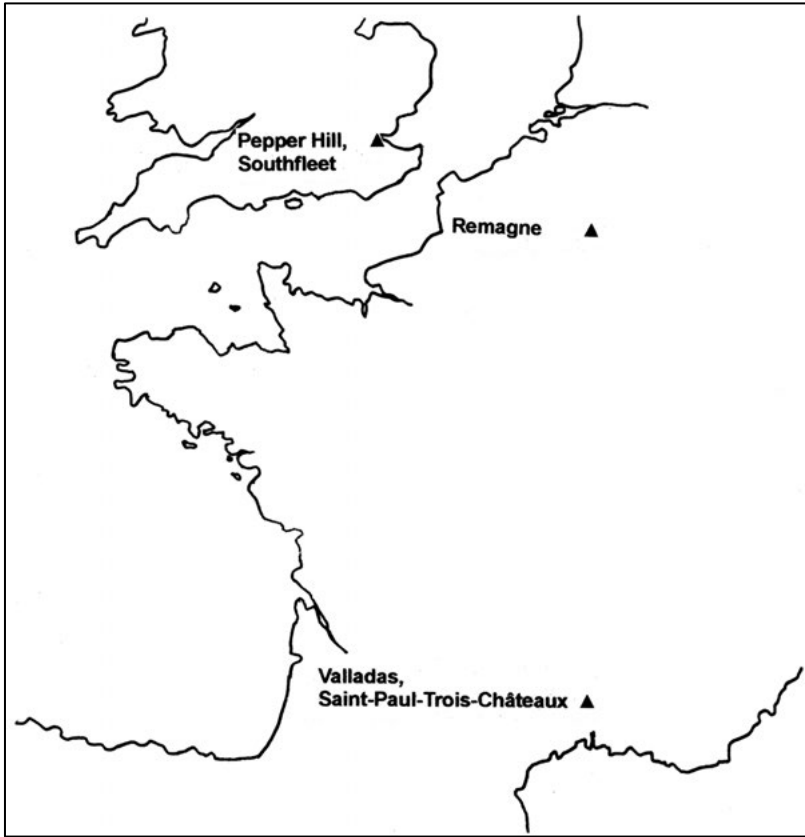


Figure 2: Map showing location of Pepper Hill, Southfleet (UK), Remagne (Belgium) and Valladas, Saint-Paul-Trois-Châteaux (Drôme) (France).

funerary assemblages, however, reveals differences between the sites.

Comparison of the Pepper Hill assemblage with two other cemeteries illustrates the point (Fig. 2). A cemetery at Valladas, situated north of the Roman city of Orange, was available for burial from the early first century to the end of the second century A.D. Some 120 graves contained pottery grave goods (Bel 2002). The cemetery at Remagne in Belgium, which contained 74 pottery-yielding graves, was operational between the mid 1st to late second/early third century A.D. (Fremault 1966). Both cemeteries overlap with Pepper Hill in terms of chronology and size. In its earliest phase (early to mid 1st century AD), the pottery assemblage from Valladas was weighted towards drinking vessels. As at Pepper Hill, flagons were common, but instead of beakers, cups were selected. Dishes also took a large share of the phase group, and there were minor quantities of jars, bowls and lamps. Over time (up to the end of the second century A.D.), the proportions of cups and dishes declined, as did flagons, though to a lesser extent, but jars and lamps became more important. By the mid second century, over 50% of vessels by count were lamps. The later first century assemblage at

Remagne more closely resembled that at Pepper Hill, with flagons, beakers and dishes making the largest contributions. Cups and bowls were also present. As for the main trends over time, beakers became more important, as did cups, which significantly increased in number from 6% to over 30% by vessel count. The proportion of flagons fluctuated, but the share of dishes fell dramatically (from over 30% in the first century to 3% in the late second/early third century).

The general similarities between Pepper Hill, Valladas and Remagne in terms of the profile of their pottery assemblages indicate a shared origin to the tradition of burying Roman-style table wares in graves. A likely route for the transmission of the memes into Britain was via north Gaul. We only have to compare the early-Roman high-status graves of Stanway, Colchester, and Folly Lane, Verulamium with those in northern Gaul to get a sense of the cultural ties between the regions (Niblett 1999; Crummy *et al.* 2007: 451–5). The connection is evident in the pottery itself. For instance, a carinated beaker which was produced in *terra nigra* and other north Gaulish wares and present at Remagne was taken up by potters of north Kent (Monaghan 1987), whose versions were recorded at Pepper Hill. Despite their broad homogeneity, the pottery assemblages from Pepper Hill, Valladas and Remagne were shaped by their local cultural environments. We can see this in the composition of drinking vessels. At Valladas, there were very low quantities of beakers and greater frequencies of the cup allele compared with Remagne and Pepper Hill, as demanded by a culture in which wine and garum consumption were important; cups were essential for both (Dannell 2006: 158–60; Grocock and Grainger 2006: 386). At Pepper Hill, the beaker allele dominated, being appropriate for a culture where ale-consumption was more usual than wine drinking. (It may be noted that evidence for malting and brewing was found at the nearby villa at Northfleet (Biddulph 2011, 224–6).) Remagne sits between the two spatially and culturally. The inhabitants of Gallia-Belgica, like other northern Europeans (Nelson 2003), drank ale, but also doubtless had better access to wine compared with Britain. Consequently, the beaker allele at Remagne is well-represented in the population, but the cup allele also took a significant share. As funerary traditions spread (plausibly from southern Gaul to northern Gaul, then to Britain), they began to adapt to their new cultural environments. The alleles that better fitted the environment had more chance of being expressed, resulting in differences between regions.

What we see here is the beginning of speciation. In the natural world, speciation—a process whereby two species emerge through divergence from a common ancestor—requires an isolation event. If there is no event to divide a population, then interbreeding tends to pull any potentially diverging portion back to the single species (Coyne 2010: 200). Typically a species splits when part of a population becomes geographically isolated. It adapts to its new environment and evolves along a trajectory separate to that of the parent population. This is known as allopatric speciation (Coyne and Orr 2004: 86). Similarly, the memes for Gallo-Roman funerary rites, once transmitted to Britain, became geographically and culturally isolated from those in Gaul and were subject to change. The resulting mutations stabilised within their own niche cultural environments (variable across Britain) and were able to evolve without reference to developments in Gaul. That is not to say that contact between Gaul and Britain ceased, but the connections were not strong enough to pull the populations back together and prevent divergence.

This divergence is evident when we subject the pottery data from Pepper Hill, Valladas and Remagne to correspondence analysis. This is a useful multivariate, statistical, tool with which to compare the assemblages based on their attributes, in this case vessel type. The scattergram, the end-product of analysis, provides a visual means of comparison. Sites that are similar in terms of their assemblage composition will broadly occupy the same space on the plot, while

the point at which the axes intersect represents the average across the combined assemblage, so that types that are further away from it can be considered to be rarer or otherwise more unusual than those closer to it (cf. Shennan 1997: 308–41). The most striking aspect of the funerary assemblages from our three sites is the centrality of flagons and to a lesser extent dishes (Fig. 3). The flagon and dish were a standard part of most grave groups in all three sites, and consequently the vessel types sit at or close to the axial intersection. We noted above that the assemblages of Pepper Hill and Remagne were broadly identical in the later first and early second centuries, and this is reflected in the cluster in the bottom left quadrant of the plot. Valladas in the early Roman period, on the other hand, is located away from Remagne and Pepper Hill on the plot as a result of its much stronger association with cups. In the second century, the assemblages of Remagne and Pepper Hill separated as Remagne gravitated towards cups. The later phases of Valladas occupy the bottom right quadrant. The site's assemblage was now more strongly associated with lamps and jars. The Pepper Hill assemblage continued to be focused around beakers throughout the second century.

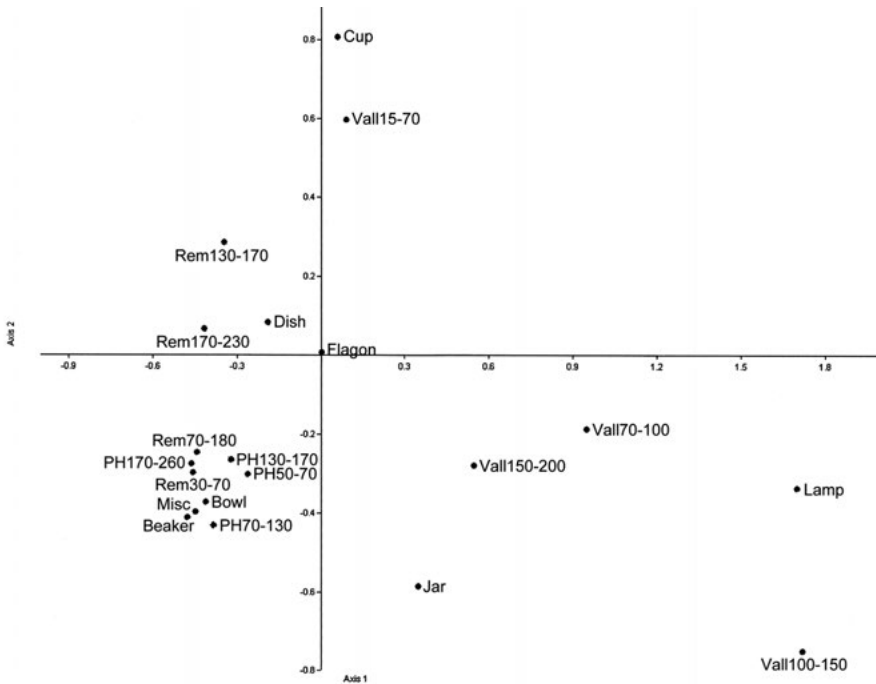


Figure 3: Correspondence analysis scattergram showing the relationships between sites and vessel types. Key: PH – Pepper Hill; Rem – Remagne; Vall – Valladas. Site abbreviations are followed by date ranges, expressed in years AD. Percentage of inertia: Axis 1 – 46.6%; Axis 2 – 30.3%; total inertia – 76.9%.

The scattergram gives a useful representation of speciation in action. Remagne and Pepper Hill were broadly identical in the early Roman period because the tradition of pottery deposition had not long arrived in Britain from northern Gaul. However, Britain was relatively isolated from the continental mainland—the English Channel saw to that—resulting in a cultural, as well as geographical, isolation. This is evident in the fact that changes at Remagne had little bearing on developments at Pepper Hill. Over time, Pepper Hill and Remagne diverged as the composition of the funerary pottery evolved along separate trajectories. The Valladas assemblage also evolved, moving away from dining forms, notably cups, to utilitarian lamps and jars. Each site was subject to pressures exerted by their own distinct cultural environments. The laws of cultural selection meant that Britons were no longer imitating the people of northern Gaul; they were imitating themselves.

Conclusion

We can see Darwinian evolution at work in funerary traditions at Pepper Hill cemetery. All the essential conditions of the cultural selection—analogueous to natural selection—are there. There is variation in the type of burials and the choice of grave goods. The survival of rites for some 200 years and the multiple examples of them show that there is replication and informational transmission. And finally, there is differential fitness, which is exposed by selection pressures or biases. Rites that best fitted the cultural environment were selected and survived to the next generation. We have also seen how the process of speciation is applicable to culture. In the case of Pepper Hill (and similar burial rites in south-eastern Britain), the funerary traditions arrived probably from northern Gaul, and, isolated from their parent environment, diverged from it and evolved along a different trajectory as the traditions were adapted to better fit their new and changing cultural environments. I hope, too, that I have shown that the meme concept is a useful one. The genetic-memetic parallel is not exact, but differences are minor compared with the value of defining units of cultural information on which cultural selection acts and highlighting the blind nature of selection. It is the task of archaeologists to identify memes and the factors that give them their survival value in the prevailing cultural environment.

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