3. The evolutionary origins of aesthetics

In the previous chapter, I set out some of the key ideas relating to the extent to which it is useful to think of the brain as an evolved organ, and further, the extent to which the nature of that evolution may have shaped how we design. An essential aspect of any consideration of how humans engage with artefacts must reside in aesthetics. Accordingly, in this chapter, I pick up some of the themes regarding an evolved human psychology, as to do so may help explain some of our aesthetic preferences. Like the technical pleasure referred to in the last chapter, which is built on kinetic senses, aesthetic pleasure is also built on sensory inputs. Technical and aesthetic pleasure both involve acts of cognition.

I will consider in turn: symmetry; proportion; patterns which excite, followed by patterns and other uniform treatments of surface, which are soothing in their effect; thereafter, I consider shininess, glossiness and glitter. I save till last the aspect of colour, as I will argue that how it operates today is less deeply or directly informed by evolutionary precedent than the other aspects considered. In each case, I endeavour not to stray too deeply into the province of how each of these characteristics may ultimately contribute to the *symbolic* value of an artefact, as this is precisely the subject of the chapter following. This has consequences for which material figures in this one.

Because I maintain that aesthetic qualities may have implications for the symbolic meanings an artefact can support (at least, I maintain that this is commonly so, at the point at which the artefact is created and introduced into its original social environment and sometimes thereafter), the aesthetic dimensions of the Egyptian scarab, Roman denarius and the Ardabil carpet will be examined in some depth in the next chapter, with a view to understanding that relationship between the two more fully. The iBook laptop is analysed in chapter five. As a consequence, in this chapter, although I refer to all of the 'bore-hole' objects from time to time, I will only conduct case studies of the seventeenth century watering pot and the twentieth-century wood screw. This is because they may legitimately be regarded as artefacts which *at the point of*

their creation and introduction to the world, whatever other kind of significance or meaning they may have had ascribed to them, were – almost certainly - not intended to bear any overtly *symbolic* meaning at all.

3.1 Aesthetic appreciation as an adaptation

There is much in nature which we regard as beautiful. Darwin wrote:

> We can understand how it is that such harmonious beauty generally prevails through nature. That there are exceptions according to our ideas of beauty, no one will doubt who will look at some venomous snakes, at some fish, and at certain hideous bats with a distorted resemblance to the human face. Sexual selection has given the most brilliant colours and other ornaments to the males, but sometimes to both sexes of many birds, butterflies, and a few other animals. With birds it has often rendered the voice of the male musical to the female, as well as to our own ears. Flowers and fruit have been rendered conspicuous by gaudy colours in contrast with the green foliage, in order that the flowers might be easily seen, visited, and fertilised by insects, and the seeds disseminated by birds. Lastly, some living objects have become beautiful through mere symmetry of growth.[1]

Radically for his time, and still a little arrestingly for today, Darwin is willing to detect evolutionary *function* in beauty and its appreciation among animals. I suggest that, as with other animals, our own preferences have arisen from millennia of interaction with our environments. What we like now is not arbitrary, but deeply informed by our evolutionary past, in that the recurrent features of that environment, over time, have shaped our brains. The astronomer, John Barrow, goes further, and argues that our minds are not just the products of interaction with the environment, but also of the wider forces which, in turn, gave rise to that environment and everything in it. Our environment, he reminds us, is not an arbitrary given, but

> …springs from the laws and constants of Nature that determine the very form and fabric of the Universe. The complexity of our minds and bodies is a reflection of the complexity of the cosmic environment in which we find ourselves. The nature of the Universe has imprinted itself upon us in ways that constrain our sensibilities in striking and unexpected ways.[2]

This, he argues, is as true of our aesthetic preferences as it is of any other human behaviour. By this view, aesthetic preferences have adaptive origins:

> Instinctive aesthetic reactions to the world could not have evolved if, on average, they contributed negatively to survival. By contrast, those responses that enhance the chance of survival persist.[3]

3.2 Pleasure is adaptive

Aesthetic appreciation is a variety of pleasure. In the previous chapter, I was at pains to suggest that many of the activities necessary physically to make and use an artefact – the securing of raw materials, their manipulation, as well as subsequent deployment - may all have been accompanied by attendant, adaptive pleasures. Following this pattern, I shall endeavour to show that choices of physical (and, eventually, visual) qualities in an artefact may also serve as yet further means by which pleasure can be elicited. As prefigured by the hominid production of Acheulian axes (*figs. 10, 11 and 12*), human beings have a universal propensity to bestow physical characteristics on some of their artefacts over and above what function alone seems to require; and these 'extras' habitually give pleasure. I suggest these pleasures are also adaptive in origin. As Miller correctly observes with regard to the narrower production of the wholly useless ('pure' art, in other words):

> …[artistic activity] is ubiquitous across human groups, cultures, and history. Art-making and art-viewing are pleasurable, and pleasure is an evolutionary hallmark of psychological adaptation. Artistic production entails costs in time, energy, effort, and skill, and such costs are rarely expended without some adaptive rationale.[4]

In this particular, I believe Miller is right but, as I shall argue in chapter five, mistaken in his judgement of the importance of some of his key inferences from this central observation.

If an individual is going to spend time creating something, on average, choices which enhance pleasurable sensations would seem the inevitable course of action. In the following paragraphs, I will suggest evolutionary, adaptive origins for the aesthetic pleasures we are familiar with today.

3.3 The method used here: a contrary view

Before embarking on a consideration of the possible origins of some of the major physical characteristics of our artefacts, I must first take issue with an argument against the method I have chosen to adopt. Thornhill supports the notion developed here - that our aesthetic sensibilities are evolved adaptations; but he is adamant that our minds are not made up of a collection of general-purpose sensibilities of the kind I will shortly elaborate:

> The special purpose design of human psychological adaptations forces rejection of the common view in aesthetics that there is one or a few [general] principles of beauty that will work equally well for landscapes, human bodily form, ideas, etc. Such principles as symmetry, harmony, truth, unity, order, femininity or woman [!], etc., have been suggested…Choosing a habitat, choosing a mate, and choosing a belief system are very different information processing problems. Each domain of aesthetic judgement is expected to coincide with special purpose aesthetic adaptation.[5]

I have not attempted to make any links with the aesthetics of ideas and, unlike Thornhill, I question the utility of doing so. Nonetheless, more pertinently, he asserts elsewhere:

> Choosing a human mate of high reproductive value or a human habitat that is safe and productive are highly specific adaptive problems, each requiring a specialized psychological adaptation…it is most likely that the human brain is composed *only* of highly specialized adaptations.[6] [Emphasis added]

In making such an assertion, Thornhill aligns himself firmly with Cosmides and Tooby, and others of the 'Swiss army knife' persuasion. Yet, as the arguments described in chapter two from Mithen, Dennett, Karmiloff-Smith and others have shown, there are many who doubt that the brain is composed *solely* of specialised adaptations. Even Fodor - who first advanced a coherent proposal of a brain which included such modules - as noted, allowed a role for general non-domain specific intelligence. Thornhill, by contrast, eschews such a possibility, preferring instead dedicated modules (or suites of modules) for each and every variety of aesthetic judgement, on the basis that each evolutionary problem is a specific, rather than a general one. Towards the goal of identifying what these may be, he proposes an interim and, as he himself acknowledges, incomplete list relating to aesthetics (or 'beauty' – a term he borrows from discussions of 'traditional aesthetics', but notably fails to define). They include adaptations for:

1. aesthetic valuation of landscape features;
2. aesthetic valuation of non-human animals;
3. aesthetic valuation of acoustical behaviour of non-human animals;
4. aesthetic judgements arising from daily or seasonal environmental cues that signal a need to change behaviour;

5. aesthetic valuation of human bodily form;
6. aesthetic valuation of status cues;
7. aesthetic valuation of social scenarios;
8. aesthetic valuation based on skill;
9. aesthetic judgements of food;
10. aesthetic judgements of ideas.[7]

As implied above, for the purposes of the present argument with its focus on the physical, I will omit considerations of the last item as, at best, tangential, if not irrelevant. Similarly (though to a lesser degree), while there may be evidence that the types of sound animals make may, partly, be a function of size and health of their bodies, I will also omit item three as of limited immediate relevance.[8] Items one and four would have been relevant, had I elected to consider landscapes, representations of landscapes and, by inference, created spatial environments, such as parklands, gardens, townscapes and interiors; however, these I defer for some later study, electing here to concentrate on discrete objects and artefacts (although I note mention, in passing, of the implication in item four, that an aesthetic judgement may be exercised as a prelude to *behaviour,* a theme I will develop considerably in chapter five).

In order to survive and reproduce, an organism must secure resources, avoid danger and mate. Accordingly, I will reflect on and develop points nine and two with regard to their food potential (and potential for poisoning, cutting, stinging or, in the case of non-human animals, likelihood of attacking). The item relating to human bodily form (5) has – primarily because of its relevance to mate choice - received much attention and will also be addressed.

However, the model constructed here embraces but - unlike Thornhill's (or Miller's) - extends beyond aesthetics alone. For that reason, and for others which will become self-evident as I articulate it, I reserve discussions relating to the aesthetics of skills (item 8), social scenarios (item 7)[9] and status cues (item 6) for chapters five and six.

For now, I will return – in the light of his interim agenda, as expressed through his list – to Thornhill's more general assertion that aesthetic judgements rest on a myriad of specialist, problem-specific neural modules. Let us suppose for a moment that he were partly correct. Indeed, some apparently highly-specialised adaptive perceptual biases, such as recognition of patterns indicating snakes, are included in the following argument. Yet, I suggest that in most cases, the cumulative effect of the operation of each of these perceptual biases (or the specialised aesthetic preferences they might eventually support) results in discriminations which, for all practical purposes, operate precisely in the manner of a generalised sensibility; or that they *are* a generalised sensibility. Thus, for example (as will be demonstrated in more detail below), *symmetry* may be favoured because it denotes soundness in plants (at least, as far as leaves, fruits and flowers are concerned: *fig. 15* - one purported specialised adaptation) and animals for food[10] or the recognition of fit predators (another); or promises health and strength in prospective sexual partners (i.e., genetic fitness – yet another). These would be accounted for by items 9, 2 and 5 in Thornhill's list of aesthetic adaptations. Yet, as has been explored with regard to the Acheulian handaxe (and testified to by countless subsequent artefacts which are the products of the fully modern human mind), a further pleasurable preference for symmetry in artefacts has also emerged. This figures nowhere in his list, but according to his strictures, would require yet another dedicated cluster of modules relating to created things to account for the preference. Indeed, the disparate nature of the entries in his interim list are symptomatic of the problem with this approach as a whole: with so many purported factors at work, how is one to arrive at coherent, plausible explanations of the phenomena he considers, rather than just an inchoate catalogue of small, dedicated domain-specific adaptations extending into infinity, as each new aspect of the appreciation is identified?

His method is unnecessarily byzantine. Either (if we are to adhere to Thornhill's demand for dedicated mechanisms) our universally acknowledged general aesthetic preferences for, in this instance, symmetry represents a

colossal coincidence of the working of countless disparate dedicated modules; each would have to have its own neural circuitry, with yet more needed for every novel context, *ad infinitum* – which would seem unnaturally extravagant. Or – and I argue that this is the more plausible – this coincidence of adaptive interests in symmetry has given rise to a *general sensibility* towards it, applicable not only in circumstances which have already figured in our evolutionary pasts and may or may not persist, but – with significant dividends in terms of a flexibility which Thornhill's approach could not accommodate – applications in the face of unknown and unpredictable circumstances. Moreover, the sustained recurrence of characteristics such as symmetry, pleasing proportions, smoothness, regularity, pattern and so on requires explanation. I suggest that looking towards catalogues of supposed dedicated, domain-specific problem-solving modules is needlessly tortuous, clumsy and as an explanation, unsatisfactory.

One further voice of opposition to the approach adopted here needs also to be noticed: a substantially different account of the evolutionary origins of aesthetics is also proposed by Miller; but, as noted above, I will defer mounting the counter-argument to his position until chapter five, when the fuller consequences (and, I believe, value) of my own have been more fully developed.

3.4 Perceptual biases: contexts and hierarchy

I propose that our responses to artefacts or, indeed, impulses to choose what they should be like, originally emerged out of pre-existing adaptive, perceptual biases towards the organic and inorganic world. I choose these characteristics of physical objects (together with our kinetic senses of them, considered in chapter two), because they account for all the possible variables of any physical object, found or created. I argue that, taken together, these *perceptual biases* have affected our making and interpreting of artefacts; and that traces of these origins can be detected still in the activity of designing.

As any of the examples of the 'bore-hole' objects chosen for consideration in this study demonstrate, the *significances* that might, for example, be attached to particular colour combinations, or surface qualities, in an artefact, will depend greatly on context; where context includes, not only the physical and social location of the artefact, but also *every other physical characteristic of it*. However – as the example of the Ardabil carpet in chapter four will demonstrate - this applies only to the symbolic or signalling potential of these characteristics. Considered at the sensory, perceptual level, there are what the anthropologist David Stout has called 'particular combinations of line mass and color, etc., that seem capable of arousing emotions in themselves',[11] which as Nancy Aiken correctly points out, means that at this level - the sensory - our responses to these features occur *irrespective* of context, that is, 'independent of cultural background and individual experience'.[12] The evidence that this is so rests on innumerable experiments in human perception which have periodically been undertaken from the nineteenth century onwards, some of which will be cited here.

In arriving at a sequence in which to consider characteristics such as these, I seek to recognise the implications of Pinker's observations on children's pre-linguistic engagement with artefacts: children can, and do respond to colour, but it is the *kinetic and technical* possibilities of artefacts which, more or less irrespective of 'color and ornamentation',[13] fascinate and give the most immediate pleasure in the earliest months of their lives. This may suggest that the adaptive value of appreciating the forms, as well as the mechanical and physical characteristics of objects is probably greater, and, therefore older, in evolutionary terms, than that of discriminations based on colour. In emphasising this kinetic basis for our engagement with artefacts (design, in the precise sense outlined in the introduction), I am allying myself with a minority. Like Miller and Thornhill, most commentators have tended to approach this field in terms of 'art' and 'beauty', and have given overwhelming priority to the visual. I propose a hierarchy which starts with the physicality of things, and only then proceeds, by degrees, to the visual. Much of relevance in

this direction has already been considered in the discussions of the kinetic and technical pleasures of 'thing using' and making in the previous chapter, which may be considered as the preliminary to what now follows:

3.5 Symmetry

Mithen has suggested two possible origins for the bias among hominids towards symmetry in handaxes, and these two views neatly represent two schools of thought on the matter: sensitivity to symmetry has been taken by Dennett, among others, to have arisen in the deep evolutionary past from a sensitivity to the symmetry of other animals. As noted in the last chapter, Dennett reminds us that we, like many other species, are 'exquisitely sensitive to patterns with a vertical axis of symmetry'[14] As Barrow puts it:

> …living things possess right-left symmetry; if they move then they do not possess front-back symmetry; and gravity dictates an up-down asymmetry. Any disposition towards detecting, and responding to patterns with right-left symmetry might turn out to be highly adaptive. It would reveal when another animal was facing in your direction. This might be a signal to escape, to prepare for dinner, or to consider the prospect of a possible mate…[15]

The alternative - or, in my view, complementary - explanation is that, in the whole of the organic environment, symmetry is very often a reliable signal of healthy genes in many organisms – an 'honest advertisement' (*fig. 15*). According to Mithen:

> Symmetry abounds in the morphology of living things. This is because single genes control the development of a feature on both sides of an organism. High levels of symmetry are, however, difficult to achieve. The presence of genetic mutations, pathogens or stress during

> development may lead to the presence of asymmetries in bilateral distributed features.[16]

As noted, Miller further proposes that the symmetry of the handaxes may have 'play[ed] on the perceptual biases of receivers to attract attention, provoke excitement, and increase willingness to mate'.[17] which is an interesting, but unprovable suggestion. Sensitivity to symmetry, then, is thus almost certainly innate. I propose that – as implied earlier – it is the result of a co-incidence of evolutionary factors, each contributing to the generalised preference.

From Acheulian axes onwards, symmetry is abundant in the overwhelming majority of artefacts humans or their ancestors have created. Every one of the 'bore-hole' artefacts selected for specific consideration in this study is either roughly or exactly symmetrical. In design, especially the designing of such things as clothing, seating, or doorways, the screens and keyboards of laptops, or indeed, a printed page such as this, the designer is obliged to begin with the near symmetry of the human body, even if that symmetry is only taken as a starting point. Thus, it is reasonable to suggest that an evolved sensibility towards symmetry in the organic world, which was often (but as in the case of detecting predators, not always) pleasurable, combined with the physiological realities of the human form, may both have fostered symmetry as one of the key distinguishing characteristics of the overwhelming majority of things created.

Paradoxically, a great many living organisms - including the overwhelming majority of animals - are symmetrical in one plane only. Accordingly, many asymmetrical structures also abound, often in the one organism. Yet Dennett's and Barrow's remarks suggest that a perceptual bias towards symmetry has probably been of greater significance in the past. Even so, as – say - the watering pot demonstrates, we ourselves also create symmetrical artefacts with asymmetries. In both cases – the natural and the created - these asymmetries are usually judged attractive when they exhibit

certain proportional relationships, and it is to the possible origins of these biases that I now turn.

3.6 Proportion

For a partial explanation of our attachment to some proportional (and other) physical characteristics in artefacts, we extrapolate from Barrow's concept of an environment conditioned by how the Universe operates, and return to Evans' views on the centrality of engineering as a deeply embedded human characteristic. Formal studies of proportion have tended to rest on the skilled deployment of mathematics of greater or lesser degrees of sophistication. I suggest that this has had the effect of distracting from the manner in which proportions affect us in everyday life. Proportional relationships exist for us to the extent that they are a) discernible, and b) pleasurable. The manner in which they are apprehended operates quite independently of any mathematical or numerical explanations; these only come into play when we try to explain these effects to ourselves. What is attempted here is an explanation of the manner in which the proportions found in the organic world may have migrated into the sphere of artefacts.

The 'veins' of leaves, spiders' webs, or the distribution of flesh and bone in an animal body, are genetic in origin. They are not 'accidental' (although, of course, in the strict sense explored in chapter one, they are just that), but have arisen through millions of years of organisms interacting with environments - environments with, as Barrow reminds us, constants such as gravity and the behaviours of solids, liquids and so forth. These structures are informed by the physical properties of the materials from which the organism is composed and the constants of their environments. The shapes, thickness and spaces between structural elements will all have been arrived at as a result of the 'discipline' of natural selection, in order, on average, to be no more nor less strong than they need to be, so that they may present a surface for photosynthesis, support the weight of a spider and its prey without breaking, or

do whatever an animal body needs to do by way of locomotion, eating and digesting, procreating and suchlike.

There will, inevitably, be a *natural economy* to these structures. If they are 'over-engineered' for their environment, they will be at a disadvantage compared with organisms whose more economic utilisation of matter and energy matches more closely the demands of that environment; if they are under-engineered, they will perish. In both cases, they would be selected against and their genes would fail to replicate. Thus, such natural economy often leads not only to symmetry, but to recurrent shapes and proportional relationships (not to mention pattern, regularity, and smoothness, as will shortly be explored). No less than with symmetry alone, these qualities and distributions of organic matter are usually only disturbed where the organism is not in good condition.

I suggest that, as with symmetry itself, humans have evolved to become sensitive to these indicators of high-quality food or healthy mates. Constant engagement with the plants and animals which made up the organic with a view to effectively exploiting it would have favoured those who exercised a critical skill in evaluation in the terms described above. Humans were surrounded by the examples of natural efficiency and economy, indeed, they were literally embodied in just such a structure (although the human body is a timely reminder of the contingent historical limitations of this 'perfection'; see below). Apart from the structures of the inorganic environment (which in comparison, would have been both less prominent and less critical to survival and reproduction), it would have been the only example to hand.

As noted in chapter two, Mithen is persuasive in arguing for a stage in the development of the human mind, where the mental 'walls' separating natural history, technical and social intelligences become breached (by symbolic thought and its expressions in language and artefacts). The critical faculty which both he and Evans identify as underpinning the sudden (or gradual) increase in the variety and effectiveness of tools is abstract thought: the ability to apply intelligence from one field - such as natural history – to

another, such as technical intelligence. In addition, there would also have been an evolutionary pressure favouring those deploying an 'economy' comparable to that of the natural examples, as it would confer a selective advantage over those more profligate in their utilisation of resources. Further, in order to reinforce these choices, I suggest that natural selection may well have favoured the refinement of an aspect of our aesthetic preferences in appreciation of just these types of proportions, shapes and so forth, such that, once again, on average, that which is practically advantageous, carries with it a pleasurable, emotional pay-off. I stress that this aesthetic pleasure originates in a *physical* appreciation of the behaviour and characteristics of materials, but inevitably leads to corresponding visual counterparts.

In this way, although perhaps originally of less significance than a perceptual bias towards the detection of symmetry, a facility for the detection of this further indicator of good condition in the found, organic world of resources and mates - 'natural economy' – might have become translated into an aesthetic by which effective, economically designed practical, or otherwise useful artefacts were brought into being and appreciated.

3.7 The Golden Section

The Golden Section provides a suggestive example, supporting the general proposition of just such a sequence: it is found in many living organisms (*fig. 31*). It is also found in the buildings and artefacts of many cultures across the world, and is susceptible to a variety of different, self-conscious or unconscious, contingent cultural expressions. As Christopher Green remarked, having conducted a systematic inquiry into the probable emotions prompted by exposure to it: '…there seems to be, in fact, real psychological effects associated with the Golden Section,' adding, in a caveat many designers and educators of designers will appreciate, 'but…they are relatively sensitive to careless methodological practices.'.[18] Although authorities are divided, there remains, therefore, a distinct possibility that, like perceptual biases to other

'good' proportions, the Golden Section is, indeed, an evolved part of human psychological make-up: it is in our genes.[19]

3.8 Natural economy and human designing: some caveats

I digress for a moment from this catalogue of the physical characteristics of artefacts to enter some caveats into this account of the 'natural economy' of evolved 'design', and the effects this may or may not have had on designing, as practised by humans or our ancestors, lest the accounts of either or the relationship between them should be thought too panglossian. Firstly, there are profound differences between 'design' as it emerges out of nature, and our own efforts at designing. Natural selection works blindly, with what already exists, and to no purpose but the immediate negotiation of averages of the environment. Thus our hands evolved incrementally out of fins, and our backs evolved to enable efficient quadripedal locomotion, rather than the bipedalism which we now favour. As noted in chapter one, not all organic structures are 'perfect' design solutions. 'Handsome is as handsome does' as far as evolution by natural selection is concerned, writes Dennett:

> Natural selection cannot tell how a system got the way it got, but that doesn't mean there might not be profound differences between systems "designed" by natural selection and those designed by intelligent engineers…For instance, human designers, being farsighted but blinkered, tend to find their designs thwarted by unforeseen side effects and interactions, so they try to guard against them by giving each element in the system a single function, and insulating it from all the other elements. [20]

Natural selection, as manifested in the characteristics exhibited by humans, represents, as has been noted, a trade-off of benefits, with each faculty co-evolving in the context of all the others. Dennett stresses that, in contrast to the 'blindness' of evolution, humans have intentions. Doubtless,

there is some truth in his observations about the character of some human creations. Indeed, David Pye, in a systematic demolition of the notion of 'function' in design, similarly cited the example of the motor car engine, intended by its designers to provide locomotion, but which also produces unlooked-for and usually unwanted heat.[21] Yet if we rarely design multi-functionality into our artefacts, the countless casual improvisations which characterise our daily (mis-?)use of objects – the folded newspaper as umbrella, the suitcase as seat at the airport, the chair as stepladder, or Evans' example of the house brick as doorstop[22] - testifies to the *post hoc* multi-functionality we are adept at practising, so Dennett's reservations must be a little qualified.

Secondly, some neurological evidence indicates that our minds' structures continue to maintain distinctions between how we consider the natural world and how the created one. While, as has been suggested by Mithen, the barriers between the different intelligences may have been eroded, permitting the transfer of abstract understandings from one sphere to the other, Pinker notes persistent differences in some of the universals which apply when we move from one class of object to another:

> People [everywhere] have intuitions about natural kinds - …such as animals plants and minerals - that they don't apply to artifacts, such as coffeepots, or to kinds stipulated directly by rules, such as triangles or prime ministers.[23]

Some, with a particular type of brain damage, find they cannot name objects found in nature, but have no trouble identifying artefacts; in others, differently damaged, this mental 'blindness' operates exactly the other way round 'suggesting that [internal representations of] artifacts and natural kinds might even be stored in different ways in the brain.'[24] The dissolution of barriers may – perhaps for good reasons – be incomplete, or intermittent.

3.9 Patterns which excite

To resume: this argument mounted above regarding symmetry and proportion can be further extrapolated to help explain aspects of our responses to pattern. Once again, a case can be made for certain perceptual biases arising from negotiating the evolutionary environment and for these biases being replicated by us in our design choices in artefacts. As with symmetry, it is interesting that of the two supposed environmental saliences which may have given rise to our perceptual biases in this area, one evokes negative emotions, and the other positive.

On the negative side, work by Richard Coss suggests an innate aversion to types of pattern which, in the past, may have indicated the presence of snakes:

> Exposure to dangerous snakes was likely to have been a common occurrence in hominids, with inattention in trees leading to reaching for fruit near arboreal venomous snakes, such as the black mamba (*Dendroaspis polylepis*), or stepping on immobile vipers while foraging on the ground…the ability to detect complex contour information with peripheral vision would be essential to mitigate attacks or envenomation.[25]

Experiments where participants were shown (at an angle from the side of 8°, as a snake might approach in the wild) patterns resembling the backs of snakes, showed that they exhibited markedly higher levels of synaptic activity in the brain, than when they were shown uniform surfaces. (Both results have consequences for how artefacts might be finished.) As Barrow remarks: 'The survival value of rapid pattern recognition is considerable.'[26] Coss prepared transparent plastic jars lined with coloured paper. One had plain paper, another tartan (known as plaid, in America), one resembled leopardskin and another the skin of a python. Infants and toddlers were given these on a random basis as toys to play with on a series of occasions over several weeks.

They were judged to be showing interest in a jar, when they repeatedly poked it with their outstretched index fingers. Coss reports: 'The jars with the python and leopard patterns engendered significantly larger frequencies of poking than the plain or plaid jars.'.

There is, I believe, a link between Coss's observations, and the following evidence from Barrow. Barrow enumerates the mathematically finite number of possible linear, frieze-like patterns resulting from reflection or rotation, and patterns on planes, if those patterns are in two colours and regular. These last were first exhaustively categorised by Eugraf Federov in 1881[27] (there are seventeen), but it is notable that they are found in cultures unknown to one another throughout the world. The Ancient Egyptians knew of and used every one.[28]

> The ubiquity of these forms of decoration, in cultures with no mathematical understanding of their significance and completeness, is witness to the innate sensitivity towards patterns – a sensitivity that has clear adaptive advantages.[29]

Still other experiments reported on by Coss, and by Aiken, demonstrate higher states of physiological arousal when subjects are shown pointed or sharp imagery, rather than smooth curves.[30] The key to understanding how such a background has led to the incorporation of such patterns in artefacts is in what Ehrlich describes as the 'aesthetic thrill'[31] that works of art – and by implication, other artefacts – can deliver. In short: what began as a perceptual bias evoking fear and recoil, has come to deliver a kind of excitement, a fascination. It is tempting to infer that something of this kind may lie behind the uses of snakeskin for shoes, or other garments, or animal skins or fur for clothes which have oblique – or indeed, overt – connotations of erotic power. In some circumstances, perhaps a suggestion of danger or anxiety can act as an aphrodisiac.

3.10 Patterns (and regularity, uniformity, smoothness) which soothe

By comparison, other types of pattern which exhibit regularity and uniformity to the point of smoothness (but not shine – see below) tend to evoke soothing, even calming responses. I suggest the origins of a sensitivity to this type of uniformity (like that towards symmetry and certain proportional relationships, considered above) partly originated as further clues to soundness in plants and animals for food, and of health and strength (and therefore genetic fitness) in prospective mates. Once again, it would only be disrupted if that being regarded were, for one reason or another, out of condition.

I further suggest two sources for the incorporation of such finishes (along with symmetry) into artefacts. Firstly, giving a uniform or regular surface treatment enables the eye more easily - more comfortably, indeed - to negotiate an object. As Sütterlin writes: 'The fact that we highly appreciate *symmetry* and *order* in a given visual situation is due to their simplifying, i.e., complexity reducing effect.'[32] Numerous perceptual experiments have demonstrated that humans have 'an evident aesthetic preference for simple versus confused figures, where "simple" turns out to be symmetrical and regular, while "confused" the opposite.'[33] Similarly, Ludmany writes of the perceptual advantages of standardised forms:

> Incoming information is strongly reduced or, rather, filtered. The totality of the perceptible world can not be introduced into the system because it can not be evaluated [because it is too great]. This strong reduction in received data is the price we pay for information processing.[34]

To this perceptual bias in favour of regularity, I would add a further reason taken from human evolution to help explain the persistence of such uniform finishes in artefacts. Pattern often arises as a by-product of the *economics* of making (*fig. 14*). Just as ploughed fields, knitted or woven cloth, or planished (beaten) metal hollow-ware, exhibit regular patterns because of

the processes by which they are worked, so some pre-historic artefacts, such as the Upper Solutrian flint blade from 18,000 to 22,000 years ago shown in *fig. 13*, have become attractive - perhaps unintentionally, perhaps not - because of regular, judicious blows.

I stress that these choices are not just favoured because of existing perceptual biases evolved as described above (although I assert that is a credible part of the explanation), but because they arise from *economy*. Possessing the skill routinely to fashion the flint into an effective tool by judicious blows ensures that neither the raw material, nor the time spent securing the raw material nor the time spent making the tool is squandered. Those without such a facility must expend greater costs to achieve comparable results, and are thus at a disadvantage (and less fit). In this way, aesthetic pleasure may have (partly) arisen out of (the older?) technical pleasure: an aesthetic preference for regularity in patterns and a pleasure at their achievement may have arisen from a kinetic sense and the attendant simultaneous pursuit of technical pleasure. Both varieties of pleasure may therefore be seen as adaptive, cognitive markers, delivering in combination, an adaptive advantage.

3.11 Shininess, glossiness and glitter

Sometimes, the regularity of such work leads not to a uniform pattern, but to a surface so uniform that we experience it as smooth. Smoothness and uniform patterns are both examples of regularity. In principle, it might be thought that their routine occurrence in artefacts – five out of the six 'bore-hole' artefacts exhibit such qualities – could be explained by further extension of the principal arguments mounted directly above: that recognising it may have emerged as yet another marker of soundness in the organic environment; and that it came to be prized in artefacts as an indication of skill and intelligence. However, once smoothness becomes *shininess* – perhaps (as explored still more fully in chapter six) arguably the most highly prized surface

treatment of all to be found in human artefacts, a further factor suggested by Coss[35] must be considered.

There is a steadily accumulating body of evidence to suggest that, on average, people will favour landscape scenes which include water over those which do not.[36] In addition to Coss's reference to this research material, I would want to point to our fondness for fountains in many contexts, the routine inclusion of lakes in countless historical exercises in landscape gardening, the mandatory inclusion of water in the Japanese tea garden, as well as the ubiquitous 'water feature' found in every other suburban garden, as but a handful of entries in the enormous catalogue of evidence that our relationship with water is by no means accidental, nor without its evolved, emotional content.

Water comes in many forms, from murky, perhaps stagnant pools, to clear, mirror-like stillness, to water which ripples, sparkles, or comes crashing through the rocks with spray glinting in the sunlight (or the moonlight). Apart from the murky, all these forms tend to be found attractive.

Water is essential for life. For our ancestors – no less than for many hunter-gatherers or nomads today - the ability to negotiate an environment depended in no small measure on the ability to identify the sites of water. Those who repeatedly failed to identify it risked dehydration, followed by death, and failed, therefore, to pass on their genes; but the converse was also true. Therefore, argues Coss, a partial explanation for our apparent preference for shiny, glossy surfaces in, perhaps, the majority of human artefacts (and a prizing of glittering, sparkling artefacts such as jewels – or, indeed, the silver denarius of the bore-hole objects - or the chromium trim found on cars, motorbikes and countless contemporary products) may have arisen, partly, from a suite of perceptual biases originally evolved as cues to detect water.

By way of support to this argument, he notes that seven to twelve month-old babies exhibited a distinct preference for holding a shiny (blue) plastic plate to their mouths - in preference to a smooth, but matt one of the same hue. Moreover 'it was not infrequent to observe toddlers on their hands

and knees mouthing and sucking the centre of the glossy plate as if drinking from a rain pool.' Coss concludes: 'This precocious activity in children of nursing age illustrates the early onset of an adaptive behaviour historically useful in much older individuals.'[37] The final interpretation of the observed behaviour is, of course, Coss's own, but the evidence is, nonetheless, suggestive.

To this explanation, and following the method adopted in considering other characteristics above, I will, briefly, flag up another drawn from the sphere of artefact manufacture (the fuller consequences of which I will also develop in chapter six): usually, it takes more work to make a surface shiny. Thus, applying the Handicap Principle introduced in chapter two, a shiny surface on an artefact made from some types of material – irrespective of its correspondence to an existing perceptual bias in favour of such a surface treatment - might additionally register as attractive, partly because it provides proof of extra 'costs' incurred, and therefore contributes to the potential for that artefact to act as a signal of genetic fitness.

3.12 The case for evolved colour perceptions

The last physical characteristic of artefacts to be addressed in this sequence is, at first sight, the most obvious: colour. As his remarks from *The Origin of Species* remind us, Darwin was alive to the roles which colour contrasts and the sensitivities of organisms to these contrasts might play in securing adaptive advantages. Of all mammals, only primates have developed full colour vision.

Historically much of the debate about the significance of colour has revolved around its relationship with language.[38] Those from the so-called 'universalist' camp have favoured the belief that there are constants in this relationship, which warrant an explanation; while others ('behaviourists') have sought purely cultural explanations. This study is primarily concerned with artefacts, but I will briefly consider some aspects of this linguistic debate,

because they prompt some interesting and pertinent lines of inquiry and argument.

In 1964 an anthropologist, Brent Berlin, and a linguist, Paul Kay, published their seminal (universalist) study: *Basic Color Terms: Their Universality and Evolution*.[39] So influential has it proven that countless authorities, including Barrow and Deacon, have reproduced their central arguments more or less wholesale. [40] The astronomer's version, inevitably, stresses the cosmological dimension: we have evolved on a planet which rotates around the sun. Therefore, some of the most fundamental constants of our environment have been connected with the presence or absence of light, and the persistence of colours within a particular range of wavelengths. Our own sensibilities are among the latest manifestations of evolved light-sensitivity. It is argued that this is a sensitivity which has developed over a very long time indeed, through countless ancestor species of *Homo sapiens*, as well as being a characteristic which, to differing degrees, we share with most other species on Earth.

At any one time, half the planet is bathed in light and the other half is in relative darkness. Fortunately, not all of the radiant energy (photons) from the sun reaches the surface of the Earth. Much of it is scattered by molecules such as water and ozone in the atmosphere. Of the different wavelengths of light being emitted from the sun, those from the blue-green portion of the spectrum are most abundant. Yet it is just these shorter wavelengths that are scattered furthest by molecules in the atmosphere, such that the sun, once these shorter wavelengths are removed from its light by being dispersed into the atmosphere, appears yellow, while the scattered wavelengths colour the rest of the sky blue. The colour sensitivity of the human eye corresponds broadly with the range of wavelengths remaining once the atmosphere has done its filtering and scattering.

In creating our sensations of colour, the eye registers three qualities: brightness level, the yellow-blue variation and the red-green variation.[41] The first is explained by the need to operate effectively when light levels change:

night and day, sunlight and shadow, different levels of moonlight, cloud cover and so on.[42] The blue-yellow sensitivity is, Barrow asserts, a function of the chief qualities of the sunlight – the blue of the sky and the yellow of the sun – reaching the Earth. The red-green variation might also be a response to atmospheric variations, but it confers, as Darwin suggested, considerable adaptive advantages for both the eater and the eaten, if fruit – most commonly red – is to be distinguished from the near ubiquitous green of chlorophyll of most leaves. It needs to be eaten in order to sustain survival, as the seeds of that fruit are distributed (usually via the gut of the forager) and reproduced (*fig. 16*).[43]

Long before humans began self-consciously choosing or applying colours to their bodies or the artefacts of their material environments, colour sensitivity in many species has had four principal adaptive roles: to attract attention (as for red fruit); as a warning (brightly-coloured berries, insects or reptiles signal to predators that they are poisonous – *fig. 21*); as an element in camouflage; and lastly – and critically for this inquiry – in organisms, like *Homo sapiens,* capable of feeling them, colour acts as a powerful stimulus to the emotions. Wassily Kandinsky, who as a painter and as a 'Master of Art' (rather than 'of Craft') at the Bauhaus had first-hand experience of the uses of colour in both art and design, wrote :

> Colour is a power which directly influences the soul. Colour is the keyboard, the eyes are the hammers, the soul is the piano with many strings. The artist [who may be a designer] is the band that plays, touching one key or another to cause vibrations in the soul.[44]

Kandinsky's somewhat loose account of the workings of colour is not atypical, as he is far from alone in asserting the power of colour on our psyche. Given, as we have seen, that it is reasonable to expect emotions to have adaptive origins, it might also seem reasonable to infer that cognitive responses to particular colours are also adaptive. Kandinsky implies that a *particular* colour

can elicit a *particular* response. If they do - and that is *not* a foregone conclusion - are those emotional responses to colour maintained by cultural tradition, or informed by our evolutionary past? In recent years, a view has been articulated, arising from this debate about colour and language, that both are in operation, a view which I will shortly reconsider, in terms of the colouring of artefacts.[45]

3.13 The naming of colours

Although the wavelengths found in our environments are a continuous colour spectrum, according to Berlin and Kay, humans consistently give colour names to particular parts of that spectrum – and they are always the same parts. They showed differently shaded, coloured cards to the native speakers of 98 languages, from the very simplest to the most complex, and asked if they had colour names for any of them. Where names were suggested, these invariably corresponded to colours for which we too have names. Not all cultures distinguish the same number of colours though. In the simplest of these languages, only black and white were named. The next commonest colour to require distinguishing by a name was red, followed by green and yellow, more or less equally. A putative sequence emerged for the order in which words for colour may have evolved:

		→ Green → Yellow →				Purple
White →		↑		↓		Pink
	→Red →			→Blue → Brown →		
Black →		↓		↑		Orange
		→ Yellow → Green →				Grey

Table 1. A putative sequence for the emergence of adaptive colour recognition among humans and their ancestors, arrived at by considering the naming of

colours in 98 languages. Originally included in Berlin and Kay's study, Basic Colour Terms *in 1964*; *reproduced in Barrow's* The Artful Universe *in 1995.*

The sequence, Barrow re-asserts, is broadly correspondent to a descending order of adaptive utility.

Yet, even if Barrow's is just one of many instances of Berlin and Kay's findings being reproduced unaltered, as Don Dedrick comments, in the intervening thirty years, further research has raised some doubts about them:

> It turns out there are more basic colour terms than the eleven they propose; that there is no basic colour term that is present in all languages; that focal colours [points on the scale of wavelengths] – the supposedly shared "best" examples – are not as predictable as the original research suggested.

Nonetheless, their view is at the core of such consensus in the universalist camp as there seems to be. Dedrick continues,

> On the other hand, there is a lot less variation in the number of colours and nature of basic colour terms than one might expect; a rather significant overlapping of basic colour terms, cross-culturally; a pattern of foci that seems remarkable, even if it is merely "statistically significant" rather than universal.[46]

Such has been the bias in this debate towards language as evidence that societies esteem some colours, rather than others, that few seem to have reflected on the workings of colour in culture through the creating of artefacts.

What value might a qualified Berlin and Kay model have in providing a plausible account of the evolutionary imperatives which may affect how particular colours and colour combinations have been chosen when creating artefacts?

3.14 The case for black, white and red in artefacts

Even allowing for the shortcomings, summarised above, in Berlin and Kay's account, the three colours they identify as being the first whose adaptive significance is recognised by having names - black, white and red – is a plausible, if ultimately unprovable suggestion. Red provides an interesting example. In our own world, on its own, or in combination with either or both the (by this schedule) even earlier black and white, red has a special place: it is not only the colour of ripe fruit (*fig. 16)*, but also the colour of blood (and hot embers). Accordingly, it is often used to signifying danger, food (and thus good fortune among the Chinese) or flesh. Hence, the countless warning lights, danger signals (*fig. 17*), flags, uniforms of the military, shiny plastic fascias of cafés, or branches of Kentucky Fried Chicken or McDonalds (*fig. 18*),[47] as well as the welcoming 'red light' (in literature, at least) and sometimes décor of the brothel, the strip club or, in the twenty-first century, of course, of the pornographic website; these all suggest that red, alone, or with black, or white or both, has commonly and persistently been used to signify danger, violence, food or sex - each of which has critical significance in terms of survival and reproduction. Red (alone, and in these permutations with black and white) would seem the closest to a recurrent of colouring artefacts, which may be more than 'statistically significant', even if universality cannot be claimed.

3.15 Green, yellow, and other combinations

A similar case might be made for green carrying associations of plant life (*fig. 19*) when it is in good condition, both in our evolutionary environment and now; as, also, combinations of colours (which include green) suggestive of abundant vegetation and flowers (the promise of fruit – *fig. 20*). Similarly, the three 'origins' of yellow – as sunlight, as ripe fruit, or as a 'warning' colour in the organic sphere (*fig. 21*) – may well continue to operate: 'Yellow is the colour of joy!' said Oscar Wilde, yet there are countless examples of yellow as a warning colour in the created environment.

But beyond these generalities, what evidence is there that the origins of the workings of colour and colour perceptions among humans continue to affect choices made for the colours of artefacts?

3.16 Colour can arise by default

I return to what I believe to be the general truth with regard to our evolved interactions with artefacts: the physical and technical may often have priority over the visual. In some circumstances today, and many more in the past, the industrious makers of useful artefacts may have been restricted in their choices of colours by the available range of mechanically and 'economically' viable materials, or settle for those arising as a by-product of making processes, or both. Colours have often not been *chosen*, but have arisen by default. Certainly, that accounts, in the main, for the orangey-black colour of the kiln-fired body of the earthenware watering pot (its meagre patch of greenish glaze is considered shortly).

In the cases both of the dyed, woollen yarns used to make the Ardabil carpet, and the translucent tangerine and frosted thermo-plastic laptop casing, studded with sparkling metal components (more water?), the range of

available, possible colours was less proscribed. Those selected for the carpet would seem to have been chosen, partly (and only partly, as the analysis in chapter four demonstrates), because they suggest some of the horticultural abundance of the garden which the carpet represents and, perhaps, this *is* a combination informed by evolutionary imperatives. But other forces, such as the esteem in which contemporaries held certain colours or colour combinations in carpets, as a consequence of their rarity, or the expense they might be thought to represent, or as expressions of exquisite taste – not to mention their metaphysical significance - may also have been at work. Such an observation shows how easy it is, in considering this commonplace characteristic of artefacts, to wander from that which is sensory or perceptual, to that which may be symbolic. Once again, these links will be more fully articulated in chapters four and five.

3.17 Colour: an alternative, adaptive mechanism

As I have hinted, Dedrick suggests a model about the relationship of recurrent, colour perceptions ('perceptual, non-linguistic saliences'[48]) with colour language, which may have uses in explaining how such 'saliences' relate to the colours of and the colouring of artefacts. It is a conceptual mistake, argues Dedrick, to think only of trying to match perceptual saliences and language (a perception of the colour red, say, with a word 'red'), one with another.

> When the universalist does not get the fit - between the perceptual and the linguistic - there is very little to say; there is nothing but (supposed) correlations to fall back upon.[49]

By extrapolation, it may also be a mistake only to look for a correspondence between those colours which, in the course of our evolutionary history, it may have been adaptive to identify, and their inclusion in artefacts. Firstly, as I have suggested, colours might not be deliberately chosen; because of

imperatives other than evolved colour preferences, they may occur in artefacts by default. Secondly, apart from black, white, red, and possibly green and yellow, plausible cases for the direct, adaptive significance of colour perceptions are not wholly convincing. Perhaps there are few or no adaptive origins for the significances attached to many of these other colours, or these colours in combination with each other, or even with those for which there is some plausible adaptive explanation. Thirdly, black, white, red, green and yellow may be consciously chosen for reasons which do *not* correspond with the reasons identified in the account of their supposed evolutionary significance.

Dedrick offers an elegant solution to this apparent conundrum:

> I think we should consider there to be a space between the perceptual and the linguistic [or the perceptual and the colours ascribed artefacts] which needs to be filled by an account of the rules that people use to generate relatively stable reference classes in a social context. These rules must be stated with some precision and yet be flexible enough to account for the kinds of variation in colour languages [or usages] that we find…It takes the idea of non-linguistic saliencies seriously and asks how such saliencies may be exploited by colour language users [or the designers and creators of coloured artefacts] for essentially social purposes.[50]

Thus in the West, the apparent (relative) dullness of men's clothing since the early nineteenth century (commented on by Dickens, Ruskin and Baudeliare), with darker colours predominating, compared with the paler, more colourful clothes expected of women, does not easily correspond to some enduring, adaptive uses of colour in our evolutionary past. If it did, then such a distinction would have had to have been true, on average, for all men, in all cultures, but this is plainly not so. John Harvey in his fascinating study *Men in Black* comments:

> Previously men, like women, had dressed in many colours. In the Middle Ages men dressed splendidly if they could afford it. Even the poor wore varied colours – brown and green, a red or blue hat – as medieval illuminations show…men wore colours in the eighteenth century and the first two decades of the nineteenth. But from this point on men's dress becomes steadily more austere and more dark, and if one consults the fashion journals one can see colour die, garment by garment, in a very few years.[51]

With exceptions and periodic 'relaxations', men's clothing in the West has remained dark – on average – compared with that of women to this day. Why? Harvey outlines an argument embracing a range of 'rules that people use to generate relatively stable reference classes in a social context' of just the sort that Dedrick proposes: black in men's clothing as an indicator of probity, of spiritual integrity, of negation, of sexiness, or even – as Baudelaire had speculated at the time – an emergent democratisation of societies no longer slavishly following aristocratic precedent, a social cohesion bought at the cost of the death of precious individuality. For Baudelaire, it was this 'death' which occasioned men's wholesale adoption of funereal garb:

> And observe that the black frock-coat and the tail coat may boast not only their political beauty, which is the expression of universal equality, but also their poetic beauty, which is the expression of the public soul…a uniform livery of grief is proof of equality[52]

Thus, the 'rules' drawn up for these uses of colour in this particular culture at this particular time are among the means by which the adaptive goals of mating and social mediation are furthered. Indeed, this example provides a vivid illustration of the general truth: the mechanisms of aesthetic preferences are evolved, but their content can be very variable. The mediation of societies is only adaptive on average. It does not guarantee that each, incidental nuance

will be, no more than it guarantees to reasonable, rational human beings, that it will deliver morality, or justice, or joy.

3.18 The uses of colour today: an uneven adaptive legacy

With regard to our uses of colour, and the extent to which an evolutionary perspective helps explain their present use, the following can be argued: such as they are, our recurrent colour perceptions are evolutionary in origin; today, our evolutionary background *may* inform some of the uses the designers and creators of artefacts make of some colours, but not others; and the looked-for constants of the universalist approach could exist, not always as colour choices as such, but as rules which enable uses of colour to achieve social objectives. By this last model, colours can be deployed singly or in combinations which, of themselves, might owe nothing to adaptive colour perceptions in our evolutionary environment; but which may, nonetheless - once their significance relates to their symbolic, rather than their perceptual impact - service social functions, which do have adaptive histories. Thus, where deliberate choices for the colours of artefacts are made, or where it is decided that artefacts whose colours have arisen by default may circulate, it can be argued that the explicit or implicit choices of colour serve to enhance that artefact's value as an agent of social modulation.

3.19 Economics: prehistory and history

As has been explained in chapters one and two, in evaluating the adaptive benefit of a trait or character – including those such as symmetry, smoothness, or colour, etc., considered here – benefits must be offset against costs. In prehistory, 'costs' include things such as time diverted away from the securing of resources, exposure to danger (as in the mating calls of birds, where to make the sound exposes it to predation; or the risks attached to the securing of a raw material might be taken as just one example from the human sphere). Plainly, the scarab, the Roman coin, the carpet, the watering pot, the woodscrew (and the laptop computer, considered in chapter five) are the result

of complex, indeed, diverse, social, political, technological, psychological and economic forces – more complex, arguably, than those which pertained during our pre-history. Yet in some respects, like psychology, the 'economics' of prehistory, referred to in this study, need not be thought of as being so completely disconnected from the economics of our own times.

Conventionally, the 'Agrarian Revolution' is dated to some 10,000 years ago when, it is argued, the hunter-gatherer way of life (apart from a few remnants) was given up in favour of agriculture; that with agriculture came accumulated wealth, and that with accumulated wealth came political states and civilisation.[53] Colin Tudge has argued that, in fact, what he calls 'hobby farming' – limited exercises in agriculture – may have been a part of hunter-gathers' lives since 40,000 years ago, but that the melting of ice sheets at the end of the last Ice Age, 10,000 years ago, had the effect of raising the sea level by 20 metres, and thus flooding the plains which had sustained the fairly leisurely hunter-gatherer way of life, forcing the adoption of farming as a survival strategy. Farming, he argues, is hard work, and these events have informed countless myths, including that of the expulsion from the Garden of Eden. [54]

As Maynard-Smith and Szathmáry remark:

> Populations of, at most, a few hundred individuals, with little division of labour except, probably, that between the sexes, have been replaced by societies of many millions, dependent on extensive divisions of labour.

…and elsewhere:

> In agricultural and industrial societies, individuals are not equal. Those who own land, factories, or shops have different options open to them than peasants, factory workers or shop assistants. [55]

Nonetheless it is reasonable to assert that in the historical world, the trade in goods, money, artefacts or services can be seen as fundamentally resting on the securing of resources (ultimately, perhaps, food and water). Of course, the pursuit of other resources such as gold, silver, gems, or more practically, raw materials (and in our own age, oil above all), or the products into which those can be turned, not to mention the securing of services, including information supply, might not immediately seem connected with the securing of food. Many western societies are abundantly supplied with food, such that the food trade might be thought of as just one, alongside other markets in these resources. Yet I suggest it is just that the links are less direct than they might have been among relatively small groups of *Homo sapiens* pursuing a broadly hunter-gatherer existence, but that they pertain, nonetheless. Thus, I argue it is reasonable to apply the 'costs' and benefits test when evaluating the persistence of the characteristics described above in the artefacts of history, rather than pre-history.

3.20 Costs and benefits

I have made it plain that both aesthetic pleasure, no less than the kinetic, technical pleasure explored in chapter two, can be thought of as adaptive in origin. Under each of the headings above, I have made some remarks in passing regarding the extent to which some of the 'bore-hole' artefacts exhibit the sensory or aesthetic characteristics being discussed. I now propose evaluating the seventeenth-century watering pot and the twentieth century woodscrew for evidence that the precepts of adaptive, kinetic, technical economy and pleasure have been followed, as well as evidence that sensory biases and aesthetic pleasure have informed their creation. Both these qualities will affect how we feel about an artefact. Where the artefact is intended to bear symbolic meaning – as the examples considered in the chapter following will show – then those characteristics may be deliberately manipulated, the better to support such meaning. In the two examples to which I now turn, I suggest that no symbolic meaning was intended. However,

satisfying aesthetic and technical qualities will affect how we respond towards an artefact, and affect its power as an instrument of social mediation.

Therefore, in applying the costs and benefits test to these characteristics as exhibited by these two examples, I will assess the extent to which costs may be offset, not only by the benefits conferred by these characteristics on the utilitarian functions of these overtly useful artefacts, but also by the extent to which such choices stand to enhance the power of the objects in the mediating of social relationships.

3.21 The watering pot

The watering pot (*fig. 5*) is earthenware, and was made in or around London at some time in the seventeenth century (the ubiquity of this design at archaeological sites of different dates makes precise dating difficult).

At first sight, a persuasive case could be made for believing that the choices made as to raw materials, design, the forms of its particular parts, the methods of its manufacture and qualities of its finish, might all be wholly accounted for by the ruthless application of the principles of *economy* offsetting its value as a practical tool, with little or no thought as to the extent to which it had to act as an instrument of social mediation. Compared with, say, the expensive porcelain imported at that time from the Far East or the decorated tin-glazed earthenware made in imitation of imported porcelain here in Britain, it was a low status object. It is made from what was known even at the time as 'ye Ordinary red-ware', the cheapest of clay bodies.[56] It was probably made near a source of such clay (sometimes, no more than a shack thrown up near where the claypit was dug, sometimes in the open air) in or around the London area, sold and almost certainly used not far from where it was made. According to the archaeologists, Sylvia Pryor and Kevin Blockley, who excavated a site at Woolwich where remains of similar watering pots dated to between 1660 and 1680 were found, the clay from which they were made was dug up at nearby Plumstead Common.[57] Similarly, with this watering pot, its low status, and therefore, low value in relation to its weight, would have

precluded expensive (i.e., extended) transportation of either raw materials or end product.

In such circumstances, it is hardly surprising to find that the evidence suggests that no-one at the time would have given much thought to anything but its utility (or if they did, there is no extant record of it being spoken of). It was primarily seen as a practical tool. A 1706 abridged edition of a translation by John Evelyn of Francis Gentil's *Le Jardinier Solitaire* explains the advantages of using a watering pot:

> …a Watering-Pot…imitates exactly the Rain that falls from the Clouds, by shedding the water it contains out of a Thousand little Holes that are in the Rose of it. The relief the plants receive by the help of this Vessel does them a great deal of good.[58]

Without it, the rush of water from some non-purpose-built vessel might just wash soil, seeds or small plants away.

Yet there are at least three characteristics of this utilitarian object which can only fully be explained, once its value as a mediator of social relationships has been taken into account. One is a by-product of necessary process: at the front, above the spout, the watering pot has an addition to its rim, enabling the pot to be tilted forwards while pouring through the rose, without the water tipping out of the top. This looks exactly as if it has been modelled to look, roughly, like a leaf. Yet this additional part is made from three or four rolls of clay, each slightly shorter than the other, placed on top of one another. The rolls have to be smoothed together. The decorative 'leaf' is a by-product of just such an 'economic' sequence of regular smoothing actions with a finger or thumb (it would be hard to achieve mechanical integrity between the rolls with fewer movements). Given the intended destination of this pot in a garden, it would not seem unreasonable to infer that these marks – which may have begun as 'process' - were intentionally decorative.

Unlike the leaf, the other two characteristics add to the cost of the artefact and would be difficult to explain in any terms other than as their function in contributing to the power of this object as a tool of social mediation. They are: the degree of finish to the main body; and the presence of a patch of greenish glaze.

The main body of the watering pot is smooth. Close examination reveals it was smoothed over, after throwing, with a wooden or metal 'rib' to remove the ridges otherwise left by the potter's fingers. Yet the practical advantages of this smoothness are virtually non-existent. Indeed, in other earthenware artefacts (of even lower status?), the ridges left by the potter's fingers were often allowed to remain. Even if the time invested was a matter of seconds for each pot in the batch, cumulatively – as any hard pressed potter using the daylight available would have known - it would mean fewer pots made in a given period of time. This suggests that smoothness was among the qualities which potters judged purchasers would expect – and which vendors would therefore have to offer - even of such a low status tool.

I propose that it was a necessary characteristic of the watering pot, if the pot was to be emotionally and psychologically, as well as practically satisfying, and have value – in all senses – as a vehicle for social transactions. It delivers a 'simple' aesthetic pleasure. As described above, I have suggested that a preference for smoothness (or some other forms of regularity) has emerged out of a long history of evolutionary imperatives shaping perceptual biases which support aesthetic pleasures, and which, I propose, continue to inform the aesthetics of our created environment to this day. Further, I now suggest that smoothness (and indeed, in this context, but not this object, the shininess, already accounted for by a number of evolutionary forces outlined earlier in this chapter) like other forms of regularity, has become a universal indicator of technical fitness for purpose. Other such indicators might include good proportions and regular patterning - the soothing, rather than stimulating features. Thus, I suggest that the evolutionary pre-dispositions towards such characteristics outlined earlier in this chapter, are reinforced by this additional

significance. I hasten to add, it is a largely unconscious significance and in this case, at least, has nothing to do with any symbolic meaning. That which is smooth signals that it is (believed to be) 'well-made', and therefore, practically effective.

I also stress this has become a matter of unconscious association: a smooth, ostensibly useful artefact may be hopelessly impractical. My laptop computer is smooth, but as a tool, it is less than perfect.[59] It is but one of a long line of tools, whose practical limitations are belied by its aesthetic power, the magic of its shape and of its surface qualities. As noted, I will develop further this theme of smoothness in chapter six.

Apart from the smoothness, there are also remnants of a large dab[60] of lead ore ('galena' glaze) on and around the sprinkler rose. Lorna Weatherill has calculated that in the early seventeenth century, glazes on what she terms 'courseware' accounted for 16% of the production costs, compared with only 5% for the clay itself.[61] This can partly be accounted for by the costs of transport of the raw material: according to Peter Brears, lead ore was principally mined in Derbyshire, the Mendips and the Yorkshire dales.[62] Of no practical use whatever,[63] this not inconsiderable 'investment' in a shiny, greenish decoration – also found on countless comparable earthenware items made over hundreds of years - must have been thought warranted.

I suggest it is explained by the extent to which it might contribute to an attractive display with other, similarly decorated goods on the retailer's stall, thus giving a credible, eye-catching, material account of the salesman and his business, attracting the buyer, facilitating a sale, and pleasing the user thereafter. If they were ranged on a flat surface, in a row, then an economic use of the space would dictate that they were placed in a row, side by side. The sprinkler rose is the feature which most immediately distinguishes them from similar plain jugs; thus, arranging them with their handles showing would make poor marketing sense. (The co-incidence of the mildly greenish colour, and the pot's function in the garden is, I suggest, felicitous, but wholly accidental. I do not believe it was striven for.) An arrangement with the roses

facing front, side by side, and maximising the visual effect of this expensive, extra detail of shiny green glaze, would make both economic and – in the sense that the selling of the watering pot was, in the eyes of its creator, doubtless the most important social transaction it would ever have to facilitate, social sense as well.[64]

Thus, although it is primarily a tool, and a tool of low status at that, the role of this artefact in terms of social mediation has been taken into account by its maker; the everyday is made special (Ellen Dissanayake's chief definition of art[65]), at a very carefully calculated cost. Although this explanation could be assembled without reference to the evolutionary dimension,[66] I argue that, fully to understand what is going on, including the reasons why we make such calculations, their origins in our shared evolutionary history, as described in this study up to this point, need to be introduced into the explanation.

3.22 The wood screw

This twentieth century, steel wood screw (*fig. 6*) provides a perfect commonplace example of an artefact where no immediate symbolic meaning was intended by its creators, and where no-one would ordinarily expect it to bear one in normal use. As with the watering pot discussed above (though not, perhaps with the same level of likelihood) I do not say it cannot have a symbolic meaning, only that none has been immediately intended, or would conventionally be attributed. The screw is a mass produced product. Although the costs of the steel, of the factory and plant where it was made, of the wages of the staff of the factory, the packaging, the distribution to retailers, and the attendant advertising, all have had to be borne, the quantity in which such items are produced means that, in relative terms, it is inexpensive.

Nonetheless, I argue that the aesthetic and technical pleasures it delivers are based on sensory and perceptual biases, exactly as described: the smoothness of the upper third of the shaft; the sensation caused by handling the sharp edges of the volute thread; the sight of the gentle taper of the residual shaft at the centre of that thread, gradually coming to a point; the

satisfying repetition of diagonals which the thread exhibits; its weight, its rigidity; and, above all, its symmetry (actually, the slot in the head is fractionally asymmetrical, but only a close examination – of a kind it would almost never receive - reveals this apparent anomaly), are all sufficient to deliver the unconscious, non-symbolic message that it has mechanical integrity and that - in a world which presupposes wood, drills, screw drivers, and a desire for one piece of wood to be reliably united with another - it will fulfil the function expected of it.

Thus, even this modern, useful artefact can be seen to exhibit characteristics which have emerged over millennia, from the continuous coincidence between that which is judged technically satisfying (and therefore both useful and economic – and therefore adaptive) and that which is aesthetically pleasing.

Conclusion

In considering the origins of the aesthetics of the making of artefacts, I claim that human perceptive sensibilities relating to both formal and visual symmetry and proportion, to surface qualities, such as pattern or smoothness, and, to a lesser degree, colour, evolved originally as part of the mental equipment by which the organic environment was more successfully exploited for food, or deployed in identifying viable, potential sexual partners. I suggest that, although questions remain about how and when activities relating to the natural historical intelligence of our ancestors informed their technical or social intelligences, at some point in our evolutionary past, these perceptual biases complete with their own emotional dividend of aesthetic pleasure, were applied to the creation of artefacts; that the 'natural economy' of the organic world served as a powerful model – indeed, the only one available - for both the technical and aesthetic sensibilities informing the creation of those artefacts; that adherence to the principles of *natural economy,* in turn, conferred 'economic', adaptive advantages on those creating; that, for example, uniform pattern in artefacts can arise, partly, as by-products of the

economics of process; that, alongside such practical considerations which may have prompted their creation, the fashioning of artefacts would, inevitably, represent the pursuit of pleasure, whereby pre-existing technical pleasures and aesthetic responses based on evolved perceptual biases, steered the process of creation towards just these favoured characteristics; that these aesthetic, emotional pleasures prompted by the forms and finishes of artefacts serve as yet another way in which they become - in Dissanayake's sense - to be perceived of as 'special'; and that this 'specialness' matters because – in addition to behaviour and language - artefacts are, I argue, a vital and – as will be shown - in some respects, unique means by which social relationships in complex groups can be mediated and articulated. The technical and aesthetic pleasures these physical characteristics evoke help ensure that they have become, and remain, the commonplaces of human designing and, partly, help explain why humans almost invariably finish, or decorate or ornament useful artefacts in ways which utility alone does not warrant.

Because of the inextricable links between the sensory perceptual level, as it informs both technical and aesthetic pleasure, and because I do not – as often occurs in analyses of this kind – want the kinetic sense nor the technical pleasure it supports to be overlooked in this account, I have chosen, for the purposes of this study, to refer to these two levels together, as the *sensory-kinetic-affective mode* of engagement with artefacts: I ask it to be understood that I mean 'sensory' to stand for the reflexive, sensory and perceptual; 'kinetic' to stand for kinetic sense; and affective to cover both technical and aesthetic pleasure – especially, as I have argued above, that technical pleasure which, in some respects at least, has contributed to aesthetic pleasure.

Through the examples of the watering pot and the woodscrew, I have demonstrated that these propositions are plausible.

Together, as I indicated in the introduction, I assert that the sensory-kinetic-affective mode and the symbolic-narrative mode account for all the possible ways in which humans engage with artefacts. Having established in

broad terms the workings of the first, I turn to the second, which is the subject of the chapter following.

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[1] Darwin, C. R., *The Origin of Species,* John Murray, London, 1859, p. 559, printed from Ridley, M., *Evolution*, Blackwell, London, 1996 (CD-ROM). This is a facsimile text; the passage quoted is omitted from the Wordsworth edition cited elsewhere (it would have been on p. 355) , although it too, claims to be based on the original 1859 edition.
[2] Barrow, J. D., *The Artful Universe*, Clarendon Press, London, 1995, pp. 30-31,
[3] Barrow, p. 91
[4] Miller, G. F., (2001). 'Aesthetic fitness: How sexual selection shaped artistic virtuosity as a fitness indicator and aesthetic preferences as mate choice criteria', *Bulletin of Psychology and the Arts 2*(1), 2001, pp. 20-25, reproduced on http://www.unm.edu/~psych/faculty/aesthetic_fitness.htm visited 05.12.03
[5] Thornhill, R., 'Darwinian Aesthetics Informs Traditional Aesthetics', in Voland, E., and Grammer, K., (eds.) *Evolutionary Aesthetics,* Springer, Heidelberg, 2003, p.18
[6] Thornhill, pp. 17-18
[7] Thornhill, pp. 27-30
[8] Ultimately, I suggest there may be some scope in attempting to extend the approach developed in the present study towards other areas of human cultural activity, including dance, music and song, but, for the sake of clarity and simplicity, I have chosen to confine this particular work to the consideration of artefacts, as defined earlier.
[9] Thornhill means literary or narrative social scenarios in his list; I will be extending that in the following chapter to include the symbolic and narrative uses to which artefacts may be put, thus returning resolutely to the physical sphere.
[10] Interestingly, while Thornhill allows a visual element to the appreciation of non-human animals, he argues for an aesthetic which rests on their *behaviour*. I suggest his account of the aesthetics of food is wayward, in that it omits any mention of the physical or visual at all, but relies on taste and smell alone.
[11] Stout, D. B., 'Aesthetics in Primitive Societies', in Jobling, C. F., (ed.), *Art and Aesthetics in Primitive Societies,* Dutton, New York, 1971 (orig. 1956), pp. 30-34, quoted in Aiken, N., 'How Art Arouses Emotion', in Bedaux, J. B., and Cooke, B., *Sociobiology and The Arts,* Editions Rodopi, Amsterdam, 1999, p. 160
[12] Aiken, p. 160
[13] Pinker, S., *How the Mind Works,* Penguin Books, London, 1997, p. 327
[14] Dennett, D. C., *Consciousness Explained*, Allen Lane, The Penguin Press, London, 1993 (orig.1991) p. 179
[15] Barrow, p. 105

[16] Mithen, S., 'Handaxes: The First Aesthetic Artefacts', in Voland, E., and Grammer, K., (eds.) *Evolutionary Aesthetics,* Springer Verlag, Heidelberg, 2003, p. 269
[17] Quoted by Kohn, M., and Mithen, S., 'Handaxes: Products of Sexual Selection?', *Antiquity* vol. 73, pp. 518-526; reproduced on http://www.antiquityofman.com/handaxes.html visited 28.07.04. The amendments in square brackets are theirs.
[18] Green, C. D., 'All That Glitters: A Psychological Research on the Aesthetics of the Golden Section', *Perception* vol. 24, 1995, pp. 937-968
[19] It has been suggested that some civilisations thought the Golden Section proved the existence of the divine. Tapping the words "golden section" into a search engine today (2004) reveals no end of websites propounding more or less extreme versions of this view, many of them American, and most profoundly against an evolutionary explanation of human life.
[20] Dennett, pp.174-175. He goes on to suggest this 'fault' is to evolution's advantage: 'In contrast, Mother Nature (the process of natural selection) is famously myopic and lacking in goals. Since she doesn't foresee at all, she has no problem of worrying about unforeseen side effects. Not "trying" to avoid them, she tries out designs in which many such side effects occur; most such designs are terrible (ask any engineer), but every now and then there is a *serendipitous side effect*: two or more unrelated functional systems interact to produce a bonus: multiple functions for single elements. Multiple functions are not unknown in human artifacts, but they are relatively rare; in nature they are everywhere…'
[21] Pye, D., *The Nature & Aesthetics of Design,* The Herbert Press, London, 1978, p. 13
[22] Evans, F. T., 'Two Legs, Thing Using and Talking: The Origins of the Creative Engineering Mind', *AI & Society*, vol.12, 1998, pp. 196-197
[23] Pinker, p. 323
[24] Pinker, p. 327
[25] Coss, R. G., 'The Role of Evolved Perceptual Biases in Art and Design', in Voland, E., and Grammer, K., (eds.) *Evolutionary Aesthetics,* Springer, Heidelberg, 2003, p. 108
[26] Barrow, p. 105
[27] Barrow, p. 112
[28] Barrow, p. 112
[29] Barrow, p. 112
[30] Coss, pp. 90-98; Aiken, pp. 159-171
[31] Ehrlich, P. R., *Human Natures: Genes, Cultures, and the Human Prospect*, Island Press, Washington, 2000, p. 226
[32] Sütterlin, C., 'From Sign and Schema to Iconic Representation', in Voland, E., and Grammer, K., (eds.) *Evolutionary Aesthetics,* Springer, Heidelberg, 2003, p. 133

[33] Sütterlin, pp. 133-134. This observation relates to a particular experiment conducted by Max J. Kobbert in 1986, but Sütterlin writes that the 'experiment confirmed earlier results' and then cites four further examples.
[34] Ludmany, A., 'The Adaptive Role Of Aesthetic Experience: An Epistemological Approach', in Bedaux, J. B., and Cooke, B., *Sociobiology and The Arts,* Editions Rodopi, Amsterdam, 1999, p. 225
[35] Coss, pp. 86-90
[36] Coss, p. 86
[37] Coss, p. 88
[38] For an account of the history of this debate, see Dedrick, D, 'Naming the rainbow: language, colour science, and culture', S*ythese Library*, vol. 24, Kluwer Academic Publishers, Dordrecht, 1998; reproduced on http://cogprints.ecs.soton.ac.uk/archive/00000378/00/Dedrick.html accessed 03.12.03
[39] Barrow, pp. 178-180; this account is discussed at greater length in Trask, R. L. *Language: the Basics*, Routledge, London, 2001, pp. 66-69
[40] Barrow, pp. 178-180; Trask, R. L. *Language: the Basics*, Routledge, London, 2001, pp. 66-69; Deacon, T., *The Symbolic Species: The co-evolution of language and the human brain,* Allen Lane, The Penguin Press, London, 1997, p. 117; Saul, S. and Bleaney, J., *Light, colour and perception,* 'How we see', 2001; this essay appears on http://www.labyrinth.net.au/~saul/essays/05colour.html accessed 03.12.03
[41] Most people who are 'colour blind' have problems with the red-green variation; a few have difficulty with the blue-yellow range.
[42] Everyone is familiar with the sensation of their eyes 'adjusting' as they move from sunlight to dark interior (or vice-versa).
[43] Indeed, this provides a neat, commonplace example of Dawkins' assertion regarding the manner in which genes residing in different organisms, may nonetheless, coevolve to their mutual advantage as far as replication is concerned. In this case, both the forager and the foraged increase their chances of reproducing and of their genes finding their way into the chromosomes of each succeeding generation.
[44] Quoted by Saul, S. and Bleaney, J., *Light, colour and perception,* 'How we see', 2001; this essay appears on http://www.labyrinth.net.au/~saul/essays/05colour.html accessed 03.12.03
[45] Dedrick, D., 'Colour categorization and the space between perception and language' Philosophy Department, University of Victoria, Victoria, British Columbia, Canada. This essay appears on http://cogprints.ecs.soton.ac.uk/archive/00000373/00/BBScommentary.html accessed 03.12.03
[46] Dedrick, D, 'Naming the rainbow: language, colour science, and culture', S*ythese Library*, vol. 274, Kluwer Academic Publishers, Dordrecht, 1998; this introduction to his book of the same name appears on this website: http://cogprints.ecs.soton.ac.uk/archive/00000378/00/Dedrick.html accessed 03.12.03

[47] Although their decor in the past ten years or so has become drained of much of its blood-red charm, this more neutral image coinciding with the emergence of fears about Creuzfeld-Jacob Disease and other meat-related health scares. Today (2004), they promote salads in advertising campaigns aimed primarily at young women.
[48] Dedrick, 'Colour categorization…'
[49] Dedrick, 'Colour categorization…'
[50] Dedrick, 'Colour categorization…'
[51] Harvey, J., *Men in Black,* The Chicago University Press, Chicago, 1996 (orig. 1995), p. 23
[52] *Baudelaire: Selected Writings on Art and Artists,* translated by Charvet, P. E., London, 1972, p. 105, quoted by Harvey, pp. 26-27
[53] An interesting word that ultimately refers to a process, rather than its results.
[54] Tudge, C., *Neanderthals, Bandits and Farmers: How Agriculture Really Began*, Weidenfeld & Nicholson, London, 1998, pp. 40-43
[55] Maynard Smith, J., and Szathmáry, E., *The Origins of Life: From the Birth of Life to the Origins of Language,* Oxford University Press, Oxford, 1999, p. 148
[56] Quote from Weatherill, L., and Edwards, R., 'Pottery Making in London and Whitehaven in the Late Seventeenth Century, *Post-Medieval Archaeology: the Journal for the Society for Post-Medieval Archaeology*, vol. 5, 1971, p. 162
[57] Pryor, S., and Blockley K., 'A 17th-century Kiln Site at Woolwich' (includes work by Rhoda Edwards), *Post-Medieval Archaeology, the Journal for the Society of Post-Medieval Archaeology,* vol. 12, London, 1978, p. 43
[58] London, G., and Wise, H., The Retir'd Gardner*,* vol. 1, London, 1706, pp. 251-252
[59] I allow, my understanding of how it is *supposed* to work is deficient.
[60] A 'dab' rather than a 'splash' of galena glaze, because the lead ore precipitated in water and could not, therefore, be turned into the creamy mixture of powder and water, by which means other glazes were often applied. It was used in powder form, either by 'strewing' – literally, throwing it at the still damp, newly-thrown pot, or by putting it into a 'pounce bag'. The bag, made of coarse cloth was then applied to the damp surface of the pot, and helped regulate the amount of ore powder applied. The distribution of glaze on the watering pot, and the relative expensiveness of the lead ore suggest this latter method was adopted in this case.
[61] Weatherill, and Edwards, pp. 162-181
[62] Brears, P. C. D., *The English Country Potter,* David & Charles, Newton Abbott, 1971, p. 125
[63] Earthenware is porous, but this broken patch of glaze would barely affect that fact.
[64] There is of course, a parallel, economic side to this distribution of glaze. If the powder was either thrown at the pot, or, more likely, given its expense, applied using a 'pounce bag', as described above, the same geometrics would have applied once the thrown and completed – but still damp - pots were

temporarily put on a table or shelf: the most economic use of space would have been side by side. If, as I argue, the glaze was required on the 'front' of the watering pots, then a whole row could be dabbed with the pounce bag, without the time and effort of picking each one up, and with the added dividend of avoiding the attendant risk of breakage in the process.

[65] Dissanayake, E., 'Sociobiology and the Arts: Problems and Prospects', in Bedaux, J. B., and Cooke, B., *Sociobiology and The Arts,* Editions Rodopi, Amsterdam, 1999, pp. 27-42; the discussion relating to 'making special' will be found on pp. 35-39

[66] As, indeed, it was, by me, in 1988, as a study submitted in connection with a Masters course in design history, run jointly by the Victoria & Albert Museum and the Royal College of Art. Batchelor, R., *An Analysis of a Watering Pot,* unpublished essay, 1988.