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Abstract

Individuals residing in the rainforest belt of Nigeria were shown photographs of five biomes: rain forest, deciduous forest, coniferous forest, savanna, and desert. Subjects overwhelmingly selected savanna scenes as representing the most desirable place to live. These results, coupled with extensive American data, support the hypothesis that humans possess an innate preference for savanna-like settings, which then is modified through experience and enculturation. Findings are discussed in relation to anthropological, biological, and psychological research.

Keywords

landscape preference, evolutionary psychology, savanna, cross-cultural, human evolution, habitat preference

The analysis of historic patterns of landscape design worldwide reveal some striking parallels in the use and organization of certain landscape elements (Hyams, 1971a; Jellicoe & Jellicoe, 1975; Newton, 1971). Particularly in large gardens and estates, where aesthetic preferences could most easily be expressed, park-like settings of short grass and scattered trees have consistently emerged. The English landscape tradition, as typified in the work of “Capability” Brown, is one of the most familiar examples (Hyams, 1971b; Stroud, 1975), where random placement of trees gathered in clumps are dispersed throughout an open field.

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This landscape tradition most closely resembles the savanna biome—grasslands with more or less scattered dense areas of trees. Orians (1980) has further demonstrated that horticulturists and landscape designers in Japan have tended to modify the phenotype of native tree-forms toward those found among trees existing in savanna environments. In a cross-cultural study of tree preference (Orians & Heerwagen, 1992), subjects from three countries rated as most attractive those trees in which the tree canopy is relatively dense and the trunk bifurcates low to the ground. These characteristics of tree-form typify those found in the East African savanna. Sommer and Summit (1995) found consistent findings, with preference for large canopies and small trunks. A later study of tree species preference and context, Summit and Sommer (1999) found that the acacia-type tree-form, typical of the African savanna, was preferred over oak, conifer, palm, and eucalyptus. Dutton (2003) has argued that the landscapes depicted in calendar art tend to have similar themes throughout the world and that these themes are the very ones that would be predicted by a savanna preference hypothesis.

Theoretical frameworks founded in evolutionary theory have been proposed that attempt to dissect landscape preference into predictive variables (Appleton, 1975; Kaplan, 1987; Ulrich, 1977). Ulrich analyzed informational qualities of various settings and identified five significant variables: focality (coherence, unity), ground surface texture, depth, mystery (the sense that more information can be gained at low risk) and complexity. Earlier studies of visual preference focused on complexity as the significant mediator of visual preference (Day, 1967; Wohlwill, 1968). These studies discovered an optimal range of preferred complexity in the visual field. The complexity of urban landscape has been shown to have a positive influence on preference (Han, 2007; Heath, Smith, & Lim, 2000). These studies isolated complexity with the use of urban scenes or geometric design, with the exception of Wohlwill who included natural scenes in his preference study. Wohlwill rated slides of non-representational art, urban and rural scenes, and natural landscapes in terms of the complexity of color, shape, line direction and texture. Subjects were then asked to rate the slides according to preference. Results showed that visual preference was an inverted U-shaped function of increasing complexity. Stimuli judged to be of intermediate complexity were the most preferred, but for natural landscapes the effect was weak. Kaplan (1987) suggested visual content of the natural landscapes to be of greater significance. Though not the primary focus of the study, Kaplan found that natural landscapes were preferred over urban scenes regardless of level of complexity. Landscape complexity accounted for relatively little of the variance in preference. As has been found by others, Han (2007) found that water was highly preferred.

Prospect refuge theory (Appleton, 1975), when applied to this landscape preference data, supports the notion that the savanna-like landscape, consisting of low shrubs and clumps of trees divided by open spaces, offers an attractive combination of prospect and refuge symbolism. Open spaces provide an opportunity to detect potential hazards—to see, whereas the low shrubs and clumps of trees provide places to hide and escape—to not be seen. Appleton makes reference to many examples of landscape painting, including “Landscape with Apollo and the Muses,” by Claude Lorraine (1600-1682), which depicts a rural scene with a vista open to the distant horizon, small clumps of large trees in the foreground, and low grasses dominating the open spaces. Claude’s work, known for conveying a sense of tranquility and security, is described by Appleton: “Black shadows under massive canopies of foliage balance long, open views, providing satisfying equilibrium of complementary strategic components” (p. 123). Appleton implies that humans have an affinity for settings that exhibit savanna-like characteristics, but he is careful not to suggest that there exists an optimum landscape preference since the idea of “optimum” implies that human needs are the same at all times. On the contrary, humans have varying requirements at different times, which effect how we interact with our environment. In his autobiography however, Appleton (1994) said “When I look back on my own preferred landscape types I find that many of the places which have most strongly attracted me can be seen to have at least some affinity with the savanna” (p. 222). Kaplan and Kaplan (1989) put it another way. People should prefer settings that (a) make the acquisition of landscape information relatively easy and nonthreatening and (b) convey the notion that additional information can be acquired if the setting is explored. The experience of landscape is one of understanding and exploring (Kaplan, 1987). Understanding, which is the comprehension or making sense of the scene, is predicted by legibility and coherence. Exploration, the promise of additional information, is predicted by complexity and a sense of mystery.

Two other constructs have been used to investigate landscape preference. Hagerhall, Purcell, and Taylor (2004) correlated the preference ratings of outdoor scenes in Sweden, northern Italy and Australia with fractal properties. Fractals are a rough or fragmented geometric shape that can be split into parts, each of which is (at least approximately) a reduced-size copy of the whole; fractals have been found to be common in nature and can be analyzed by their specific properties such as scale independence, self-similarity, and complexity. When scenes with visible water were removed, Hagerhall et al. found that the most preferred landscapes were those calculated to be in the mid-range of the fractal dimension. This peak in preference corresponded to the fractal

characteristics of savanna-like natural environments. Another construct for investigating landscape preferences has been affordance, described by Gibson (1979) as the quality of an object or an environment which allows an individual to perform an action. According to some researchers (e.g., Kaplan, 1992; Rourke, 2007), landscape preference reflects those physical attributes that are perceived to be beneficial to survival. Without denying the influence of experience, a range of theoretical frameworks reflect a growing consensus that a complete understanding of the human experience of natural landscapes requires the use of evolutionary principles.

Our investigations of human landscape preference were similarly motivated. Struck by the prevalence of human-created parklands in widely disparate societies, and mindful of a number of biological studies showing that some degree of preference for specific habitats is at least in part genetically determined (e.g., Klopfer, 1969; Wecker, 1963). Falk (1977) hypothesized that human landscape preferences could be strongly affected by our evolutionary adaptation to life on the savannas of East Africa. Preferred landscapes would be those subjectively perceived to contain features favorable to human survival; landscapes that (unconsciously) appeared to afford access to subsistence resources and pose minimal threat. Our previous research revealed that a large sample of Americans, drawn from a broad educational, socioeconomic and age range, showed a visual preference for savanna environments at least as strong as that for more familiar natural settings, namely deciduous and coniferous forests (Balling & Falk, 1982). In fact, subjects under the age of 12 demonstrated a significant preference for savannas over all other environments. Savanna and the familiar environments were also significantly preferred by all age levels over two other biomes: desert and tropical rainforest. To account for these data, we argued that an initial innate preference for savanna, most clearly expressed in childhood, was modified and overlain by experience with certain other vegetative forms. Savanna, however, was never significantly less preferred than the more familiar environments for any participant. Although the data supported the savanna hypothesis, the possibility existed that some cultural bias, rather than some innate preference, provided the best explanation of the results. Members of Western societies, Americans in particular, may differ from other peoples in their preference for open forests and savanna environments. Perhaps the structure, desirability, and commonness of the parkland typically incorporated into urban settings has influenced Westerners' preference for savanna-like landscapes.

Cross-cultural studies conducted since our initial findings have reported high correlations between groups in their preference for varied landscapes, with familiarity accounting for much of the variance (Herzog, Herbert, Kaplan, &

Crooks, 2000; Kaplan & Herbert, 1987). Herzog et al. replicated the earlier study by Kaplan and Herbert, but included a broader sample of settings and examined several subcultural groupings. Familiarity once again emerged as a significant predictor of preference and is consistent with our earlier thesis that preferences can be modified by experience and enculturation. Six landscape categories were selected: including rivers, dry lake beds, flood plains, terraces, mallee (a type of *Eucalyptus*) plains and cultural images. American college students were compared to several Australian subcultural groups. Australian students were divided further by age: primary, secondary, college students, and adults. College students were further subdivided into three groups and adults into four professional groups. On a 5-point scale, participants rated the 60 slides for preference, defined as how pleasing they found the setting, or how much they liked it. The two cultures showed high correlations, with the greatest divergence coming from the Australian adults. In the cross-cultural perception comparison test, participants independently divided the 60 slides into six of their own categories: vegetation, open smooth, open coarse, rivers, agrarian, and structures. The two open categories, featuring little or no vegetation with vast open views, and the structures category, represented by man-made materials present in the scene, were similarly least preferred. Two categories, vegetation, consisting of near trees and bushes, and agrarian, consisting of agricultural settings with trees present, were significantly more preferred, but similar in preference to each other. The most preferred category, significantly above all others, was rivers. Each of these six categories was represented by one photograph each in the published study. Although none of the photographs clearly represented a savanna-like setting, it is interesting to note that the top three preferred categories included trees relatively close to the observer with large open areas in view, with the highest preference ratings coming from the youngest participants.

Our initial study (Balling & Falk, 1982), conducted in the eastern United States, represented one culture from a region dominated by one biome, deciduous forest. The study reported here extends our research to a very different cultural and environmental milieu and provides support for our previous conclusions.

Method

In February 1981, J.F. sampled three populations of West Africans from Rivers State, Nigeria. Two of the samples were drawn from "First Form" secondary school children, ranging in age from 12 to 18 years. Sample A ($N = 27$) was taken from a coeducational public secondary school, in an upland rain-forest area, roughly 100 km north-west of Port Harcourt. The dominant local

vegetation was slash and burn agricultural land interspersed with scattered pockets of remnant rainforest. Sample B ($N = 36$) was from a girls' parochial school located in a small fishing village on one of the hundreds of small islands in the Niger Delta. The dominant local vegetation was mature tropical rainforest and mangrove forest; very little of the land was under cultivation. A total of 87% of subjects from both samples A and B had been born in and had never traveled beyond areas vegetationally comparable to their home town area. Each participant was individually interviewed and asked to examine 45 pairs of $3'' \times 5''$ (8.6 cm \times 12.8 cm) photographs of landscapes representing all possible unique binary combinations of 10 scenes, two each of tropical rainforest, temperate deciduous forest, temperate coniferous forest, tropical savanna, and mid-latitude desert.¹ Except for vegetational density, all pictures were as comparable as possible (see Balling & Falk, 1982). The participant was asked, for each pair, to indicate which photo looked most like a place where he or she would like to live. Although subjects varied greatly in age, they were all at similar levels of schooling. Performance on this rather hypothetical task, which demands making judgments without recourse to real world knowledge, should tend to be more a function of years in school than chronological age (Sharp, Cole, & Lave, 1979).

Sample C ($N = 37$), aged 20-39 years, was drawn from a class of students at a technical college in Port Harcourt, Nigeria. These students' homes were located throughout Rivers State, both delta and upland areas. A total of 73% had never traveled outside of the rainforest belt of West Africa. This sample was shown 20 randomly ordered slides, representing four replicates of each of the five biomes previously mentioned. This was the same procedure used with most of our American subjects. Subjects were asked to indicate on a 5-point Likert-type scale the degree to which the scene depicted appeared to be a favorable place in which to live.

Results

For samples A and B, the total number of times each slide was preferred to every other slide was calculated. As indicated in Table 1, for subjects in samples A and B, savanna was highly preferred relative to all other biomes ($X^2(4) = 119.6, p < .001$). Pair-wise tests revealed that rainforest, desert, deciduous forests, and coniferous forests were not significantly different from one another. As indicated by Thurstone scale values also shown in Table 1, a positive preference was demonstrated only for savanna; subjects were either neutral or slightly negative toward all other biomes. There were no statistical differences between the two samples.

Table 1. Biome Selection With Corresponding Thurstone Scale Values

	Biome				
	Savanna	Rain Forest	Deciduous Forest	Coniferous Forest	Desert
Total number of preferred responses	794	559	498	482	502
Thurstone scale values	0.493	-0.022	-0.147	-0.184	-0.141

Note: The total number of times each biome was selected as the preferred environment in the paired-comparison task with Samples A and B (Total $N = 63$), plus corresponding Thurstone Scale Values to illustrate the standing of each biome relative to a neutral point.

Table 2. Mean Preference Rating With Standard Error

	Biome				
	Savanna	Rain Forest	Deciduous Forest	Coniferous Forest	Desert
Mean rating	3.82	2.24	2.89	2.77	2.83
Standard error	0.11	0.13	0.13	0.11	0.15

Note: Mean preference rating (5 = very high) and standard error for each biome in the slide judgment task with Sample C ($N = 37$).

A within-participant analysis of variance was performed on the rating data from Sample C with biome as the major independent variable and the picture replicates within each biome as a nested random variable. Based on the expected mean squares, there was no appropriate error term in this design for a test of the biome effect, but an F^1 can be calculated (Myers, 1972). As can be seen in Table 2, there were differences in preference among the five biomes, thus the omnibus tests were significant ($F^1(4, 21) = 9.29, p < .001$). Comparisons revealed that savanna was again significantly preferred over all other biomes ($F^1(1, 21) = 9.03, p < .01$). However, unlike the data from samples A and B, rainforest was the least preferred biome ($F^1(1,21) = 7.31, p < .025$).

Discussion

We have previously argued that the tendency to purposefully create savanna-like landscape elements and arrangements is not accidental, but rather at least partially the result of an innate preference for savanna-like settings

(Balling & Falk, 1982; Falk, 1977). Such a preference for the savanna-like landscape would have theoretically developed over the course of human evolution, initially as an adaptation to surviving in the savannas of East Africa. Although life experience modifies preference, the affinity younger subjects have for savanna-like settings seems to suggest that a preference for savanna-like environments likely represents a vestigial trait of early human biology; a trait which expresses itself in modern humans as an aesthetic preference.

The belief that human biology and behavior were significantly molded by adaptations our early ancestors made in order to survive in savanna-like environments grew out of a series of major hominid fossil discoveries in southern and eastern Africa during the early part of the 20th century. Associated fauna and flora led anthropologists to the reasonable inference that the evolution of modern hominids was guided by the change in habitats throughout Africa. The increase in aridity was thought to have propelled early hominids away from the comfort of tropical habitats into the more hostile savanna. Recent studies indicate that the landscape of human evolution was not exclusively savanna, but rather a mosaic of environments including grasslands, savanna, open and closed forests (Butzer, 1977; Foley, 1996; Kingston, Marino, & Hill, 1994; Leakey, Feibel, McDougall, & Walker, 1995; Scott, 1990; White, Suwa, & Asfaw, 1994).

The growing body of information about the habitats in which early humans evolved remains insufficient to make a strong case for or against the hypothesis that humans evolved a habitat preference for savanna-like environments. We do know that human ancestors lived in or near savannas. We also know they lived in or near a wide range of other habitats. However, the presence of hominid fossils in these other settings does not in and of itself inform where these hominids lived, since remains may have been transported to other environments by predators or through physical events (e.g., flash floods). Hence, fossil remains alone provide insufficient evidence to say which, if any, of these many environments were the preferred habitat of our immediate ancestors. Given the diversity of environments inhabited by early hominids, Chamberlain (2000) argued that a human preference for savanna habitats may have arisen relatively recently with the emergence of *Homo sapiens*. Evidence in other living primate groups suggests that environmental preferences are a species-specific adaptation rather than primitive or generalized traits that have been inherited by all members of a genus. Furthermore, as advances in our understanding of the human genome reveal, modern humans are exceedingly closely related (Davies, 2001; Ridley, 2000; Wells, 2002). For example, any two modern humans, from anywhere on the globe, possess greater genetic similarity than do any two chimpanzees; even those selected

from neighboring groups in Africa. These findings add credence to current theories that all modern humans evolved from a very small founder population, perhaps no more than a few thousand closely related individuals, living in Africa some 70,000 years ago (Lander, 2001; Rogers & Jorde, 1995; Wells, 2002). Hence, if a vestigial genetic habitat preference for savanna exists among modern humans, it is because it was present in this single founder population of *Homo sapiens*. Whether or not a savanna habitat preference existed in related populations living in similar or dissimilar environments in other parts of Africa or the world is irrelevant.

Habitat preferences are found in all animals, and most biologists would agree that they are adaptive, since fitness is likely to be higher in a preferred habitat. Natural selection would maintain habitat preferences to the degree that they have a genetic basis (Jaenike & Holt, 1991; Rausher, 1984). According to Petit and Petit (1996), "the ability to distinguish and select among habitats is one of the most evolutionary significant traits possessed by any organism." A wide variety of investigations have found evidence that vertebrate habitat preferences are at least in part, genetically determined (Holt, 1987; Jaenike & Holt, 1991; MacCallum, Nurnberger, Barton, & Szymura, 1998; Martin, 1998; Partridge, 1978; Petit & Petit, 1996; Rausher, 1984; Wecker, 1963). One early study showed that distinct, genetically determined, habitat preferences can exist even within races of a single mammalian species (Wecker, 1963). More recently, MacCallum et al. used biochemical markers to distinguish between the different alleles for at least one of the genes linked to habitat preference in two closely related species of toads. Previous studies have identified the genes responsible for habitat preference in several insect species (Barker, Starmer, & Fogleman, 1994; Fox, 1993; Singer & Thomas, 1988). Hence a growing body of data support the fact that a complex behavior such as habitat preference can be genetically determined and that a wide range of organisms, including vertebrates of all kinds possess these genetic traits.

In contrast to an evolutionary and biological interpretation, it can be argued that human landscape preferences is best understood as a continuous progression of aesthetic ideals, tempered by social convention, passed on from one generation to the next through human culture. This view of the world, which assumes that all human behaviors are the products of our culture and history has a long history in the humanities and anthropology. More recently, this sociocultural view of the world has become reinvigorated among psychologists with the rediscovery of the writings of Vygotsky (1978). The basic premise of this group of psychologists is that the world in which each of us lives is socioculturally constructed (Moll & Greenberg, 1990; Wertsch, 1986); psyche and culture are

seamlessly interconnected. Several studies have been conducted which show that even such “basic,” presumed biologically influenced human perceptions as color recognition (Berlin & Kay, 1969; Garro, 1986; Heider, 1972; Kay & Kempton, 1984; Lucy & Schweder, 1979), facial expressions (Gerber, 1975, 1985; Levy, 1973, 1990; Lutz, 1982, 1985; Poole, 1985) and emotion (Wierzbicka, 1986; Gerber, 1985; Lutz, 1986) are culturally bound. So why not landscape preference as well? According to this view, all objects in the world, including landscapes are cultural constructs and represent a socially mediated form of culturally specific conversation between the producers of that medium and the user (Moll & Greenberg, 1990); landscape preferences are not innate but acquired.

Against this mix of opinion, we try to make sense of the current data. The three modern human populations sampled in this study represented a diversity of sociocultural backgrounds and experiences (Agrarian, fishing and urban professional; rural and urban). When compared to previously sampled Americans, with dramatically different sociocultural and economic histories, we find a striking convergence in the data. The results reported here are consistent with our earlier findings, leading to greater confidence in the accuracy of our earlier thesis: humans appear to possess an innate preference for savanna-like settings, but that preference can and typically is modified through experience and enculturation. Beyond a strong modal tendency to prefer savanna, however, responses to landscapes become much more difficult to predict in different populations. We have earlier postulated that experience and familiarity with nonsavanna environments can lead to an elevation of preference for these landscapes (Balling & Falk, 1982); or as suggested by Sample C in this study, an aversion. The data strongly support the idea that life experience modifies preference (a variable rarely taken into consideration in much of the current research on landscape preference where samples are drawn primarily from populations of self-selected college students). Such an interpretation is generally reinforced in Samples A and B where rainforest was the second most preferred biome. By contrast, Americans of comparable age gave the rainforest a low preference rating and deciduous forest high ratings. However, in Population C, rainforest dropped to the least preferred position despite the fact that subjects were highly familiar with this biome. One explanation is that this aversion was brought about by a purposeful rejection of their “bush” roots by these newly urbanized youth. Whatever the reason for the aversion by the urban Population C to rainforest, the main effect remains—all three of these groups demonstrated an overwhelming preference for a savanna environment; an environment with which most were totally unfamiliar. This evidence strongly supports the hypothesis that some kind of an innate, biological preference exists for the savanna landscape, despite familiarity with another biome and

regardless of prior experience with the savanna landscape. The data do suggest that landscape preference is a complex amalgam of factors, with innate preferences forming a foundation which is then overlain by both sociocultural and personal experience factors.

Other theories can be used to supplement our understanding of these findings, including Gibson's (1979) affordances theory, the coherence, legibility, mystery, complexity theory of Kaplan and Kaplan (1989), and Ulrich's (1977) five factors theory. All of these hypotheses share an underlying conceptual framework rooted in a Darwinian view of landscape preference. It is highly likely that something as behaviorally complex as a habitat preference involves multiple genetic loci, and as indicated above is strongly influenced by the interaction of the phenotype with the environment. Accordingly, factors such as affordance, coherence, legibility, mystery, complexity, and sensitivity to the fractal properties of the visual environment cannot be ruled out as important psychological dimensions associated with a genetically influenced ability to discriminate between preferred and nonpreferred landscapes.

In conclusion, the results of this study plus the equally compelling data from our earlier American research support our hypothesis that humans, regardless of origin and experience begin life with a preference for savanna-like environments. The data strongly suggest that human evolutionary history has had a major influence not only on such physical features as human posture, brain size and diet but also on some of our most fundamental behaviors and preferences as well.

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Note

1. Images were identical to those used and previously published by Balling and Falk (1982).

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Bios

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