The Biophilia Hypothesis and Life in the 21st Century: Increasing Mental Health or Increasing Pathology?

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THE BIOPHILIA HYPOTHESIS AND LIFE IN THE 21st CENTURY: INCREASING MENTAL HEALTH OR INCREASING PATHOLOGY?

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ABSTRACT. Wilson's biophilia hypothesis includes the claim that, as a consequence of evolution, humans have an "innate tendency to focus on life and lifelike processes." A review of various literatures converges to support this central claim. One area of support for our innate affiliation with nature comes from research demonstrating increased psychological well-being upon exposure to natural features and environments. Support also comes from the strength and prevalence of phobic responses to stimuli of evolutionary significance and near absence of such responses to potentially dangerous human-made stimuli. That survival emotions of equivalent intensity and prevalence have failed to develop in response to modern life-threatening stimuli can be explained by the extremely rapid process of change and progress that has occurred post World War II and continues at an ever increasingly rapid pace. Given that our modern ways of living, as prescribed by Western industrialised culture, stand in stark contrast to our evolutionary history, it is proposed that we may currently be witnessing the beginnings of significant adverse outcomes for the human psyche.

KEY WORDS: mental health, psychopathology, evolutionary, biophilia, natural environment.

OUR ANCESTORS AND OUR EVOLUTIONARY HISTORY

Evolutionary accounts indicate that, for the most part of two million years, human beings lived on the savannas of East Africa, a landscape characterised by specific features. Certain of these features are those that today many of us find aesthetically appealing and are undoubtedly the same as those that enhanced the survival of our species. For example, bodies of water not only provided a physical necessity to individuals, but it is likely they also provided a perimeter of defence from predators or other enemies. Animals and plants on which humans depended were also more likely to congregate around water. Higher areas that overlooked grass lands were likely an important feature as they would have afforded views of approaching threats such as inclement weather. Trees with low trunks would have been valued by our ancestors who could have climbed them in times of danger. Trees with high canopies were advantageous in other ways as they did not block the view, nor did they permit enemies to hide behind them (Kahn, 1997; Wilson, 1984).

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Today's Western societies are markedly changed and, particularly in the last two hundred years, have rapidly advanced. In fact, we are currently witnessing human manufactured change at a pace unprecedented in the history of the human species (Saunders, 1999). Technology has enabled us to plough and pave the most unlikely landscapes, to travel and communicate across unforeseen distances, and to technologically produce and manipulate material goods and sentient beings, including ourselves. Not only have the changes to our lifestyles been immense compared to those of our ancestors, but we go on advancing with the blind assumption that the human species has an unlimited capacity to adapt to the environment, no matter how far removed it is from that in which we evolved. But do we indeed have an unlimited capacity to adapt?

Wilson (1993), the founder of sociobiology, has argued that the natural environment is as central to human history as social behaviour itself. As such, social scientists should be concerned about what will happen to the human psyche when such a deep defining part of human evolutionary experience is diminished or erased. From prehistory to the present time, the actions of the human species have eliminated 10 to 20 percent of the earth's species. Today "Only 3 percent of the global land surface is set aside in parks and protected areas. More than 95 percent is already under direct human influence, whether plowed, paved, and managed intensively, or sparsely occupied by rural or indigenous peoples." (Baskin, 1997; p. 224). Apart from the potential loss of as yet untapped sources of pharmaceuticals, crops, fibres, pulp, and petroleum substitutes etc., what is the potential loss to human psychological well-being?

The Biophilia Hypothesis

In his 1984 book entitled *Biophilia*, Wilson described his biophilia hypothesis as a human "innate tendency to focus on life and lifelike processes." (p. 1). Indications of the human tendency to maintain contact with nature can be seen throughout history. The homes of the ancient Egyptian nobility, Persian settlements, and medieval Chinese villages were all marked by extensive and elaborate gardens demonstrating that people went to considerable lengths to maintain contact with nature (Ulrich, 1993). In more recent times, particularly the last two centuries, the provision of parks and the preservation of nature reserves have been supported by the belief that exposure to nature fosters psychological

well-being, reduces the stress related with modern living and promotes physical well-being (Ulrich, 1993). Not only are these places provided, they are extensively frequented. Indeed, people crowd national parks to experience natural landscapes. They travel long distances to stroll along the seashore, and the wealthy select dwellings on prominences above water or amidst parkland. Humans' affiliation with nature is also reflected in their expressed enjoyment in making contact with or viewing other species. For example, in the United States and Canada, more children and adults visit zoos than attend major professional sporting events combined (Wilson, 1992; 1993). In America alone, there are 40 million pet cats and 55 million pet dogs (Newby, 1999; Shepard, 1993).

The significance of biophilia has profound implications. According to this hypothesis, given our species' long history as subsistence hunters, gatherers, and farmers, it is inconceivable that the natural environment has not shaped our cognitive and emotional apparatus. Our tendency to affiliate with nature in all likelihood enhanced the fitness of our ancestors. The brain which modern members of our species have inherited must be a product of this evolutionary process – a brain attuned to extracting, processing, and evaluating information from the natural environment (Wilson, 1984; 1993).

The process through which biophilia evolved has been proposed to be a biocultural one during which hereditary learning principles have elaborated upon culture while the genes which prescribed the biophilic propensities spread by natural selection in a cultural context. This process is referred to as a gene-culture coevolution wherein a certain genotype makes a behavioural response more likely. In turn, if this response enhances survival and reproductive fitness, the genotype will spread through the population, and the behavioural response will grow more frequent (Wilson, 1993).

Wilson (1993) describes biophilia as being mediated by rules of prepared and counterprepared learning. In other words, the rules describe a tendency to more easily learn certain associations compared to others. These rules have been inherited and they relate to emotional experiences of a positive and negative kind; "from attraction to aversion, from awe to indifference, from peacefulness to fear-driven anxiety" (Wilson, 1993; p. 31). The argument is that the rewards and the dangers associated with natural settings, during human evolution, favoured individuals who readily learned and remembered various adaptive behaviours including

both approach (biophilia) and avoidance (biophobia) responses to specific natural stimuli and configurations (Ulrich, 1993). Much of this tendency was, and remains, woven into symbols composing a large part of culture.

According to the biophilia hypothesis, when humans become removed from the natural environment, the biophilic learning rules do not become replaced by modern versions. "Instead, they persist from generation to generation, atrophied and fitfully manifested in the artificial new environments into which technology has catapulted humanity." (Wilson, 1993; p. 32).

Even in the absence of evidence, Wilson (1993) argues that the biophilia hypothesis would still be compelled by pure evolutionary logic since human history began hundreds of thousands of years ago with the genus *Homo*. Our history dates back to long before agriculture and villages. In fact, more than 99 percent of human history is characterised by hunter–gatherer bands closely involved with other organisms.

> In short, the brain evolved in a biocentric world, not a machine-regulated world. It would be therefore quite extraordinary to find that all learning rules related to that world have been erased in a few thousand years, even in the tiny minority of peoples who have existed for more than one or two generations in wholly urban environments (Wilson, 1993; p. 32).

Biophobia

Among the strongest empirical data supporting Wilson's proposal that biophilia is mediated by inherited or prepared rules relating to emotional experiences of a negative and positive kind, are data related to fears and phobias. It was Charles Darwin (1877) who first suggested the idea of prepotent fears which are those fears that are innately highly arousing; a conception which has been supported by subsequent research determining that humans and other animals are more likely to fear certain situations and stimuli than others. A century later, Seligman (1970; 1971) maintained that humans are most likely to develop fear for those stimuli that pose a threat, or have, in the species' evolutionary history, posed a threat to its survival. Thus, it is proposed that organisms are pre-programmed to fear certain stimuli as in propotent fears or are

evolutionally predisposed to more easily learn and retain associations that facilitate survival than others which are not evolutionally significant. Seligman referred to those fears of evolutionary significance as *prepared*. A prepared association is characterised by ease of acquisition, resistance to extinction, and an enhanced non-cognitive component (i.e. prepared fears are resistant to being influenced by information or instructions (McNally, 1987).

The finding that fears appear at particular ages, at times even in the absence of the situation or stimulus concerned (Gullone, 1993; 1996; 2000) provide some support for the prepared/prepotent nature of certain fear stimuli. Additional support for the preparedness concept has been provided by experimental studies, most notably by Ohman and associates (e.g., Ohman, 1986; Ohman, Dimberg, and Ost, 1985; Ohman, Erixon, and Loftberg, 1975). These have typically involved slide presentations of fear relevant (i.e. snakes, spiders) or fear neutral stimuli (e.g. flower, mushroom). These presentations are paired with an aversive unconditioned stimulus usually in the form of an electric shock which gives the sensation of a bite. Responses are assessed via autonomic nervous system indicators such as skin conductance and heart rate. Following the conditioning phase, the same stimuli continue to be presented (up to forty times) in the absence of the unconditioned stimulus (i.e. the shock). The consistent finding from these experimental studies is that although the conditioned responses have not been demonstrated to be consistently acquired more quickly for the fear relevant stimuli, they have been shown to be significantly and consistently more resistant to extinction.

Other research has investigated the conditioning of fear to "prepared" stimuli compared to far more dangerous stimuli in current times such as handguns and frayed electric wires (Cook, Hodes, and Lang, 1986; Hugdahl and Karker, 1981). As with the research conducted by Ohman and colleagues, conditioned responses to modern stimuli were found to extinguish more quickly than those to snakes and spiders.

The preparedness concept has also been considered useful in explaining the non-random nature of fears and in explaining why certain stimuli or situations elicit more fear than others, often regardless of the individual's conditioning history and type of exposure (Rachman, 1977). As is indicated by listings of the most common specific fears, the majority are of natural phenomena. For example, Lane and Gullone (1999) asked 439 adolescents aged 11–18 years to list their three greatest

fears. Among the most commonly reported fears were spiders, snakes, heights, enclosed places, sharks and dogs.

Epidemiological research can also be drawn upon to further support the non-random nature of fear. For example it has been demonstrated that the fears of certain uncommon stimuli or situations are highly prevalent (e.g. snakes) (Rachman and Seligman, 1976). In contrast, fears of other more commonly experienced and potentially more dangerous stimuli of modern times (e.g. hand guns) are comparatively rare. Often cited findings are those of Agras, Sylvester, and Oliveau (1969) in their epidemiological investigation of common fears. These researchers reported that the prevalence of fear of snakes was 390/1000 while fear of the dentist was only 198/1000. Considering that, for most people, contact with the dentist is much more likely than that with snakes, exposure and experience are unlikely to be the explanations for people's fear of snakes.

Moreover, Wilson (1984) has argued that snakes would very likely have caused significant morbidity in hunter–gatherer societies, particularly in tropical and subtropical regions. Further expanding on the evolution of snake fears, Ulrich (1993) notes that simple observation of another person's fear or strong aversive reaction can be sufficient to condition aversive responses. Even simply receiving information regarding a likely aversive outcome can bring about fear responses. Indeed the proposal that fears can be acquired through a variety of pathways including observational or informational pathways is entirely consistent with Rachman's (1977; 1991) learning theory proposals. Related to the informational pathway, it has been proposed that oral folklore and mythology serve an adaptive function (Rachman, 1991; Ulrich, 1993):

> . . .consider the example of an early human in a hunting and gathering group who is bitten by a poisonous snake. Although the bite experience would presumably condition in the person a persistent disposition to respond with fear/avoidance to snakes, this response would have no adaptive value for the person if the venom proved fatal. But other members of the group might acquire unforgettable fear/avoidance responses by having witnessed the bite episode, by having observed the effects on the person, or by receiving vivid information from others about the episode and its painful, fatal consequences (Ulrich, 1993; p. 79).

Additional support for the biological basis of fears and phobias is provided by twin studies which have reported that fears and phobias have a significant heritability component (e.g. Neale et al., 1994; Phillips et al., 1987; Rose and Ditto, 1983).

Although the research on phobias has been strongly characterised by responses to animal threats, physical environments can also be differentiated regarding their risk and survival properties. Ulrich (1993) has proposed that humans may be biologically prepared to respond with caution to spatially restricted settings that may contain hidden dangers and that may limit escape opportunities. At the same time, Ulrich argues that, whilst caution in certain settings may be prepared for its adaptive properties, stronger responses such as fear or avoidance would be maladaptive since these same environments may provide food opportunities. Consequently such settings are not as commonly evidenced as phobias.

Empirical research supports the above argument since people in Western and Eastern cultures have been demonstrated to prefer natural settings with moderate to high openness and visual depth compared to restricted environments (Kaplan and Kaplan, 1989; Ulrich, 1986). Further support was demonstrated in an experimental laboratory study conducted by Ulrich, Dimberg, and Ohman (cited in Ulrich, 1993) in which they examined whether people could be differentially classically conditioned to high-depth versus low-depth settings. Scenes dominated by green vegetation were projected on a large screen through a hooded viewing port. The unconditioned stimulus was an electrode fixed to the participants' finger, which administered a bite-like electric shock. In support of their predictions, the researchers found that aversion responses conditioned to the high-depth settings were more resistant to extinction that those for the low-depth settings.

Biophilia

As noted by Ulrich (1993), the strength of empirical support for there being a biological basis to respond in a negative way (i.e. with fear or aversion/disgust) to certain natural phenomena provides a foundation to hypothesise that humans are also prepared to respond in a positive way to other natural phenomena or stimuli. Research seeking to identify humans' positive relationships with nature, has gradually expanded

over the last 20 years, particularly in the area of aesthetic preferences for varying landscapes. This research provides empirical support for the biophilia hypothesis.

According to Ulrich (1993), certain advantages afforded by specific natural settings during our evolutionary history may have been so central to survival that natural selection favoured those individuals who acquired and retained certain positive or approach responses toward them. Ulrich (1993) has proposed that biologically prepared learning may function in at least three different ways to promote adaptive responses to non-threatening natural landscapes. These include the selection of adaptive approach behaviours, restoration or stress recovery, and enhanced high order cognitive functioning.

ADAPTIVE APPROACH BEHAVIOURS

As with processes of fear acquisition, it is proposed that humans are genetically predisposed to acquire and retain liking, attention, or approach responses to natural features and landscapes that are associated with adaptation or survival such as provision of resources including water, food, and places of refuge. As noted earlier, considerable evidence indicates that much of human evolution took place in savanna environments. Compared to landscapes such as rain forests, savannas are argued to have been better suited to humans (Ulrich, 1993). Given their upright posture, bipedal locomotion, free swinging arms, and general ground dwelling life style, savannas are argued to have provided the most suitable sources of plant and animal food. In savanna landscapes there is better visual openness and a lower probability of encountering a close hidden predator. There are also better escape opportunities (Kahn, 1997; Ulrich, 1993). Consequently, it is not surprising that in present times, natural settings that have 'park-like' properties such as spatial openness, scattered trees or small groupings of trees and a domination of grassy ground cover are preferred over dense woodlands, desert landscapes, or modern constructions (Kaplan and Kaplan, 1989; Ulrich, 1983).

Ulrich (1993) has noted that studies relevant to this conceptualisation of humans' relationship with nature number in the hundreds (see Kaplan and Kaplan, 1989; Ulrich, 1986 for reviews) and have

focused upon people's affective responses to nature and natural landscapes. This research has typically involved the presentation of different landscape scenes to respondents in the form of photographs or slides. Research participants have been required to provide their ratings on measures such as preference, perceived pleasantness, and scenic beauty. Thus, the majority of studies have obtained such ratings from simulations of nature as opposed to real life exposure. Given the validity questions associated with such a technique, some researchers have compared ratings on such representations with real life viewings of landscape scenes and have demonstrated strong correlations between them.

Despite some concerns regarding the methodology used in the majority of these studies, their findings are largely supportive of the conceptualisation described above. European, Asian, and North American samples have all been demonstrated to report high preference for savanna-like or park-like scenes (e.g. Ruiz and Bernaldez, 1982; Ulrich, 1977). Also, there is evidence to indicate that both adults and children consistently demonstrate a preference for scenes which include bodies of water (e.g. Bernaldez et al., 1989; Chokor and Mene, 1992; Shafer et al., 1969). In fact, water appears to be a dominant feature in natural landscapes that obtain positive ratings with the exception of scenes depicting potential risk such as a stormy sea or where there is visible pollution (Ulrich, 1993).

The least preferred elements of natural landscapes are scenes with large amounts of felled trees, closely spaced trees, visually impenetrable dense understorey foliage, and abrupt terrain. Importantly, following a summary of study findings from different countries and cultures, including Europe, North America, and Asia, Ulrich (1993) notes that, overwhelmingly the findings are convergent.

A second category of studies has examined aesthetic preferences for natural compared to urban scenes. Again, the general finding is one of consistency across culture and other demographic variables with an overwhelming preference for natural scenes over urban ones. In fact, the difference found has typically been so large that the distributions of scores for the two sets of ratings rarely overlap (Kaplan et al., 1972). Moreover, the introduction of artificial elements into otherwise natural landscapes (e.g. power lines) has been shown to have a significant detrimental effect on preference ratings (Ulrich, 1993).

RESTORATION, STRESS RECOVERY, AND ENHANCED COGNITIVE FUNCTIONING

The discussion thus far has focused upon the selection of adaptive approach and avoidance behaviours. Additional survival functions of certain environments, that may also be biologically prepared, are restoration and the promotion of higher order cognitive functioning. A capacity for restorative responding may be adaptive by promoting recovery from physical or mood states often associated with a decline in cognitive functioning or performance, such as illness or fatigue, that interfere with survival behaviours (Kaplan and Kaplan, 1989). Ulrich (1993) has proposed that elements of a restorative experience should include attention or interest accompanied by increased positive affect and decreased negative affect as well as decreases in sympathetic nervous system activity.

Numerous studies have determined that leisure activities in natural settings or exposure to natural features have important stress reduction or restoration effects (e.g., Parsons et al., 1998; Sheets and Manzer, 1991; Ulrich, 1981). A frequently cited study is that by Ulrich (1984) who examined the effect of window view on recovery rate from gall bladder surgery. Two groups of patients were matched on age, sex, weight, tobacco use, and previous hospitalisation. The pairs of patients thus differed only on their hospital room window view. One member of each pair looked out onto a group of deciduous trees whilst the other's window view comprised only a brown brick wall. The study results showed that those patients with the natural view recovered faster than those in the other group (i.e. their post-operative hospital stays were shorter). Also, the natural view group patients had fewer negative comments in the nurses' notes and they had fewer injections of potent pain killers compared to those with the wall view.

Additional support for the restorative and therapeutic effects of nature has come from a large number of studies which have evaluated encounters with wilderness settings. These studies have typically evaluated already existing wilderness programs oriented towards special client groups such as psychiatric patients, abused women or adolescents. However, many of these studies have been criticised as being methodologically flawed, atheoretical and for implementing poor research designs. In many, the subjects have been self-selecting and few have included comparison or control groups. In addition, determining

the specific role of nature in such effects has been problematic since other elements of the activities, such as physical exercise, could be contributing (Hartig, Mang, and Evans, 1991). Despite these limitations, across many varied study designs and measures, there has been overall consistency in outcomes (Kaplan and Talbot, 1983).

In their own research which now spans more than 20 years, the Kaplans (see Kaplan and Kaplan, 1989 for review) have sought to address many of the limitations of earlier work which has focused on the measurement of emotional and cognitive changes following an outdoor challenge program. During the typically two week program, participants have been exposed to a variety of survival skill tasks in a wilderness setting. Pre- and post-program comparisons and inclusion of control groups has indicated that those participants who had undergone the wilderness program evidenced an increase in confidence and self-sufficiency. Five month follow-ups indicated that these changes were enduring (R. Kaplan, 1974; 1977).

Other studies examining the restorative effects of exposure to nature have examined the effects of spending time in urban parks and other urban natural settings. These studies too have indicated that such exposure has stress reduction or restorative effects. Although the same limitations as those listed above typically apply, a handful of studies has attempted to determine the specific effects of the nature element in the restorative experience. For example, Hartig, Mang, and Evans (1991) examined the restorative effect of nature following researcher induced stress (completion of a demanding cognitive task) while controlling for the effect of physical exercise. They randomly assigned participants to one of three conditions; (1) walking for forty minutes in an urban nature area dominated by trees and other vegetation and (2) walking for forty minutes in a comparatively attractive, safe urban area, and (3) reading or listening to music for forty minutes. Their findings indicated that people in the nature walk condition reported more positive affect following the walk compared to the other two groups. They also performed better on a cognitive task.

Along similar lines, a more recent study by Ulrich and colleagues (Parsons, Tassinary, Ulrich, Hebl, and Grossman-Alexander, 1998), involving a sample of 160 undergraduate students, investigated whether stress recovery varies as a function of roadside environment. The participants were required to view one of four video-taped simulated drives immediately following and preceding exposure to stressful experiences.

The participants were assessed on several measures including blood pressure, electrodermal activity, and electromyographic activity. It was hypothesised that participants who viewed nature-dominated drives, compared to artefact-dominated drives, would demonstrate less autonomic activity indicative of stress and also less somatic activity indicative of negative affect. It was also predicted that people exposed to nature-dominated drives would demonstrate quicker recovery from stress. On the whole, the results were supportive of the hypotheses. On the basis of their findings, the authors proposed that there is a sympathetic-specific mechanism that underlies the effect of nature on stress recovery.

In summary, studies examining the restoration benefits of recreation experiences in settings comprising natural features or in wilderness settings have provided further support for the biophilia hypothesis. Although many of these studies have methodological limitations, the consistency in findings, despite their many differences lends confidence to their conclusions. Moreover, a select number of methodologically superior studies have yielded converging results, all lending support to the proposal that exposure to natural landscapes with non-threatening features (i.e. savanna like elements) promotes positive affect, higher level performance, and positive changes in physiological activity. Nevertheless, confidence in the proposal that these effects are primarily biologically based (i.e. genetically selected for their adaptiveness) awaits cross-cultural investigation to support their universality.

A Typology of Humans' Attitudes Toward Nature

Converging with Wilson's proposals relating to biophilia are the nine perspectives or values put forth by Kellert (1993) that describe humans' relationship with the natural world (see Table 1). Consistent with Wilson's conceptualisation, Kellert describes these perspectives as relating to a complex of learning rules that are fundamentally biologically based. The nine perspectives include physical, emotional and intellectual expressions of humans' association with nature that essentially, describe human evolutionary dependence on nature for both survival and personal fulfilment. The nine perspectives have received varying amounts of empirical support (e.g. Kellert, 1983; 1985; 1991; 1996). Research support relating to several of these perspectives, namely the *utilitarian*, *naturalistic*, *aesthetics*, and *negativistic* perspectives has already been discussed above.

Research related to the *humanistic* perspective is particularly relevant to the biophilia hypothesis. As noted in Table 1, this perspective describes the human experience of a deep emotional connection with the sentient aspects of nature and its individual elements. According to Kellert (1993), as a social species for whom extensive cooperation and affiliational ties has central value for survival, our affiliation with other species may have served the adaptive value of enhancing our capacity for bonding, altruism, and sharing. Also, as argued by Newby (1999),

TABLE I
Kellert's nine perspectives describing humans' relationship with nature

Perspective	Description
Utilitarian	The biological advantage afforded to humans in their exploitation of nature's vast resources including food, clothing, tools, medicine and shelter.
Naturalistic	The satisfaction that humans derive through their contact with nature – contact characterised by fascination, wonder, and awe at nature's beauty, complexity and diversity (cf Kaplan and Talbot, 1983).
Ecologistic-scientific	The motivation to systematically study the biophysical patterns, structures, and functions of the natural world. This motivation involves a sense of satisfaction at experiencing the complexity of natural processes, quite separately from their utility.
Aesthetics	The preference for natural design over human design has been demonstrated in a variety of studies (e.g. see Kaplan and Kaplan, 1989 for review).
Symbolic	Refers to humans' use of nature symbols to communicate. As noted by Kellert (1993), over 90 percent of the characters employed in children's language acquisition and counting books are animal characters. Also, natural symbols also feature prominently in mythology, fairy tales, and legends.
Humanistic	The human experience of a deep emotional connection with the sentient aspects of nature and its individual elements.
Moralistic	The strong feeling of affinity, and the sense of an ethical responsibility for the natural world as is often associated with the views of indigenous people.
Dominionistic	Refers to the desire to master and control the natural world, often associated with destructive tendencies.
Negativistic valuations of nature	Refers to negative affect associated with nature experiences including fear, aversion and disgust.

human-dog relationships most likely served the advantage of providing early warnings in the event of human conflict. By pooling senses, mixed species communities perhaps gained a competitive edge.

Companion animals are particularly prone to "humanisation" in that it is not uncommon for them to be assigned a relational status equal to that of other humans. In their review of research into companion animals, Katcher and Wilkins (1993) describe support for the proposal that humans have an innate tendency to focus on living things and hence elaborate on Kellert's humanistic perspective of nature. Consistent findings have been yielded between studies that have demonstrated restorative effects of exposure to certain natural landscapes (discussed in detail in a subsequent section), and research regarding exposure to animals. For example, research by Katcher and colleagues (Katcher et al., 1983; Katcher, Segal, and Beck, 1984) demonstrated that watching fish in an aquarium was as relaxing for patients about to undergo oral surgery as hypnosis. Others have confirmed their findings (e.g. DeSchriver and Riddick, 1990).

Other research has shown that the presence of an animal increases social interaction among humans and also the social attractiveness of humans (e.g. Hart, Hart, and Bergin, 1987; Lockwood, 1983). That there are therapeutic mental and physical benefits to be derived from the human-animal relationship has also been documented (e.g. Anderson, Reid, and Jennings, 1992; Francis, Turner, and Johnson, 1985; Friedman et al., 1983; Katcher and Wilkins, 1993).

Much of the research discussed thus far has found either direct or indirect support for the basic tenet of the biophilia hypothesis, that our species evolved in a world where relationships with nature, be they positive or negative, were central to our survival. The research to date is consistent with the proposal that predispositions that evolved in our ancestry environment, and that involved certain cognitions and affect, continue to be present today despite their more limited relevance for modern humans. The fear and phobia research provides clear support of this. Also supportive is the research looking at the positive associations with nature including restoration, approach behaviours, and enhanced cognitive functioning.

The remainder of this paper will examine evidence, albeit indirect, for the proposal that the modern industrialised style of living characteristic of Western individualistic societies is not conducive to mental well-being. Two main bodies of research will be drawn upon for this discussion. The first is cross-cultural research into the prevalence and

prognosis of major psychopathologies. The second is the evolutionary psychopathology literature examining current diagnoses of pathology.

Culture and Mental Health

In his reviews of research examining the relationship between culture and psychopathology, Draguns (1986; 1990) nominated major depression and schizophrenia as the two most disabling psychopathologies. Despite the apparent universality of these disorders, cultural differences have been found.

SCHIZOPHRENIA ACROSS CULTURE

A series of studies was sponsored by the World Health Organisation (WHO, 1973; 1979) to examine the existence of Schizophrenia in nine different nations, namely, China, Colombia, Czechoslovakia, Denmark, India, Nigeria, the Soviet Union, the United Kingdom, and the United States. The studies identified the existence of the core symptoms of schizophrenia across all nine locations. However, the prognosis of the disorder differed across cultures such that in poorer and less developed countries, patients were found to recover more rapidly and in higher proportions than in the industrialised nations, including the U.K., U.S.A. and Denmark.

Later research reported by Jablensky, et al. (1992), again sponsored by the WHO, examined the manifestations, incidence, and course of schizophrenia in 13 different geographical areas in 10 countries. Included were Colombia, Czechoslovakia, Denmark, India, Ireland, Japan, Nigeria, the Union of Soviet Socialist Republics, the United Kingdom, and the United States of America. A sample of 1,379 patients with schizophrenia was involved in an initial examination and two follow-up examinations at annual intervals.

As with the previous research described, the study revealed no large difference in the manifestation rate of schizophrenic disorders across cultures but culture was found to be significant for predicting the prognosis of the disorder. Specifically, on six outcome measures, patients in developing countries showed a more favourable outcome than their counterparts in the developed countries.

A proposed explanation for this finding is that schizophrenia is particularly poorly accommodated in the lifestyle characteristic of

industrialised societies. Characteristics such as; larger communities, nuclear family units, the automobile, the computer, and living by the clock as opposed to characteristics of pre-industrial societies including extended families, were identified as major factors (Cooper and Sartorius, 1977). Murphy (1982) extended upon this argument by highlighting the characteristic tendency of people with schizophrenia to easily become confused by complex, contradictory, and ambiguous rules of living. The more complex the rules, the more likely they are to retreat into a world of their own making. Non-industrialised societies are less likely to be characterized by such rule systems. Rather, their rules can be described as explicit, clear, sincere and simple. Further, in industrialised nations, people who in their past have been diagnosed with schizophrenia have been found to experience great difficulty in being accepted and in once again becoming socially integrated. Thus, although the disorder seems to be unquestionably present across very different societies, it may constitute a more debilitating disorder in industrialised societies.

DEPRESSION ACROSS CULTURE

The second major disorder for which extensive cross-cultural data are available is depression. In a cross-cultural investigation involving Iran, Japan, Canada and Switzerland, WHO (1983) reported that of the various depression symptoms, the most stable across cultures included; loss of sexual interest, loss of appetite, weight reduction, fatigue, and self-accusatory ideas. These core symptoms of depression were found in 75% of the depressive patients in all four societies. These findings, however, are not entirely in agreement with earlier research examining 30 different countries (Murphy, Wittkower, and Chance, 1967). In the earlier research it was reported that in nine of the 30 societies, the symptoms of depression were, in fact, quite different. All nine of these societies were non-Western and symptoms characteristic of depression included; agitation, ideas of influence and partial mutism.

Also, it seems to be tentatively agreed upon that the incidence of depression is substantially lower in Africa and various regions of Asia than in countries of Western Europe and North America. However, the caveat to this conclusion is that whilst depression is present in places such as Western Africa, India, and Thailand, there is great variation

in its expression, therefore, its detection by Western researchers or clinicians may prove difficult.

Kleinman (1982), for example reported that, in China, somatisation is a typical channel of depressive expression. Thus, depressed persons reported their psychological problems in terms of bodily ailments including headaches, back problems, and stomach ailments. This channel of expression is culturally sanctioned and understood as a cry for help in certain societies. Somatisation, although existent as an expressive channel for depression in Western societies, is considered to be a less sophisticated form of expression and is associated with persons of low educational and occupational status (Kleinman, 1982). These findings clearly demonstrate that culture can be central to the manifestation and expression of specific psychological states. Moreover, in contrast to the Western judgement that the somatic expression of depression is less sophisticated, it can also be argued that such expression is less likely to lead to isolation and suicidal ideation. Rather, it may be likely to increase significant others' awareness of the problem and thereby harness their support.

Regardless of manifestation type, in the 1990's depression has become the leading cause of disability worldwide and its incidence is predicted to be on the increase, particularly in cohorts born in the later part of the 20th century (Klerman and Weissman, 1989; Kovacs and Gatsonis, 1994; WHO, 1999). In high-income countries, psychiatric conditions, including depression, account for 25 percent of disease burden followed by the three leading causes of death being heart disease, cancers, and stroke (WHO, 1999). Others have also reported evidence that converges with this picture (Fombonne, 1998; Rutter and Smith, 1995). Of particular relevance to the argument being made in the present paper, following the second world war, rates of psychosocial disorders have been shown to be on the increase in almost all *developed* countries (Rutter and Smith, 1995). These disorders include drug abuse, crime, depression, and suicidal behaviour. Moreover, in a recent National Health and Medical Research report (NH and MRC, 1997), the factor 'living in the later decades of the century' was listed as a risk factor for developing depression in young people.

Researchers typically conclude that the causes or antecedents for this rise in psychopathology, particularly in young people, are little understood. In particular, the cultural antecedents of psychopathology have received very little attention. However, consistent with the

argument that our manufactured modern life is central to understanding this increase in psychopathology, Rutter (1995) has proposed that the most likely factors, among others, include family conflict and break up, as well as increased individualism. He also argues that social disadvantage, inequality and unemployment are not sufficient explanations although they are associated with disorder at the individual level.

In sum, differences in the manifestation of symptoms, prognosis, and prevalence rates, across developed and developing countries, strongly suggest culture-biology convergence as central for human psychological well-being. Moreover, the finding that the most marked increases in psychopathology, particularly in developed countries, have occurred post-World War II, which coincides with an increasingly rapid pace of human manufactured change, provides important support for the biophilia hypothesis.

Evolutionary Psychopathology

In this final section, the evolutionary psychopathology framework will be introduced. Although a detailed discussion of this literature is beyond the scope of the present paper, the fundamental assumptions made within this theoretical framework in themselves provide additional support for the basic tenets of the biophilia hypothesis.

In psychology and psychiatry, the terms pathology and psychopathology are most commonly used as references to diseases or disorders, the common conceptualisation being that psychopathology is related to non-adaptive errors, malfunctions or breakdowns. In contrast, within the evolutionary psychopathology framework, it is proposed that many psychological states, currently identified as pathologies, may in fact represent the activation or manifestation of once adaptive strategies (i.e. application of biologically prepared rules in a relevant environment). These claims are supported by the high prevalence rates of certain disorders such as bipolar disorder (i.e. one percent) (Gilbert, 1998; Wilson, 1998). Such a high prevalence rate suggests that there has been positive selection for the genes which mediate the traits of excessive mood alteration. Similarly, more common disorders such as anxiety and depression are likely to have been positively selected.

Gilbert (1998) also points out that the evolutionary psychopathology viewpoint begins with the fundamental position that traits are selected on the basis of their effects on reproduction rates in subsequent

generations and not on the basis that the adaptive goal of normal functioning is to be happy and relate to fellow human beings. In support of this position, Gilbert points out that evolutionary explanations have now been advanced for many so called 'pathologies' including mood disorders, psychosis, social anxiety, phobias, violence and substance abuse (see Gilbert, 1998 for a more detailed discussion). Thus, it is considered that psychological states, which we currently identify as pathologies, may serve, or more correctly for the present discussion, may have served an adaptive purpose in their relevant social environment (Wakefield, 1992). For example, it may be more adaptive for an animal to generally be more anxious in contexts where threats have previously existed even when they are not currently observable. Regarding depression, it may be (or have been) more adaptive to be depressed in the absence of sufficient safety cues, particularly following an experience of defeat or inability to escape threat (Gilbert, 1998).

The evolutionary psychopathology perspective has been incorporated into this paper to strengthen the argument that, despite the very different environment in which we now live, our species' evolution continues to significantly dictate aspects of our behaviour. Furthermore, cultural beliefs and practices that are inconsistent with our evolutionary constitution and physical environments that stray too far from that in which we evolved may compromise our psychological well-being. In other words, having only limited opportunities available in the modern environment to express our biophilic tendencies may impact negatively upon our psychological functioning.

Thus, to return to the original question. Has our modern lifestyle, brought about by industrialisation, advanced technology, and corresponding cultural changes, enhanced our psychological well-being? The above discussion, incorporating varying literatures, strongly indicates that it has not. Rather, the opposite conclusion may be warranted. Our modern lifestyle manifests as a large discrepancy between who we are and how we live. There are indications that this discrepancy may well be responsible for the increases in psychopathology evidenced in the modern world (Leckman and Mayes, 1998; Wilson, 1998).

Integration and Concluding Remarks

Despite the strength of the above argument, there remain several caveats. Firstly, in relative terms, only a small proportion of the population suffer from psychopathology. A second caveat relates to the subjective well-being literature which has demonstrated that community

levels of life satisfaction have remained stable over time despite modernisation (Cummins, in press). A third caveat relates to the cross-cultural literature on subjective well-being which has indicated that individuals in collectivist countries (which can be argued to more closely resemble the kinship groupings of our ancestors), report lower levels of subjective well being than those in individualist nations. Interestingly, however, Diener et al., found that although Chinese individuals reported lower levels of life satisfaction, they also reported the lowest frequency of negative affect (Diener et al., 1995).

How can these opposing literatures be reconciled? Measurement issues may be central. Although socially acquiescent responding has been considered an unsatisfactory explanation for the lower life satisfaction levels in collectivist countries, it has not been conclusively ruled out as an explanation for the higher life satisfaction in individualist countries. Impression management pressures to respond in a socially desirable manner have been documented (Diener et al., 1999). For example, "Very well thank-you" is a socially appropriate and often automatic response to the greeting "Hello, how are you?" Supporting this proposal, in their investigation of national differences in subjective well-being, Diener et al., (1995) found that for the American respondents, reports of positive affect mirrored their social desirability ratings. In sum, are reports of subjective well-being that are coloured by societal norms validly comparable across very different cultures? The universality of positive subjective well-being reports can be questioned in the light of Heine, Lehman, Markus, and Kitayama's (1999) extensive review including Japanese (collectivist) and North American (individualist) data. These data strongly suggest that the positive self-regard/self-esteem construct, long regarded as a fundamental psychological construct by Western psychologists, may in fact not apply in cultures such as the Japanese culture.

An alternative explanation to understanding the apparent inconsistency between increasing levels of psychopathology but stable levels of life satisfaction post World War II is that happiness is not necessarily a sufficient preventative barrier against psychopathology. Also, happiness and reports of life satisfaction have been argued to strongly be under homeostatic control and as such vary little from person to person (Csikszentmihalyi, 1997; Cummins, 1995; Diener, et al., 1999). Consequently, as argued by Csikszentmihalyi (1997), improvement in the perceived quality of everyday life may be dependent on feelings other than happiness, feelings which are more directly influenced by an

individual's actions and behaviours. He argues that how active, strong and alert one feels may be more important for psychological well-being particularly since such feelings are likely to become more intense when one is engaged in a challenging task. Related to this proposal, Csikszentmihalyi describes two psychic states. The first is referred to as psychic entropy which is characterised by negative emotions including sadness, fear, or boredom. He refers to the second state as psychic negentropy. This state is characterised by strength and alertness. When in a state of negentropy, attention tends to be focused outward, rather than inwards as in psychic entropy. Following from this, Csikszentmihalyi argues that psychic negentropy is more likely to lead to flow or optimal experiences which are described as moments when our feelings, motives and thoughts are in harmony. Such experiences are totally engaging and absent of self-consciousness. It is such experiences, according to Csikszentmihalyi that make for an excellent life. Moreover, he argues that when in the experience of flow, happiness is not a central feature because happiness requires reflection on inner states, thus by definition forcing us out of the flow experience. A person whose lifestyle includes many flow experiences can be described as having an autotelic personality.

Other ways in which such experiences or ways of living have been conceptualised include having a sense of spirituality, or experiencing the self as being fundamentally interconnected with the environment (e.g. Folkman, 1997; Roszak, 1995). This contrasts with self-focussed attention or having a disconnected sense of self which have been shown to be associated with clinical disorders (e.g. Ingram, 1990). Moreover, it is conceivable that the experiencing of states consistent with Csikszentmihalyi's flow experience may have adaptively evolved as motivating and energising emotions to promote optimal interaction with the environment. The curious, alert, and energetic, albeit cautious, individual would undoubtedly have been more successful in exploiting the resources of an area. In this regard, the individual who was consumed with self focussed attention would have been at risk of not efficiently processing information undoubtedly missing many promising opportunities. Clearly, such a state would not have been adaptive.

The experience of flow described by Csikszentmihalyi overlaps significantly with the experiences aroused in wilderness or nature settings as described by Kaplan and Talbot (1983). Kaplan and Talbot described an absence of boredom and the arousal of fascination enabling an

individual to be alert, attentive in an effortless but absorbing way. Thus, it is likely that flow experiences are more probable in a natural environment.

Moreover, the documented benefits that can be derived from exposure to features of the natural environment or from choosing a life style that shares elements with that of our ancestors may be explained through the experiencing of flow. It follows from the above discussion that the majority of individuals living in Western society, who are surrounded by manufactured environments and living a modern lifestyle must be falling short of experiencing the psychological benefits possible from increased exposure to our native environment.

Support for the proposal that a lifestyle more consistent with that of our evolutionary past predicts increased flow experiences has been demonstrated by Fave and Massimini (1988). They compared four European groups in close geographical proximity but who were part of very different ecologies and cultural environments. In particular, the groups differed in the degree to which they followed a traditional lifestyle. The researchers found that the groups differed on the extent to which their daily activities produced optimal experiences with the most traditional group being significantly more likely to report optimal experience as part of their everyday activities. In contrast, the less traditional groups, particularly the younger members (who were presumably more acculturated into the modern lifestyle) were more likely to report optimal experiences in leisure activities such as playing soccer. On the whole, however, for the latter individuals, daily frequency of flow experiences was lower.

Further support that a lifestyle consistent with our ancestry environment predicts increased well being can be found in the research studies carried out by Jacob and Brinkerhoff (Brinkerhoff and Jacob, 1986; Jacob and Brinkerhoff, 1997; 1999). These studies have investigated the life quality of people who have chosen to adopt a life style best described as semi-subsistence agriculture. Such individuals share the ideal of self-reliance and a belief that living simply is important for sustainability. They also share a concern that the mainstream, high consumption culture is driving itself to extinction. The self-identities of these individuals are very likely to be different from those prescribed by modern individualist cultures where consumerism is one of the strongest defining characteristics. Although not investigated by Jacob and Brinkerhoff, these individuals are more likely to be described

as having an autotelic personality (c.f., Csikszentmihalyi, 1997), or as having a self-conception that is interconnected with the environment. Support for the positive influence on well-being of a lifestyle more consistent with our human ancestry is indicated by the higher than normative levels of life satisfaction (see Cummins, 2000) reported by participants in Jacobs and Brinkerhoff's work.

CONCLUSION

In conclusion, it is most intriguing that support for the biophilia hypothesis and related proposals can be found across the several different literatures included in this review. On the whole, although more research is required so that specific conclusions can be made, there is substantial evidence to suggest that, as a species, our modern lifestyle may have strayed too far from that to which we have adapted. There is also support for the proposal that including elements of nature or of our species' ancient life style into our modern lifestyle may serve to enhance our psychological well-being. Nevertheless, there remain many unanswered questions which if resolved will not only strengthen the links between what presently constitute quite separate areas of inquiry but will also lead to a more profound understanding of psychological functioning and well-being.

REFERENCES

Agras, S., D. Sylvester and D. Oliveau: 1969, 'The epidemiology of common fears and phobia', Comprehensive Psychiatry 10, pp. 151–156.

Anderson, W., C. Reid and G. Jennings: 1992, 'Pet ownership and risk factors for cardiovascular disease', Medical Journal of Australia 157, pp. 298–301.

Baskin, Y.: 1997, The work of nature: How the diversity of life sustains us. (Island Press, Washington DC).

Bernaldez, F.G., R.P. Abello and D, Gallardo: 1989, 'Environmental challenge and environmental preference: Age and sex effects', Journal of Environmental Management 28, pp. 53–70.

Brinkerhoff, M.B. and J.C. Jacob: 1986, 'Quality of life in an alternative lifestyle: The smallholding movement', Social Indicators Research 18, pp. 153–173.

Carver, C.S. and M.F. Scheier: 1990, 'Origins and functions of positive and negative affects: A control–process view', Psychological Review 97, pp. 19–35.

Chokor, B.A. and S.A. Mene: 1992, 'An assessment of preference for landscapes in the developing world: A case study of Warri, Nigeria, and Environs', Journal of Environmental Management 34, pp. 237–256.

Cook, E.W., R.L. Hodes and P.J. Lang: 1986, 'Preparedness and phobia: Effects of stimulus content on human visceral conditioning', Journal of Abnormal Psychology 95, pp. 195–207.

Cooper, J.E., and N. Sartorius: 1977, 'Cultural and temporal variations in schizophrenia', British Journal of Psychiatry 130, pp. 50–55.

Cummins, R.A.: 1995, 'On the trail of the gold standard for subjective well-being', Social Indicators Research 35, pp. 179–200.

Cummins, R.A.: (in press), 'Normative life satisfaction: Measurement issues and a homeostatic model', in B. Zumbo (ed.), Methodological Developments and Issues in Quality of Life Research (Kluwer, Amsterdam).

Cummins, R.A.: 2000, 'Personal income and subjective well-being: A review', Journal of Happiness Studies 1, (in press).

Csikszentmihalyi, M.: 1997, Finding Flow: The Psychology of Engagement with Everyday Life (Basic Books, New York).

Darwin.: 1877, 'A biographical sketch of an infant', Mind 2, pp. 285–294.

Davey, G.C.L.: 1994, 'Self-reported fears to common indigenous animals in an adult UK population: The role of disgust sensitivity', British Journal of Psychology 85, pp. 541–554.

Diener, E., E.M. Suh, R.E. Lucas and H.L. Smith: 1999, 'Subjective well-being: Three decades of progress', Psychological Bulletin 125, pp. 276–302.

Diener, E., E.M. Suh, H. Smith and L. Shao: 1995, 'National differences in reported subjective well-being: Why do they occur?' Social Indicators Research 34, pp. 7–32.

DeSchriver, M. and C. Riddick: 1990, 'Effects of watching aquariums on elders' stress', Anthrozoos 4, pp. 44–48.

Draguns, J.G.: 1986, 'Culture and Psychopathology: What is known about their relationship?' Australian Journal of Psychology 38, pp. 329–338.

Draguns, J.G.: 1990, 'Applications of cross-cultural psychology in the field of mental health', in R.W. Brislin (ed.), Applied Cross-Cultural Psychology (Sage, Newbury Park).

Fave, M.D. and F. Massimini: 1988, 'Modernization and the changing contexts of flow in work and leisure', in M. Csiksentmihalyi and I.S. Csiksentmihalyi (eds.), Optimal Experience: Psychological Studies of Flow in Consciousness (Cambridge University Press, New York), (pp. 193–213).

Folkman, S.: 1997, 'Positive psychological states and coping with severe stress', Social Science and Medicine 45, pp. 1207–1221.

Fombonne, E.: 1998, 'Increased rates of psychosocial disorder in youth', European Archives of Psychiatry and Neuroscience 248, pp. 14–21.

Francis, G., J. Turner and S. Johnson: 1985, 'Domestic animal visitation as therapy with adult home residents', International Journal of Nursing Studies 22, pp. 201–206.

Friedman, E., A.H. Katcher, J.J. Lynch and Messent, 1983, 'Social interaction and blood pressure: Influence of animal companions', Journal of Nervous and Mental Disease 171, pp. 461–465.

Gilbert, P.: 1998, 'Evolutionary psychopathology: Why isn't the mind designed better than it is?' British Journal of Medical Psychology 71, pp. 353–373.

Gullone, E.: 1993, Self-reports of Normative Fear in Children and Adolescents: A Cross-sectional and Longitudinal Investigation, Unpublished Doctoral Thesis, (Monash University, Melbourne, Australia).

Gullone, E.: 1996, 'Developmental psychopathology and normal fear', Behaviour Change 13, pp. 143–155.

Gullone, E.: 2000, 'The development of normal fear: A century of research', Clinical Psychology Review, 20 (4), pp. 429–451.

Hart, L.A., B.L. Hart and B. Bergin: 1987, 'Socialising effects of service dogs for people with disabilities', Anthrozoos 1, pp. 41–44.

Hartig, T., M. Mang and G.W. Evans: 1991, 'Restorative effects of natural environment experiences', Environment and Behavior 23, pp. 3–26.

Heine, S.J., D.R. Lehman, H.R. Markus and S. Kitayama: 1999, 'Is there a universal need for positive self-regard', Psychological Review 106, pp. 766–794.

Hugdahl, K. and A.C. Karker: 1981, 'Biological versus experiential factors in phobic conditioning', Behavior Research and Therapy 19, pp. 109–115.

Ingram, R.E.: 1990, 'Self-focused attention in clinical disorders: Review and a conceptual model', Psychological Bulletin 107, pp. 156–176.

Jablensky, A., N. Sartorines, G. Ernberg, M. Arker, A. Korten, J.E. Cooper, R. Day and A. Bertelien: 1992, 'Schizophrenia: Manifestations, incidence, and course in difference cultures: A World Health Organisation ten-country study', Psychological Medicine 20, entire issue.

Jacob, J.C. and M.B. Brinkerhoff: 1997, 'Values, performance and subjective well–being in the sustainability movement: An elaboration of multiple discrepancies theory', Social Indicators Research 42, pp. 171–204.

Jacob, J.C. and M.B. Brinkerhoff: 1999, 'Mindfulness and subjective well-being in the sustainability movement: A further elaboration of multiple discrepancies theory', Social Indicators Research 46, pp. 341–368.

Kahn, P.H.: 1997, 'Developmental psychology and the biophilia hypothesis: Children's affiliation with nature', Developmental Review 17, pp. 1–61.

Kaplan, R.: 1974, 'Some psychological benefits of an outdoor challenge program', Environment and Behavior 6, pp. 101–116.

Kaplan, R.: 1977, 'Patterns of environmental preference,' Environment and Behavior 9, pp. 195–216.

Kaplan, R. and S. Kaplan: 1989, The Experience of Nature: A Psychological Perspective (Cambridge University Press, New York).

Kaplan, S.: 1987, 'Aesthetics, affect, and cognition: Environmental preference from an evolutionary perspective', Environment and Behavior 19, pp. 3–32.

Kaplan, S., R. Kaplan and J.S. Wendt: 1972, 'Rated preference and complexity for natural and urban visual material', Perception and Psychophysics 12, pp. 354–356.

Kaplan S. and J.F. Talbot: 1983, 'Psychological benefits of a wilderness experience', in I. Altman and J.F. Wohlwill (eds.), Human Behaviour and Environment : Advances in Theory and Research, Vol. 6: Behavior and the Natural Environment (Plenum, New York).

Katcher, A., E. Friedman, A. Beck, and J. Lynch: 1983, 'Looking, talking, and blood pressure: The physiological consequences of interaction with the living environment', in A. Katcher and A. Beck (eds.), New Perspectives on our Lives with Companion Animals (University of Pennsylvania Press, Philadelphia).

Katcher, A., H. Segal and A. Beck: 1984, 'Comparison of contemplation and hypnosis for the reduction of anxiety and discomfort during dental surgery', American Journal of Clinical Hypnosis 27, pp. 14–21.

Katcher, A. and G. Wilkins: 1993, 'Dialogue with animals: Its nature and culture', in S.R. Kellert and E.O. Wilson (eds.), The Biophilia Hypothesis (Island Press, Washington DC), pp. 173–200.

Kellert, S.R.: 1983, 'Affective, cognitive and evaluative perceptions of animals', in I. Altman and J. Wohlwill (eds.), Behavior and the Natural Environment (Chap. 7) (Plenum, New York).

Kellert, S.R.: 1985, 'Attitudes toward animals: Age related development among children', Journal of Environmental Education 16, pp. 29–39.

Kellert, S.R.: 1991, 'Japanese perceptions of wildlife', Conservation Biology 5, pp. 297–308.

Kellert, S.R.: 1993, 'The biological basis for human values of nature', in S.R. Kellert and E.O. Wilson (eds.). The Biophilia Hypothesis (Island Press, Washington DC), pp. 42–69.

Kellert, S.R.: 1996, The Value of Life (Island Press, Washington DC).

Kellert, S.R. and E.O. Wilson: 1993, (eds.), The Biophilia Hypothesis (Island Press, Washington DC).

Kleinman, A.: 1982, 'Neurasthenia and depression: A study of somatization and culture in China', Culture, Medicine, and Psychiatry 6, pp. 117–190.

Klerman, G.L. and M.M. Weissman: 1989, 'Increasing rates of depression', Journal of the American Medical Association 261, pp. 2229–2234.

Kovacs, M. and C. Gatsonis: 1994, 'Secular trends in age at onset of major depressive disorder in a clinical sample of children', Journal of Psychiatric Research 28, pp. 319–329.

Lane, B. and E. Gullone: 1999, 'Common fears: A comparison of self-generated and fear survey schedule generated fears of adolescents', Journal of Genetic Psychology 160, pp. 194–204.

Leckman, J.F. and L.C. Mayes: 1998, 'Understanding developmental psychopathology: How useful are evolutionary accounts?' Journal of the American Academy of Child and Adolescent Psychiatry 37, pp. 1011–1021.

Lockwood, R.: 1983, 'The influence of animals on social perception', in A. Katcher and A. Beck (eds.) New Perspectives on Our Lives with Companion Animals (University of Pennsylvania Press, Philadelphia).

Marks, I.M.: 1969, Fears and Phobias (Heinemann, London).

Matchett, G. and G.C.L. Davey: 1991, 'A test of a disease-avoidance model of animal phobias', Behaviour Research and Therapy 29, pp. 91–94.
McNally, R.J.: 1987, 'Preparedness and phobias: A review', Psychological Bulletin 101, pp. 283–303.
Murphy, H.B.M.: 1982, 'Comparative psychiatry', (Springer-Verlag, Berlin).
Murphy, H.B.M., E.W. Wittkower and N.A. Chance: 1967, 'Cross-cultural inquiry into the symptomatology of depression: A preliminary report', International Journal of Psychiatry 3, pp. 6–15.
National Health and Medical Research Council: 1997, Depression in young people: Clinical practice guidelines (Australian Government Publishing Service, Canberra).
Neale, M.C., E.E. Walters, L.J. Eaves, H.H. Maes and K.S. Kendler: 1994, 'Multivariate genetic analysis of twin-family data on fear: Mixed models', Behavior Genetics 24, pp. 119–139.
Newby, J.: 1999, The Animal Attraction (Australian Broadcasting Corporation, Sydney).
Ohman, A.: 1986, 'Face the beast and fear the face: Animal and social fears as prototypes for evolutionary analyses of emotion', Psychophysiology 23, pp. 123–145.
Ohman, A., U. Dimberg and L.G. Ost: 1985, 'Animal and social phobias: Biological constraints on learned fear responses', in S. Reiss and R.R. Bootzin (eds.), Theoretical Issues in Behavior (Academic Press, New York).
Ohman, A. G. Erixon and I. Loftberg: 1975, 'Phobias and preparedness: Phobic versus neutral pictures as conditioned stimuli for human autonomic responses', Journal of Abnormal Psychology 84, pp. 41–45.
Parsons, R., L.G. Tassinary, R.S. Ulrich, M.R. Hebl and M. Grossman-Alexander: 1998, 'The view from the road: Implications for stress recovery and immunization', Journal of Environmental Psychology 18, pp. 113–140.
Phillips, K., D.W. Fulker and R.J. Rose: 1987, 'Path analysis of seven fear factors in adult twin and sibling pairs and their parents', Genetic Epidemiology 4, pp. 345–355.
Rachman, S.: 1977, 'The conditioning theory of fear acquisition: A critical examination', Behaviour Research and Therapy 15, pp. 375–389.
Rachman, S.: 1991, 'Neo-conditioning and the classical theory of fear acquisition', Clinical Psychology Review 11, pp. 155–173.
Rachman, S. and M.E.P. Seligman: 1976, 'Unprepared phobias: "Be prepared"', Behaviour Research and Therapy 14, pp. 333–338.
Rose, R.J. and W.B. Ditto: 1983, 'A developmental-genetic analysis of common fears from early adolescence to early adulthood', Child Development 53, pp. 361–368.
Roszak, T.: 1995, 'The greening of psychology: Exploring the ecological unconscious', The Gestalt Journal 18, pp. 9–46.
Ruiz, J.P. and F.G. Bernaldez: 1982, 'Landscape perception by its traditional users: The ideal landscape of Madrid livestock raisers', Landscape Planning 9, pp. 279–297.
Rutter, M.: 1995, 'Causal concepts and their testing', in M. Rutter and D.J. Smith (eds.), Psychosocial Disorders in Young People: Time Trends and their Causes (Wiley, Chichester).

Rutter, M. and D.J. Smith, (eds.): 1995, Psychosocial Disorders in Young People: Time Trends and their Causes (Wiley, Chichester).
Saunders, P.: 1999, 'Capitalism and the environment', in M.J. Smith (ed.), Thinking Through the Environment (Routledge, London), pp. 269–279.
Seligman, M.E.P.: 1970, 'On the generality of the laws of learning', Psychological Review 77, pp. 406–418.
Seligman, M.E.P.: 1971, 'Phobias and preparedness', Behavior Therapy 2, pp. 307–320.
Shafer, E.L., J.F. Hamilton and E.A. Schmidt: 1969, 'Natural landscape preferences: A predictive model', Journal of Leisure Research 1, pp. 187–197.
Sheets, V.L. and Manzer, C.D: 1991, 'Affect, cognition, and urban vegetation: Some effects of adding trees along city streets. Environment and Behavior 23, pp. 285–304.
Shepard, P.: 1993, 'On animal friends', in S.R. Kellert and E.O. Wilson (eds.), The Biophilia Hypothesis (Island Press, Washington DC), pp. 275–300.
Ulrich, R.S.: 1977, 'Visual landscape preference: A model and application', Man-Environment Systems 7, pp. 279–293.
Ulrich, R.S.: 1981, 'Psychological and recreational benefits of a neighborhood park', Journal of Leisure Research 13, pp. 43–65.
Ulrich, R.S.: 1984, 'View through a window may influence recovery from surgery', Science 224, pp. 420–421.
Ulrich, R.S.: 1986, 'Human responses to vegetation and landscapes', Landscape and Urban Planning 13, pp. 29–44.
Ulrich, R.S.: 1993, 'Biophilia, biophobia, and natural landscapes', in S.R. Kellert and E.O. Wilson (eds.), The Biophilia Hypothesis (Island Press, Washington DC), pp. 73–137.
Wilson, E.O.: 1975, Sociobiology: The New Synthesis (Addison-Wesley, Cambridge, M.A).
Wilson, E.O.: 1984, Biophilia (Harvard University Press, Massachusetts).
Wilson, E.O.: 1992, The Diversity of Life (Harvard University Press, Massachusetts).
Wilson, E.O.: 1993, 'Biophilia and the conservation ethic', in S.R. Kellert and E.O. Wilson (eds.), The Biophilia Hypothesis (Island Press, Washington DC), pp. 31–41.
Wilson, D.R.: 1998, 'Evolutionary epidemiology and manic depression', British Journal of Medical Psychology 71, pp. 375–395.
World Health Organisation: 1973, Report of the international pilot study of Schizophrenia (Author, Geneva).
World Health Organisation: 1979, Schizophrenia: An International Follow-up Study. (John Wiley, New York).
World Health Organisation: 1983, Depressive Disorders in Different Cultures: Report of the WHO Collaborative Study of Standardized Assessment of Depressive Disorders (Author, Geneva).
World Health Organisation: 1999, The World Health Report 1999: Making a Difference (Author, Geneva).

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