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Videophilia: Implications for Childhood Development and Conservation

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Abstract: *Direct experience with nature is the most highly cited influence on environmental attitude and conservation activism. Yet our research (using U.S. national park visits as a proxy) suggests a trend away from interactions with nature and a concurrent rise in the use of electronic entertainment media. We suggest this trend represents evidence of a fundamental shift away from "the innate tendency to focus on life and lifelike processes," or "biophilia" (Wilson, 1984) to "videophilia." We define videophilia as "the new human tendency to focus on sedentary activities involving electronic media." Increasing use of electronic media has been implicated in negative psychological and physical effects, including obesity, loneliness, depression, and attentional problems. Internet use at home is shown to have a strong negative impact on time spent with friends and family as well as time spent on social activities. Outdoor play and nature experience have proven beneficial for cognitive functioning, reduction in symptoms of ADD, increase in self-discipline and emotional well being at all developmental stages. Yet, in contrast to the hours spent per child per week in front of electronic entertainment, children living in the United States reportedly spend on average only 30 minutes of unstructured time outdoors each week. Virtual nature, which we here define as "nature experienced vicariously through electronic means," has potential conservation benefits such as providing unprecedented access to natural areas for many people. However, accessing virtual nature, particularly through electronic media, appears to reduce direct contact with nature. Virtual nature experiences tend to sensationalize nature's hazards and habitats, generating the perception that local natural areas are simultaneously dangerous and lackluster. In contrast, direct experiences of nature tend to be neither particularly hazardous nor momentously spectacular, but evidently intrinsically important to both development and conservation.*

Introduction

The greatest threat to conservation and to the environmental legacy represented by the U.S. national park system may be more subtle than bulldozers and chainsaws. A review of studies on attitude toward the environment suggests that direct contact with nature, especially as children, is the most critical influence on later attitude toward the environment (Bögeholz, 2006; Wells & Lekies, 2006). Family vacations and spending time with family and other mentors outdoors are cited as a major influence on later environmental attitude and activism (Chawla, 1998). Yet for the period 1987–2003 per capita visits to national parks (America's iconic family nature vacation) steadily declined as shown in Figure 1 (Pergams, Czech, Haney, & Nyberg, 2004; Pergams & Zaradic, 2006b), with this trend continuing at least through 2005 (Pergams & Zaradic, 2006a).

Teachers, environmental education, and exposure to nature through other venues (such as reading about nature) are credited with influencing environmental sensitivity, but to a much lesser degree than direct actual experience of natural areas (Chawla, 1998, 1999; Duda et al. 2003; Kahn & Kellert, 2002; Wells & Lekies, 2006). Similarly, direct sustained contact with nature best cultivates children's environmental knowledge and concern (Vaske & Kobrin, 2001; Fisman, 2005). Direct experience with nature appears to uniquely affect childhood development as compared to other types of nature encounters.

Kellert (2002) describes three modes of experiencing nature: direct, indirect, and vicarious. Direct experience involves actual physical contact with natural settings and nonhuman species. This is the spontaneous play in a forest, creek, neighborhood park, backyard, or even vacant lot. Although these settings are affected by human manipulation to some degree, they function largely independent of human intervention. Indirect experience of nature involves physical contact but in a much more controlled and restricted setting. Examples include zoos, nature centers, aquariums, natural history and science museums, and domesticated animals such as cats and dogs. Vicarious experience of nature occurs in the absence of actual physical contact with the natural world. Nature in this form ranges from stylized and symbolic art to photographs, videos, and virtual webcam tours of natural areas.

A comparative review by Kellert (2002) suggests that of the three modes of contact, direct experience with nature plays the most significant role in cognitive and evaluative development. Direct experience of nature offers a multiplicity of sights, sounds, smells, and tactile stimuli shifting continuously in space and time. The spontaneity and complexity of these sensory experiences engage a wide range of adaptive and problem solving responses, requiring alertness and attention (Sebba, 1991). In contrast, the more structured, indirect experiences of nature do not require the same level of spontaneous engagement and do not exert the same types of long-term developmental impacts on children (Kellert, 2002; Pyle, 2002). Similarly, Wells and Lekies (2006) found that direct contact with "wild" as compared to "domesticated" nature before age 11 is a particularly potent pathway to shaping environmental attitudes and behaviors in adulthood. Indirect experiences may exert the greatest positive effect in conjunction with direct encounters in familiar natural settings (Kellert, 2002). The

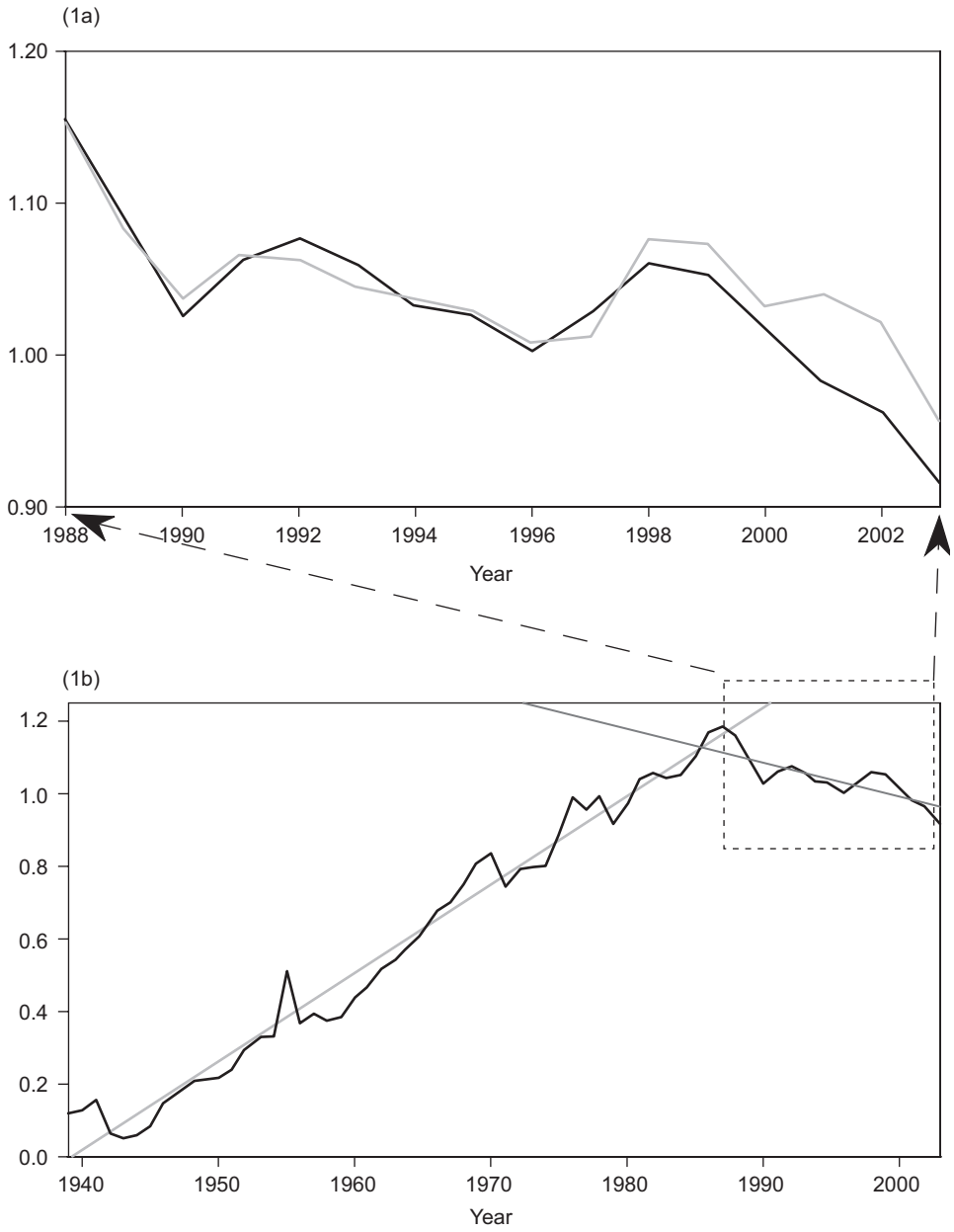

FIGURE 1a. The attendance portion of the graph from 1988 until 2003 in the dashed box is expanded to show both the actual attendance data (black) and the multiple linear regression model (grey) of four entertainment media variables and oil prices. Reprinted from Pergams and Zaradic (2006) with permission.

FIGURE 1b. Per capita U.S. national park attendance from 1939 until 2003 is graphed in black. In light grey is a linear regression calculated using park attendance between 1939 and 1987; and in dark grey, from 1988 until 2003.

least sensory engaging and spontaneous type of nature contact, vicarious experience through an electronic outlet, is becoming more prevalent. More families live in or near urban settings with more time committed to wage earning (Duda et al., 2002). Internet, video game, and home movie use continues to increase dramatically as direct contact with nature via outlets such as national parks decreases (Pergams & Zaradic, 2006a). What are the long-term impacts of this trend for childhood development and conservation?

Videophilia and National Parks

Our research results suggest the trends do not bode well for direct interactions with nature. After fifty years of steady increase, per capita visits to U.S. national parks (the quintessential family vacation) have declined since 1987 (Pergams & Zaradic, 2006a).[1] Prior to this, per capita national park visits increased from 1939 (the start of available data) until 1987. This fifty-year period is remarkable for its steady increase and only minor dips and jumps in the face of World War II, changing demographics, and economic depressions, recessions, innovation, and invention. After fifty years of steady visitation increase, there is an equally steady decline, from 1987 until today, coincident with the rise in electronic entertainment media (Pergams & Zaradic, 2006a).

Along with several electronic entertainment media variables (hours of TV, video games, theatre, home movies, and Internet), we compared the decline in per capita visits to a set of indicators representing alternate recreation choices and potential constraints. The other recreation choices included foreign travel, and more extreme nature experiences such as hiking the entire 3500 km Appalachian Trail. The possible constraints to the number of visitors included the average number of vacation days, median family income, aging baby boomers, federal funding to the National Park Service, park capacity at the most popular parks, and the price of oil (as a proxy for the cost of driving to and through the parks).

We used correlation analysis to consider the relationship of each of our chosen variables with the decline in national park visits. Park capacity was examined separately by graphical comparison to the decline in visitorship and was rejected as limiting since both total overnight stays and visits at the seven most popular parks rose well into the mid-1990s. There was no significant correlation of mean number of vacation days, indicating available vacation time is probably not a factor. Aging of baby boomers was also rejected as they are only now reaching retirement age, and thus during the period of visitation decline were still of prime family vacation age. Federal funding was rejected as a factor as funding to the park service increased during this period. However, it should also be noted that the costs of visiting parks need to be seen against a backdrop where the costs of all government services are being passed along to users, at a time when many potential users are experiencing declining real incomes. Income was significantly positively correlated with foreign travel, but negatively cor-

1. The full paper is accessible at www.videophilia.org.

related with national park visits, suggesting that wealthier sectors of the population may eco-tour outside of the United States.

In an ancillary analysis, trend effects were removed by comparing only the percentage of year-to-year changes. Home movies and oil prices were still significantly correlated with national park visits.

Finally, those raw variables that demonstrated a significant relationship with national park visits (i.e., television, home movies, theatre, video games, Internet use, oil prices, Appalachian trail hikers, and money spent on foreign travel) were used as independent variables in an automatic backward stepwise multiple linear regression to model the decline in visits.

Of the variables we considered, only the four more recently popularized electronic media variables (home movies, theatre, video games, and Internet use), together with the price of oil were significant in generating the closest multilinear fit with the data, explaining 97.5% of the 16 year decline in per capita U.S. national park visits (multiple $r^2 = 0.950$, adjusted multiple $r^2 = 0.925$, SE = 0.015, $F = 37.800$, $P < 0.0001$, Fig. 1). Significant entertainment media effects were per capita hours spent watching home movies ($P = 0.0003$), playing video games (P=0.0066), on the Internet ($P = 0.0012$) and in movie theatres ($P = 0.0195$). Variables rejected as not significant to the step-wise multiple linear regressions were per capita hours spent watching television, Appalachian Trail hiking, and foreign travel. Finally, oil prices also have a significant effect in explaining national park visits ($P = 0.0009$).

Although we wish we could predict the stock market as successfully as our multilinear model predicts the decline in national park visits, correlation is of course not causation. We have five rejoinders. First and most broadly, we are generating a plausible hypothesis with the hopes that further research will test our model. The preliminary mode of testing support for our hypothesis is correlation, in an ecological analysis. Second, one part of our analysis removed trend effects by comparing the percentage of year-to-year changes rather than comparing raw values. Two variables were significantly correlated with the percentage of year-to-year changes in park visits: hours spent watching home movies and oil prices. Third, we must note that a raw r value of 97.5% in a multiple linear regression denotes a huge amount of explanatory power. The two factors significant in percentage of year-to-year change correlations also led the way in explaining this regression (hours spent watching home movies with $P = 0.0003$ and oil prices with $P = 0.0009$), but the other three factors were not far behind. It is a little hard to imagine logically related factors with this much explanatory power being totally devoid of causal connection. Fourth, the media variables we consider are logically related to national park visits, in that all are competing for our limited time. Last, home video game and Internet use essentially came into existence around the time park visitation started declining, and this increases the likelihood of causality.

We think it likely that national park visits are simply a proxy for how much people in the United States are associated with nature in general, and that further research will find the same longitudinal declines in other nature-related activities. We intend to pursue such research. If this is indeed the case, this paradigm shift has huge conservation and childhood development implications. We may well be seeing evidence of a fundamental shift away from “the innate tendency to focus on life and lifelike

processes," or biophilia (Wilson, 1984; elaborated with Kellert, 1993; Kahn, 1997), to videophilia. Moreover, adult attitudes toward the environment are often nurtured through family vacations and spending time outdoors with family and mentors (Chawla, 1998). If parents, mentors, and children are indeed spending less recreational time in nature, the implications for conservation and impacts on childhood development may be compounded in future generations.

A Sedentary Society

Increasing time spent in sedentary indoor media activities has been implicated in the decline in time available for outdoor physical activities (Skidmore & Yarnell, 2004; Fotheringham, Wonnacott, & Owen, 2000; Utter, Neumark-Sztainer, Jeffery, & Story, 2003). An increasingly sedentary lifestyle in the United States is one of the explanatory factors in the rise in obesity (Flegal, Carroll, Ogden, & Johnson, 2002; Skidmore & Yarnell, 2004). Frequency of being overweight and obesity in U.S. children older than six and adolescents has doubled in the last two to three decades (Deckelbaum & Williams, 2001). Moreover, the spread of this sedentary behavior is resulting in similar doubling rates of obesity in developing countries (Deckelbaum & Williams, 2001). Even younger children are at risk because of this increasingly sedentary lifestyle, with more than 22 million children under 5 years of age overweight across the world (Deckelbaum & Williams, 2001).

Adult activity choices are significant for childhood development because children often depend on adults both for access to nature and as role models for recreational choices. Dong, Block, and Mandel (2004) provide an index of how much energy we currently spend on various activities during a 24-hour day in our sedentary society. In the period 1992–1994, 7,515 adults (weighted to be representative of the contiguous 48 states) were surveyed to create a detailed report of each activity performed in the previous 24 hours. An energy expenditure index was created by multiplying duration and intensity of each activity by each individual and summing across all individuals. The top five ranked activities (representing 42.9% of all energy expended) are reprinted in Table 1. "Watching TV/movie, home or theater" and "Activities performed while sitting quietly" (presumably including time on the Internet and playing video games) were together 14.4% of the total. The study was not designed to compare indoor vs. outdoor activities, but it is still interesting that the two clearly outdoor recreational activities ("Fishing and Hunting" and "Gardening") were together only 1.5% of the total, and ranked 22nd and 27th respectively. Given the activity choices adults are making, it should be of no surprise that children are also spending less time in outdoor recreation as compared to time in front of a video screen.

Children and Videophilia

American Academy of Pediatrics guidelines recommend zero hours/day of screen time for children less than 2 years old and 2 hours/day for older children. The guide-

Table 1. Energy Expended in Key Activities

Data reprinted from Table 2 of Dong et al. (2004), which provides an index of how much energy we currently spend on various activities during a 24-hour day in our sedentary society. The top five ranked activities represented 42.9% of all energy expended. Activities relevant to videophilia are in **bold**.

Rank	Activity	% of Total Score	Cumulative %	# of People
1	Driving car	10.9	10.9	6,574
2	Job: Office work, typing	9.2	20.1	2,094
3	**Watching TV/movie, home or theater**	**8.6**	28.8	**5,919**
4	Taking care of child/baby (feeding, bathing, dressing)	8.4	37.2	6,545
5	**Activities performed while sitting quietly**	**5.8**	42.9	**4,086**

Table 2. Activities Engaged in by Young Children

Data reprinted from Charts 1 and 6 of Rideout et al. (2005), a 2003 survey of 1000 parents of the parents of young children aged 0.5–6 years. Values below, related to videophilia, represent what % of young children of different age groups performed the activities listed in a typical day.

Activity	% of Children <2 Years Old	% of Children 0.5–6 Years Old (Total Sample)
Use any screen media	68	83
Watch TV	59	73
Watch home movies	42	73
Use a computer	5	18
Play video games	3	9

lines also recommend that there are no electronic media at all in young children's rooms. In contrast, in a 2003 survey of 1000 parents of the parents of young children aged 0.5–6 years, Rideout, Vandewater, and Wartella (2005) had a number of startling findings. Table 2 is taken from Charts 1 and 6 of the study, and represents the percentage of young children of different age groups that performed the activities listed in a typical day. Forty-three percent of children less than 2 years old watch television every day, and 26% have a television in their bedroom. Sixty-eight percent of children less than 2 years old spend more than two hours a day using screen media. The larger sample (children aged 0.5–6 years) used screen media a little under two hours a day. Almost all homes (95%) with children 0.5–6 years old had at least one VCR or DVD player, and 27% of children had one in their bedroom. On average, these children spend 40 minutes a day watching movies at home, with 25% watching videos every day. Video games still seem to start a little later, but by age 4–6, 50% of children play them, and 25% play several times a week or more, with an average time played of a little over an hour per day.

Children and the Natural Environment

Research has recently begun to explore children's relationships to the natural environment. Children under 13 living in the United States reportedly spend on average only about half an hour of unstructured time outdoors each week, consisting of gardening, boating, camping, picnicking, pleasure drives, walking, and hiking (Hofferth & Sandberg, 2001). Bartlett (1997) describes behavioral and emotional problems as a result of lack of opportunity to play outside. Hüttenmoser (1995) found that 5-year-old children, limited in playing outdoors by automobile traffic, exhibited poorer social, behavior, and motor skills and had fewer playmates than children not so limited. Grahn, Mårtensson, Lindblad, Nilsson, and Ekman (1997) found that children attending a day care facility surrounded by orchards, pastures, and woodlands (and where the children went outdoors every day regardless of weather) had better motor coordination and greater attention capacity than did children who attended an urban day care center surrounded by tall buildings. Wells, in one of the few studies to employ a longitudinal design (2000), found that children who moved to housing with more nature nearby tended to have higher levels of cognitive functioning than children who moved to housing with less nature. Taylor, Kuo, and Sullivan (2001) found that activities in green settings tend to lower the symptoms of children with ADD. Taylor, Kuo, and Sullivan (2002) also examined the effect of nearby nature on girls aged 7 to 12 living in Chicago public housing. The relative naturalness of window views was predictive of the girls' self-discipline, as defined by ability to concentrate, inhibit impulses, and delay gratification.

Wells and Evans (2003) interviewed 337 rural third, fourth, and fifth graders to determine whether vegetation near their homes provided a buffer to stressful situations such as family relocation, being picked on or punished at school, or being subject to peer pressure. The children's emotional well-being was assessed by both the children themselves and their parents. Stressful life events had less impact on psychological distress under "high nature" conditions than under "low nature" conditions. This buffering appears to be greatest for those at most risk: those experiencing the highest levels of life stress.

Early TV and ADD

Christakis, Zimmerman, DiGiuseppe, and McCarty (2004) applied logistic regression to the National Longitudinal Survey of Youth, containing data for some 2600 children at ages 1 and 3. The hypothesis tested was that early television viewing (at ages 1 and 3) is associated with attentional problems at age 7. Children watched an average of 2.2 hours (SD: 2.91) of television per day at age 1 and 3.6 hours (SD: 2.94) of television per day at age 3. They corroborated the hypothesis even after controlling for a number of potentially confounding factors, including prenatal substance abuse, gestational age, maternal psychopathology, and socioeconomic status. A 1-SD increase in the number of hours of television watched at either age 1 or age 3 was associated with a 28% increase in the probability of having attentional problems at age 7.

The developmental physiological mechanisms speculated to be responsible relate to the rapid development of the brain in young children. Environmental variables, including visual and auditory experiences, are thought to greatly influence the number and density of neuronal responses (Turner & Greenough, 1985; Greenough, Black, & Wallace, 1987; Wallace, Kilman, Withers, & Greenough, 1992). However, in contrast to the pace with which real life unfolds, television can rapidly portray changing scenes and events. Also, this speed of portrayal is not at all chronologically constant, but rather in itself varies greatly from moment to moment, scene to scene, show to show, movie to movie. Thus, this unevenness and rapidity in depicting the passage of time, during the critical period of synaptic development in early childhood, is speculated to affect the number and density of neuronal responses (Christakis et al., 2004). Though no similar research exists specifically for video games or movies, given their similarity one would be surprised if the same factors did not apply.

Internet and Socialization

One of the major trends in electronic media is the increase in use by children of younger ages. The National Center for Education Statistics (DeBell, 2005) provides a weighted sample representing approximately 58.3 million children age 3 and older in nursery school through the 12th grade in October 2003. A survey of this sample describes the use of computer and Internet technologies by age group: 67 percent of children in nursery school were already computer users, as were 80 percent of those in kindergarten. About one-quarter (23%) of nursery school children were already Internet users, rising to about 32% in kindergarten. By high school, nearly all students (97%) use computers and a large majority (80%) use the Internet (USDE, 2005).

The exponential rise in Internet use over a mere two decades from its initial availability offers little time to study its long-term developmental effects. However, these trends in adult Internet use at home clearly must have direct implications on time spent interacting with children, and indirect implications for parents as role models and gatekeepers of children's recreation choices. Nie and Hillygus (2002a) explore the effects of the Internet on interpersonal communication and sociability, collecting data from time diaries of their subjects. Internet use at home (but not at work) is shown to have a strong negative impact on time spent with friends and family as well as time spent on social activities. Similarly, Internet use during weekend days is more strongly related to decreased time spent with friends and family and on social activities than Internet use during weekdays. The relationship is highly significant: for every hour spent online at home or on the weekend, there is a corresponding 41 minutes less spent with family members ($\beta = -0.69$, t-stat = –6.65, $p < 0.001$). Nie and Hillygus (2002b) refine the parameters of this reallocation: in other words, what activities are affected, rather than in whose company they are performed. Not surprisingly, Internet time seems to be reallocated most from discretionary activities, especially social activities, hobbies, reading for pleasure, and television viewing. However, Internet time is also reallocated from nondiscretionary activities such as housework and childcare, especially by heavy ($\geq$61 minutes/day) Internet users. These findings seem to strongly corroborate the hypothe-

sis that the Internet has created a shift in people's time allocation away from family and friends, and that this loss of time is suffered by a wide spectrum of specific activities.

Kraut et al. (1998) examine the social and psychological impacts of the introduction of the Internet to a household. The behaviors of 169 people in 73 households were tracked over the first 1–2 years of Internet use. Again, greater use of the Internet was associated with declines in communication with family members and in reduced social contact outside the home. In addition, increased Internet usage was associated with increases in loneliness and depression.

Media and Fear

Television and other electronic media probably provide most incidental information about nature (Bixler & Carlisle, 1994). As well as transmitting neutral information about nature, media depiction of nature's hazards can teach fear. Fears of evolutionarily relevant natural dangers such as snakes and spiders seem easier to acquire and harder to extinguish than fear of post-technological dangers such as cars and guns (Heerwagen & Orians, 2002). Children exposed to realistic media depictions of life-threatening events, such as fire and drowning, report feeling more at risk to those events and less likely to engage in activities related to the depicted tragedies (Bixler & Carlisle, 1994). Hence, media depictions of nature tend to focus on and sensationalize nature's hazards, promoting the perception that natural areas are dangerous.

Similarly, for parents, sensationalism in the media has greatly reinforced paranoia over children being abducted while playing outdoors. Finkelhor, Hootaling, and Sedlak (1992) report 200–300 stereotypical criminal child kidnappings per year (approximately 0.00008% of the population), as opposed to the tens of thousands per year suspected in the public imagination. The best inoculation against inaccurate and sensationalized depictions of nature is an accurate frame of reference for nature built from early firsthand experiences (Bixler & Carlisle, 1994).

Children's firsthand experience in natural settings plays an important role in developing environmental attitudes and preferences for nature (Heerwagen & Orians, 2002). Without early and regular exposure to nature, urban dwellers find the unfamiliarity of wilderness settings uncomfortable and overwhelming (Bixler & Carlisle, 1994), preferring built settings to natural environments (Heerwagen & Orians, 2002).

Biophilia must be nurtured to truly take hold (Verbeek & de Waal, 2002). Active behaviors that require direct involvement with live animals, such as fishing, hunting, and bird watching lead to the most consistent environmental attitude and knowledge (Duda et al., 2003). Values such as reverence and respect for nature appear to be derived in part from direct involvement (Matthews & Riley, 1995; Duda et al., 2003).

Conservation and Virtual Nature

One of the most potentially controversial issues pertaining to videophilia is the issue of "virtual nature," here defined as "nature experienced vicariously through elec-

tronic means." What are the costs? What are the benefits? For there are indeed (at least in theory) benefits. Certainly, the Internet has provided unprecedented access to natural areas for many people. From a viewpoint solely focused on *Homo sapiens*, some of the relaxing and educational aspects of nature can in fact be delivered through vicarious experience (Ulrich, 1993; Levi & Kocher, 1999) on a video screen, or as technology advances, through a virtual reality space. An example is the National Park Service webcam showing Old Faithful in Yellowstone National Park (National Park Service, 2006). In particular, children, not able to travel to the Amazon rainforest or Old Faithful on their own, can do so online without the need for a car, plane, or parent. Bugs, snakes, spiders, predators, and pests can all be left behind in virtual nature. There is even a little something for conservationists: endangered species and sensitive sites can be visited with little or no impact on habitat via webcam, and there is greatly reduced maintenance of natural areas when they do not have any real visitors. Lastly, whether or not we believe in the potential benefits of videophilia to conservation, we must unfortunately at least admit the possibility that the very strong current increase in videophilia (Pergams & Zaradic, 2006a) is a juggernaut in whose way we cannot stand. This might leave virtual nature as the best related conservation option.

The potential costs of virtual nature to conservation are, of course, huge, and may be compounded in future generations. Environmental awareness, primarily nurtured through parents and adult mentors while outdoors (Chawla, 1998), may be the cost of replacing real nature with virtual nature, and this possibility should not be underestimated. Moreover, today's children are tomorrow's parents, but potentially with greatly decreased connection to nature. If children experience Old Faithful primarily through a webcam, where is the nurturing connection that in the past was provided by the sharing the experience with family or an adult mentor? If parents and children are sharing the experience of virtual nature, will the nurturing connection be to the subject matter (nature) or to the media (the virtual experience)? From a conservation context, will they still go to see it in real life? Will they still pay their tax dollars to maintain Yellowstone?

Lacking direct experience of our natural environment, we lack the most immediate feedback of our impact on nature. When experiencing nature vicariously, we may not be aware of the sensory experiences we are missing through the virtual medium, but the real nature we leave outside continues to receive the footprint of our presence on the planet. If we spend our recreational time on virtual tours, do we still pick up litter at our local parks? Or do we opt for solutions consistent with our simulated experience of nature? In Los Angeles, it was proposed to replace highway median plantings with plastic trees, rather than to deal with the larger issue of air pollution (Levi & Kocher, 1999). In the long run, spending less time in real nature seems likely to speed the onset of environmental generational amnesia. This psychological phenomenon, described by Kahn (2002), is the tendency for each generation in its youth to take the existing environmental conditions as normal, even though with each ensuing generation the amount of environmental degradation increases.

If we generationally redefine normal conditions, we might well increasingly use experiences of vicarious nature as our benchmark rather than the local environment. A study of the effects of simulated experience through commercially available nature images suggests this type of vicarious contact with spectacular natural environments

increases support for national parks and forests, but decreased support for preservation and acquisition of local natural areas (Levi & Kocher, 1999). Thus, vicarious nature experiences tend to sensationalize nature's spectacular habitats, generating the perception that local natural areas are relatively lackluster.

Given that the frequency of direct contact with nature depends on local availability (particularly for children, due to their dependence on caregivers for access), the devaluing of local natural areas as compared to sensationalized virtual views of nature seems likely to further reduce direct experiences, and perforce increase our reliance on vicarious nature experiences. Moreover, the recent decline in per capita visits to national parks (Pergams, Czech, Haney, & Nyberg, 2004; Pergams & Zaradic, 2006a) suggests that although vicarious exposure to spectacular habitats may increase the perceived value of national parks, this increased value does not translate to increased direct experiences. In fact, the results of our research suggest just the opposite, that increased use of virtual electronic media is significantly correlated with decreased direct experiences with national parks (Pergams & Zaradic, 2006b). Concurrent with the almost 25% decline in national park visits, Internet use increased from none in 1987 to a per person annual average of 174 hours by 2003 and average overall annual electronic media use (i.e., home movies, theatre movies, video games, and Internet use) rose by an average of 327 hours per person (Pergams & Zaradic, 2006a). Thus virtual access to nature is, in our data, already very strongly associated with loss of direct contact with actual nature. In other words, visiting Old Faithful on the web more seems to result in visiting Old Faithful in person less.

Conclusion

Direct experience with nature is the most highly cited influence on environmental attitude and conservation activism. Yet our research suggests a trend away from interactions with nature and a concurrent rise in videophilia, the new human tendency to focus on sedentary activities involving electronic media. Videophilia has both direct and indirect implications for childhood development and the future of conservation.

Most directly, increasing videophilia has been implicated to yield negative psychological and physical effects. Some of the negative effects are linked to the sedentary nature of videophilia and reduced time available for outdoor physical activities and nature experiences. Conversely, outdoor play and nature experience have proven beneficial for cognitive functioning, reduction in symptoms of ADD, increase in self discipline, and emotional well being at all developmental stages. Other detrimental effects of videophilia seem to be more related to its potential for isolation and much faster pace than real time. High levels of children's electronic media consumption are correlated with attentional problems and increases in loneliness and depression.

Potentially more complex are the implications of virtual nature. Virtual nature, here defined as "nature experienced vicariously through electronic means," has some potential benefits, particularly for children who are dependent on adults for access to many natural areas. Although a sedentary, videophilic outlet, the Internet provides unprecedented access for children to natural areas, delivering some of the relaxing

and educational aspects of nature vicariously. Yet, given increasing Internet use by younger children, virtual nature appears to directly compete with time previously allocated to the more beneficial, direct contact with the outdoors. In addition, virtual nature experiences may further discourage direct contact with local nature by sensationalizing nature's hazards and habitats, generating the perception that local natural areas are simultaneously both dangerous and lackluster.

Ultimately, to more conclusively resolve the long-term impact of videophilia, further research is needed to answer the questions of exactly what videophilia means to a) children's development, b) their success and happiness as adults, and c) specifically, their environmental consciousness. We propose the initiation of a large-scale longitudinal study to determine the effects of videophilia on children's development and future outcomes. Such research would follow controlled groups of children from birth to adulthood, and quantify differences in as many areas as possible, correlated to exposure to nature and/or videophilia. Physical and mental health, educational achievement, career choices, and economic success as adults, would all be among areas considered in addition to environmental awareness. The proposed research would require the cooperation of a number of experts from a wide variety of fields. As daunting as the proposal might seem, children are already exposed, at earlier and earlier developmental stages, to an uncontrolled videophilia treatment. More daunting is the prospect of today's children (tomorrow's parents) in a culture devoid of contact with the evolutionary driver and life-support system that is our natural world.

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Comment on "Videophilia"

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We who grew up in earlier decades, who played outdoors with friends after school, lay on the grass and identified shapes in clouds, slept under the stars in the back yard, walked to school, read books for pleasure, made things for play without the use of kits, waded in nearby creeks in summer and ice-skated on local lakes in winter, may sometimes wonder whether our misgivings about children's pastimes today are perhaps just old fogeyish or simple nostalgia for our own lost youth. However, Zaradic and Pergams, like others, provide empirical evidence that the sedentary, indoor, electronic-centered occupations of most children today have physical, social, and environmental consequences that are not in the best interests of young people or the societies they will one day inherit.

Although not quantitative, my ethological studies of the origin and functions of the arts in human evolution provide a perhaps unfamiliar but interesting perspective on the effects of videophilia in children. Ethologists tell us that the behavior and psychology of an animal are as much a product of its environment and way of life as its anatomy and physiology. For example, caribou and reindeer live on open plains, are exposed to predators, and have evolved to graze in large herds. Forest-dwelling roe deer, however, move around alone and browse inconspicuously in well-spaced, defended territories (Eisenberg, 1981, pp. 200–201). As a result of millions of generations of biological adaptations for a particular ecological niche and way of life, caribou psychology is as ill-equipped for solitude as is the roe deer's for togetherness.

If we think of ourselves as animals whose psychology evolved to operate in a particular way of life, what might this fact contribute to a discussion of the consequences of videophilia on the young human mind? Whether we think of human evolution as beginning with the first upright hominids of five million years ago, the earliest representatives of our genus *Homo* some two million years ago, or behaviorally modern humans who lived after 100 thousand years ago, it is clear that twenty-first century human life *style* differs enormously in most respects from that of our ancestors and is unprecedented. Yet human *psychology* is arguably little changed.

Even though hominids left Africa and settled in widely diverse habitats that required diverse material cultures, they did not relinquish the emotional needs and psychological satisfactions of their hunter-gatherer (or "small-scale") way of life. Human psychology evolved over hundreds of thousands of generations to find such a life satisfying. Being carried around as infants on our mothers' bodies; growing up in a small

group of like-minded others of all ages; learning to make the artifacts necessary for subsistence (from tools to shelter to clothing) and to do what was needful (hunt, trap, fish, prepare food, make and keep fire) with our own hands and bodies, using the materials of the natural world; socializing with our fellows and demonstrating with them in participative ceremonies a shared system of beliefs—these are the behaviors that an ethologist from Mars would have recorded as characteristic of our species until the invention of agriculture made possible much larger, stratified, settled societies.

Surely these are behaviors that our cognition and emotions have evolved to find appealing, satisfying, and meaningful. I have no doubt that such lives would have seemed full and rewarding. Had our ancestors not felt that way, had they all been depressed and alienated, we would not be here today. And I think it is fair to say that humans today still have a Pleistocene psychology. Looking at a timeline of life on earth, on which five million years of human evolution is only a few seconds before midnight of a 24-hour day (Potts, 1996, p. 6), modern (post-agricultural or post-Enlightenment) life is itself only a nanosecond of those few seconds. There simply has not been enough time for the fundamental emotional needs and predilections acquired during our lives as hunter-gatherers to have changed very significantly.

To be sure, adaptability is in itself one of humankind's prominent adaptations. Wherever children grow up and in whatever time period, their dexterous hands want to handle and manipulate—whether mud, fibers, and rocks or dials, knobs, and electronic buttons. Curious young minds, ready to participate and learn, are sure to be attracted by fast-moving colorful action, excitement, adventure, violence, and competition—whether in stories told or read aloud by elders or on a computer or TV screen. Can't we say that the toys of twenty-first century life are just a new variation on the old "let's have fun and learn" theme?

Pioneer art therapist Edith Kramer reports that in her long career of working with hospitalized children, the use of art materials with a real person easily out-competed television for their interest (Williams, Kramer, Henley, & Gerity, 1997). But she found that with the availability of video games, children no longer preferred art making. She describes an important psychological as well as physical difference between the two. Although video games may satisfy a need for mastery, they do so without the benefits of the lessons of *real* hands-on play, action, and adventure in an actual social and natural environment. Pressing keys or clicking a mouse is not like building or making real things. Real materials, says Kramer, may resist as well as obey. Handling them generates a kind of body-mind interaction that is not found in computer art.

Zaradic and Pergams mention that videophilia easily fosters a reduction in physical activity. Equally detrimental is the loss of human *inter*activity, which is a vital psychological and emotional need from birth. Human infants, born "natural," immediately show their preparedness to become cultural beings. Newborns are ready to interact socially, preferring human faces and voices to any other sight or sound. Babies are imitative, ready to copy what others do—from early facial expressions and the sounds of language to the gestures and actions of the people around them. Through play and watching what other children and adults do, they acquire the manipulative, physical, cognitive, and social skills that their lives will eventually require. They wish to please others and be accepted by them.

In his landmark work, building on studies by Daniel Stern, Colwyn Trevarthen, and others, Allan Schore presents evidence from many disciplines that caretaker-infant interaction, based on face-to-face visual-vocal communication with mutual gaze, critically influences the development of the infant brain (Schore, 1994). Such interaction is essential to the child's future capacity to self-regulate emotions, to appraise others' emotional states, and to manage stress. Later social interaction with family and peers builds on infant interactivity and intersubjectivity and helps them to develop. Electronic communication, although interactive, remains cognitive and disembodied—the opposite of two people face-to-face. Studies of mother-infant interactions have shown that as early as 8 weeks of age, infants expect their mothers to respond to their own visual, vocal, and kinetic behaviors contingently—that is, in fractions of a second (Beebe, 1982; Murray & Trevarthen, 1985; Nadel et al., 1999). An electronic image may respond to a finger click but not to a small change in facial musculature, vocal sound, or head movement. Coordinating body movements and vocalizations with others has been a time-honored way of building emotional rapport and one-heartedness—from mother-infant play to the ritual ceremonies of the Pleistocene to folk dances and gospel choirs of today. Understanding that humans evolved with the readiness—nay, the emotional need—to interact face-to-face with other people, to handle natural materials, to make and use things for their lives, and to sing and dance in groups is further indication that it is not only the natural environment but the natural human social world that is in danger of virtualization from videophilia.

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