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## **Coping with Poverty: Impacts of Environment and Attention in the Inner City**

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## COPING WITH POVERTY

### Impacts of Environment and Attention in the Inner City

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**ABSTRACT:** Considerable evidence suggests that exposure to “green” environments can enhance human effectiveness and make life’s demands seem manageable. Does this phenomenon extend to poor inner cities, where green space is minimal and life’s demands may be overwhelming? In 145 urban public housing residents randomly assigned to buildings with and without nearby nature, attentional functioning and effectiveness in managing major life issues were compared. Residents living in buildings without nearby trees and grass reported more procrastination in facing their major issues and assessed their issues as more severe, less soluble, and more long-standing than did their counterparts living in greener surroundings. Mediation tests and extensive tests for possible confounds supported the attention restoration hypothesis—that green space enhances residents’ effectiveness by reducing mental fatigue. These findings suggest that urban public housing environments could be configured to enhance residents’ psychological resources for coping with poverty.

Whether ‘tis nobler . . . to suffer the slings and arrows of outrageous fortune,  
Or to take arms against a sea of troubles, and by opposing, end them.  
To die, to sleep . . . to sleep, perchance to dream.

*Hamlet, Act III, scene i*

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Urban public housing residents face a sea of troubles—an array of troubles sufficient to cause despair, hopelessness, and resignation. And yet without the hopefulness and energy to tackle these troubles, residents are doomed to remain in a course of continued or deepening poverty. As state and federal funding for entitlements reaches new lows in the United States, there is an urgent need to find low-cost ways of helping poor families become self-sufficient. Do environmental designers and environmental design researchers have anything to contribute? Are there changes to the physical environment of public housing that could help give residents the strength to “take arms” against their troubles, and by opposing, potentially end them?

This study examines whether the presence of nearby nature might lend urban public housing residents the psychological resources to grapple with the challenges facing them. More specifically, it examines whether natural elements in the public housing outdoor environment—trees and grass—can assist in restoring the very psychological resources likely to be depleted in the struggle against poverty.

Does the presence of trees and grass outside a public housing apartment building affect residents’ capacity to tackle the critical issues in their lives? Both theory and evidence on the relationship between contact with nature and effective functioning suggest it might.

#### PREVIOUS WORK ON CONTACT WITH NATURE AND EFFECTIVE LIFE FUNCTIONING

Reports of the rejuvenating, invigorating effects of spending time in natural settings have arisen in the writings of philosophers (e.g., Thoreau, 1892/1995), naturalists (e.g., Leopold, 1949), landscape architects (e.g., Olmsted, 1865/1968), and urban participants of Outdoor Challenge programs (see R. Kaplan, 1984). Attention Restoration Theory (Kaplan, 1995) provides a potential explanation for why contact with nature might have a rejuvenating effect, resulting in renewed effectiveness.

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*Attention Restoration Theory.* Kaplan notes that many settings, stimuli, and tasks in modern life draw on a critical resource for effective functioning: the capacity to deliberately direct attention, or pay attention. The information-processing demands of everyday life—traffic, phones, conversations, problems at work, and complex decisions—all take their toll, resulting in mental fatigue. In contrast, natural settings and stimuli such as landscapes and animals seem to effortlessly engage our attention, allowing us to attend without paying attention. For this and a number of other reasons (see Kaplan, 1995), nature provides a respite from deliberately directing one's attention. As a consequence, Kaplan suggests, time spent in nature allows us to recover from mental fatigue and leaves us with enhanced effectiveness and a sense of rejuvenation.

*Empirical work.* A review of the literature reveals 16 studies bearing on these proposed effects. In 14 of these 16, one or more of the predicted effects was statistically significant. Chronologically, these are Kaplan (1984); Mang (1984), described in Study 1 of Hartig, Mang, and Evans (1991); Cimprich (1990), described in Cimprich (1993); Hartig (1990), described in Study 2 of Hartig et al. (1991); Canin (1991); Gilker (1992), described in Tennessen and Cimprich (1995); two studies in Kaplan (1993); Macdonald (1994); the first study in Hartig, Boeoeck, Garvill, Olsson, and Gaerling (1996); Lohr, Pearson-Mims, and Goodwin (1996); Ovitt (1996); Miles, Sullivan, and Kuo (1998); Taylor, Kuo, and Sullivan (2001; this issue); and Taylor, Wiley, Kuo, and Sullivan, 1998.

One of the compelling features of this body of work is the persistence of positive findings in spite of low power. Of the 14 studies with positive findings, few involve strong manipulations: Only 5 involve extended exposure (> 30 min) to a truly natural setting, and 5 studies involve surrogates of nature (e.g., pictures, views, interior plants). Most (10) of the studies involve field settings in which there was no experimenter control over conditions. Although the use of such settings has the benefit of strengthening external validity and generalizability, the lack of control in such settings also increases within-condition variability, decreasing power. And finally, almost half of these studies employ relatively small samples, with condition *n*s as low as 13 to 20 in 3 studies and 9 to 12 in 3 others. Each of these factors—weak manipulations, lack of experimental control, and small sample sizes—undermines the capacity to detect effects of nature. Under these conditions, the presence of null findings is unsurprising, and the persistence of positive findings may point to a large, robust effect. According to the principles for calculating power (Howell, 1982), studies with high within-condition

variability and low sample size will only reliably find effects if the effect size is large.

The diversity of methodologies employed in these studies makes the persistence of positive findings particularly compelling. Correlational, quasi-experimental, and experimental designs have been employed; comparisons have been made both within and between subjects; and comparisons have been made along different dimensions (e.g., naturalness of setting, frequency of contact with nature, total time spent in nature). Because different research designs guard against different confounding variables, the variety of research designs in this body of work helps offset the frequent lack of experimental control, strengthening the case for internal validity.

The diversity of operational definitions employed in this body of studies also speaks to the generalizability of these findings. The independent variable, nature, has been examined in a wide range of forms, including wilderness, urban parks, views of urban nature, interior plants, and images of nature. Outcome measures have been similarly diverse. Exposure to nature has yielded reliably superior performance on objective measures ranging from standard neuropsychological measures of attention to simple laboratory tests of cognition and "real world" cognitive tasks such as proofreading. Positive findings have also been obtained with a variety of self-report measures indexing attention, effectiveness, and effectiveness-related constructs (e.g., job strain).

Nonetheless, it should be noted that 2 of the 15 studies depart from the pattern of significant positive findings. One study found a systematic negative relationship between nature and effectiveness (Larsen, Adams, Deal, Kweon, & Tyler, 1998), and another obtained only null findings (Study 2 in Hartig et al., 1996). Although it is unclear at present how the anomalous negative finding might be explained, the null finding might be attributed to the small sample size (9 *Ps* per condition) and weak manipulation employed (12 minutes of nature or urban slides, interspersed with questions about the slide-viewing conditions).

On the whole, then, the empirical literature to date provides reasonable confidence in the restorative effects of nature on attention and effectiveness. The phenomena that Thoreau, Leopold, and Olmsted observed appear to be systematic. Moreover, the empirical literature suggests that the rejuvenating effect of nature extends to far less "pure" forms of nature than wilderness and that it results in systematically greater effectiveness on a wide variety of tasks. Thus, the previous work on contact with nature and effectiveness raises the hopeful possibility that, in poor inner-city neighborhoods, the availability of even relatively weak forms of nature could enhance residents' effectiveness in the tasks they face.

**CONTRIBUTIONS OF THIS STUDY**

This study tests whether the availability of green views and nearby green spaces in poor inner-city neighborhoods enhances residents' effectiveness in coping with poverty. In doing so, it helps address three basic challenges in the study of nature and effectiveness.

One basic challenge in the research on nature and effectiveness is to determine which forms or doses of nature enhance effectiveness and which do not. For example, do desert landscapes have an effect? vest pocket parks? nature sounds? Is a 5-minute exposure enough? This study examines whether very low doses of residential nature are sufficient to produce detectable enhancements in effectiveness. By examining very low levels of nature, this study may help establish the lower limits of the nature-effectiveness dose-response curve. And by examining residential nature, this study may help establish the extent to which the effects of nature on performance are subject to habituation: That is, does the effect of a given nature stimulus wear off with repeated or continued exposure? If so, everyday forms of nature (e.g., residential and workplace nature) are likely to be most susceptible to habituation.

A second basic challenge in the research on nature and effectiveness is to identify the mechanism(s) underlying the nature-effectiveness relationship. For example, is effectiveness enhanced through attention? arousal? positive affect? some combination of these factors? Previous studies have shown that nature is reliably associated with both enhanced attentional functioning (as measured by laboratory and standard neurocognitive measures of attention) and enhanced everyday functioning, but they have left open the question of whether these are actually independent benefits. This study uses mediation testing (Baron & Kenny, 1986) to more closely examine whether the effects of nature on life functioning can be attributed to its effects on attention; such testing also helps address the question of whether the link between nature and effectiveness is causal.

A third basic challenge in the research on nature and effectiveness is to identify the tasks or performance domains enhanced by exposure to nature—to delineate nature's sphere of influence. For example, does contact with nature enhance performance in sports requiring concentration? Scholastic Aptitude Test scores? Social functioning? Previous research on nature and effectiveness has focused on what might be termed "everyday cognition" or "day-to-day effectiveness": the individual's effectiveness in managing the myriad small tasks and challenges of everyday existence (e.g., proofreading some writing, organizing one's day, deciding what to make for dinner). This study examines whether nature's impact extends to the management of the

most important issues in an individual's life, such as deciding whether to pursue a master's degree and finding employment.

The potential costs of an individual failing to address the major issues and challenges in his or her life are the stuff of tragedy: important problems and decisions deferred, major opportunities lost, central problems rendered increasingly intractable through neglect. To the extent that facing and dealing with one's major life issues draws on attentional resources, attentional fatigue may lead to neglect and ineffectiveness in the management of one's life course. By the same token, attentional restoration might enhance the management of one's life course. Hence, it seems valuable to determine whether nature's restorative powers extend to the domain of major life-issues management. For individuals who live in urban public housing and whose major challenges are likely to include unemployment and inadequate education, the consequence of failing to address "the big picture" may be continued and deepening poverty, at immense cost to themselves, their families, and society.

*Summary.* Three hypotheses were central in this study:

*Hypothesis 1:* The capacity to deliberately direct attention is important not only for day-to-day functioning but for the management of major life issues.

*Hypothesis 2:* Relatively low levels of nearby vegetation are sufficient to reduce attentional fatigue.

*Hypothesis 3:* By reducing attentional fatigue, the presence of nearby vegetation enhances the management of major life issues.

To test these hypotheses, structured interviews and attentional tests were conducted with urban public housing residents. Attentional performance and self-reports of effective major issues management were then compared for residents living in buildings with relatively high versus relatively low levels of nearby nature.

## METHOD

The data presented here were collected as part of the *Coping with Poverty* archive, a multistudy research effort examining the effects of the physical environment on the functioning of individuals, families, and communities residing in urban public housing.



**Figure 1: Attrition Has Left Some Buildings Surrounded Almost Entirely by Concrete and Asphalt and Others With Pockets of Green**

**THE SITE: A NATURAL EXPERIMENT ON THE EFFECTS OF NEARBY NATURE**

Robert Taylor Homes (RTH) in Chicago, Illinois, meets a rare combination of methodological requirements for studying the effects of nearby nature. In essence, RTH constitutes a naturally occurring field experiment on the effects of residential vegetation, with random assignment of individuals to vegetation conditions and a host of environmental and social variables held constant.

First, whereas the amount of vegetation in neighborhood common spaces at RTH varies considerably from building to building, the high-rise buildings are identical in architecture and share a single 3-mile corridor (see Figure 1). Thus, RTH is distinct from most communities, in which vegetation is confounded with physical environmental factors related to income. At RTH, such physical factors as building size, building layout, the number of residential units in a building, and building location are not only unconfounded with vegetation but also held constant, removing several important sources of extraneous variability.

Second, public housing policies result in random assignment of residents with respect to levels of nearby nature. Although urban public housing applicants can specify their choice of development, they have little choice of where they will be assigned within a development. To examine whether self-selection might play a role in the assignment of residents to levels of nearby nature at RTH, participants were asked what criteria were important to them in choosing a place to live: Of 118 responses, 93% were clearly unrelated to levels of vegetation.<sup>1</sup> About 7% of the responses referred to criteria that might indirectly be related to levels of vegetation (e.g., location, neighborhood, area, environment), and one participant (of the 145) specifically reported that natural setting was important to her in choosing a place to live; however,



analyses indicate that these participants lived in no greener areas, on average, than the remainder of the participants in this study. Thus, the level of nearby nature does not seem to be an important criterion in residents' selection of apartments within RTH; moreover, it appears that the level of choice residents have in selecting an apartment is sufficiently low that even residents who might strongly value access to nature are no more likely to be assigned to a green area.

Third, residents have little role in the landscaping outside their building. When RTH was originally built in the 1960s, trees and grass were planted around each of the 28 high-rise buildings. Over time, the majority of these green spaces have been paved in an effort to keep dust down and maintenance costs low; this paving has killed many of the original trees, leaving some buildings with completely barren common spaces, others with a few scattered trees, and still others with leftover pockets of green. Ongoing landscape maintenance at RTH is handled entirely by a small landscaping crew serving all of the developments managed by the Chicago Housing Authority; residents are not involved in maintenance, and funds are inadequate to fulfill special requests from residents. Thus, a relationship between greenness of common spaces and effective functioning in this setting cannot be explained by a process in which especially effective residents have made their surroundings greener.

Finally, RTH residents constitute a strikingly homogeneous population with respect to many of the individual characteristics that might be expected to affect effective life functioning: income, education, life circumstances, and perhaps most important, economic opportunities. This, again, decreases sources of extraneous variability, increasing the power to detect variability associated with differences in the physical environment.

#### PROCEDURE, PARTICIPANTS, AND DESIGN

To maximize participants' ease in responding, interviewers were selected to be as similar to interviewees as possible. Three African American woman residents of RTH were hired and trained to conduct the recruitment, interviewing, and testing for this research. All three were long-time residents of RTH (19 years or more) and resided in buildings outside the study sample. Thus, interviewers were matched to interviewees in race, gender, socioeconomic status, life circumstances, background, and such subtleties as patterns of speech and dress.

In preparation for interviewing and testing, interviewers completed extensive training (50 hours of general training in interview methods, 12 hours learning the specific interview measures used, and 14 hours of supervised

and unsupervised practice in performing practice interviews). In addition, an on-site research supervisor met regularly with the interviewers to review procedures and address any difficulties or questions. Interviewers did not interview individuals with whom they were previously familiar, and interviewers were counterbalanced for nature condition.

Recruitment was conducted door-to-door in buildings spanning the range of vegetation of RTH. Sampling was restricted to 18 buildings; the 10 buildings adjacent to parks, police stations, and other relatively unique features were excluded to minimize effects of extraneous factors on residents' access to nearby nature. Within buildings, sampling was restricted to apartments on Floors 2 through 4, where residents' had maximum physical and visual access to the trees outside their building (there are no residences on the first floor).

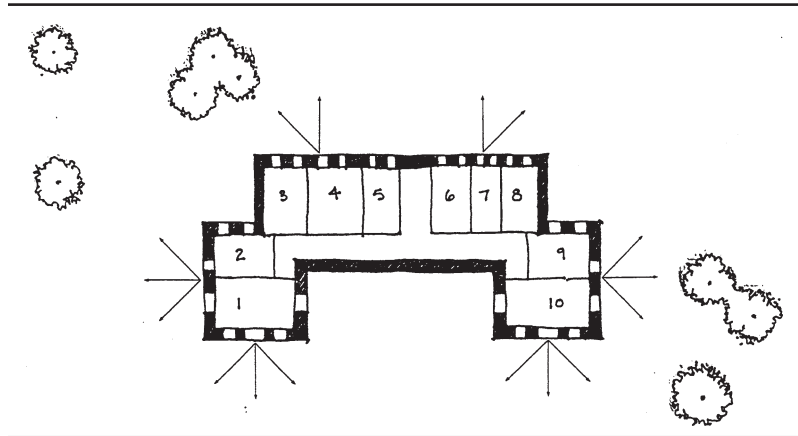
Recruitment criteria included not only environmental factors but resident characteristics. To examine the life functioning of residents with the greatest responsibilities, recruitment focused on heads of household younger than 65. Because official adult residents in urban public housing are predominately female (80% in RTH; Chicago Housing Authority, 1995), recruitment focused on female heads of household. Residents who fit these criteria were invited to participate in a University of Illinois study about life at RTH. Participants were told that they could refuse to answer any question, that they could stop the interview at any time, and that they would receive \$10 on completion of the interview.

Of the 158 qualified residents invited to participate, 92% chose to do so, yielding a final sample of 145 residents, 69 with relatively low levels of nearby nature and 76 with relatively high levels of nearby nature. The composite participant profile is that of a 34-year-old African American single woman with a high school or equivalency diploma, raising three children on an annual household income less than \$10,000.

Individual interviews were conducted during summer and fall months in participants' apartments. Residents' attentional capacity, life functioning, and a number of control variables likely to be associated with life functioning were assessed as part of a 45-minute structured interview.

## MEASURES

*Nearby nature.* Levels of nearby nature were assessed using standardized sets of photographs and multiple independent raters. For each of the 18 buildings to be sampled, a standardized set of photographs was taken of the area immediately surrounding the building—as Figure 2 shows, each standardized set comprises 16 photographs showing views from 16 specified vantage



**Figure 2: Plan View of an Apartment Building at Robert Taylor Homes With Nearby Trees**

NOTE: The numbers within the building indicate apartments. The arrows indicate the position from which photographs were taken (for each building), photos that were then rated by 22 independent raters. Note that despite the presence of trees outside a building, residents in particular apartments may have little or no visual access to trees.

points. Then, 22 undergraduate and graduate students in horticulture independently rated levels of nearby nature in each of the 18 sets of photographs (1 rating per set of 16 photographs, for a total of 18 ratings per observer); their ratings were averaged to produce a summary Greenness Rating for each building. Greenness Ratings for the 18 buildings ranged from 0.8 to 3.6 on a response scale from 0 to 4 (0 = *not at all green*, 1 = *a little green*, 2 = *somewhat green*, 3 = *quite green*, 4 = *very green*).

With these data, agreement between raters is analogous to the reliability of items in a scale; the hope is that different raters will respond to a particular building in a similar fashion. Thus, to assess interrater agreement, a Cronbach's alpha was calculated, with individual raters treated as individual items in a scale and individual buildings treated as individual respondents. This procedure yielded an alpha of .97, indicating a high level of agreement between raters with regard to building greenness.

Greenness Ratings were used as the basis for assignment to two conditions.<sup>2</sup> Buildings whose ratings fell below the midpoint of the range were designated *Barren*; buildings whose ratings were at or above the midpoint were designated *Green*. Greenness Ratings for the 7 buildings in the Barren condition ranged from 0.8 to 1.7, with a mean of 1.2. Greenness Ratings for the 11 buildings in the Green condition ranged from 2.0 to 3.6, with a mean of 2.6. In interpreting the condition labels, it should be noted that none of the buildings

were completely barren (having a 0 Greenness Rating). It should also be noted that because raters were encouraged to use the entire response scale, even a high greenness rating of 3.6, or *very green*, is relative to the range of vegetation at RTH—and even the greenest pockets at RTH contain only grass and a small number of trees. Nonetheless, within the context of RTH, the labels Barren and Green seem appropriate characterizations of the two conditions (see Figure 1).

*Attentional capacity.* The capacity for directed attention was assessed with the Digit Span Backwards (DSB) test. DSB is a standardized neurocognitive measure and is used in the measurement of attentional fatigue (Cimprich, 1990; Schwartz, 1994; Tennessen & Cimprich, 1995) as well as in the clinical measurement of attention (Lezak, 1983; Mesulam, 1985). DSB is particularly useful for field settings because it is easy to administer: The administrator reads aloud a series of digits (e.g., 2 . . . 5 . . . 1), and participants are asked to repeat back the series in reverse order (e.g., 1 . . . 5 . . . 2). Series are administered in increasing length; if a participant fails a series of a given length, a second series of equal length is administered. Scoring was based on the longest series performed correctly within two attempts.

*Life functioning.* For the purpose of assessing the management of major life issues, a new instrument was developed. This instrument was modeled closely on Little's (1983) Personal Projects methodology, in which participants first list their personal projects and then assess or characterize those projects in a series of Likert-style items. The content and wording of items in this instrument were first based on similar items in Little's instrument, then refined through extensive discussion with resident interviewers and pretesting with residents.

This instrument begins with the participants' identification of their most important issues. Three categories of issues are assessed: Major Goals, Major Problems, and Major Decisions. For example, to elicit Major Goals, participants are told,

This set of questions is about the kinds of goals that you may have for yourself or your family. Where would you like to be in 5 years, or 10 years? What would you like to accomplish? What do you want to make happen in your life?

Participants are then asked to list some of their major goals and, of the goals listed, to nominate the two most important goals. For each of the two most important goals, participants rate their overall importance on a 0 to 4 scale

**TABLE 1**  
**Ineffective Management of Major Issues Scale**

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Difficulty	How difficult or challenging is [this issue]?
	How hopeless do you feel about [this issue]?
Neglect	Have you found that you have been putting off working on this goal?
	Has delaying working on this goal cost you in some ways?
	Do you feel you could take a more active role in trying to achieve this goal?
	How much have you been putting this decision off?
	[In this decision] how inclined do you feel to just go with the option that requires the least thought?
	Has delaying this decision cost you in some ways?
Length	For how much time has [this issue] been a problem or worry for you now?
Severity	How serious are the consequences if this issue isn't resolved?
	How serious are the impacts of it right now in your everyday life?
	How important is it that this issue be resolved in the very near future?

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NOTE: Each item is asked with respect to two major issues.

(0 = *not at all*, 1 = *a little*, 2 = *a medium amount*, 3 = *quite*, and 4 = *very*). Participants' effectiveness in managing these issues is then assessed in additional items using the same scale. An analogous procedure is used in eliciting and assessing Major Problems and Major Decisions.

Table 1 presents the items used in assessing participants' effectiveness in managing major life issues, the Ineffective Management of Major Issues (IMMI) Scale. The IMMI consists of 24 items; 12 items are asked first in reference to the respondent's most important issue, then in reference to their second-most important issue. Four specific topics are probed: the perceived difficulty of participants' most important life issues, participants' neglect of those issues, the length of time these issues have been of concern, and the current state or severity of the issues. The Difficulty, Length, and Severity subscales assess coping outcomes; the Neglect subscale assesses coping behavior likely to lead to poor long-run outcomes (see Suls & Fletcher, 1985, for a meta-analysis showing the long-term costs of avoidant coping).

A number of initial analyses provide some confidence in the reliability and validity of this new measure. First, the IMMI has an alpha of .81, comparable or superior to the reliabilities reported for the vast majority of instruments designed to measure coping (for reviews, see Latack & Havlovic, 1992; Parker & Endler, 1992).

Second, intercorrelations between subscales revealed a coherent, sensible pattern of relationship between the various subscales. The Length of major

**TABLE 2**  
**Importance of Major Life Issues**

	<i>Goal</i>		<i>Decision</i>		<i>Problem</i>	
	M	SD	M	SD	M	SD
Most important	3.72	.56	3.80	.53	3.74	.59
Second-most important	3.63	.58	3.66	.61	3.56	.69

0-4 scale: 0 = not at all important to 4 very important.

issues was related to their Severity ( $r = .51, p < .0001$ ), and problems judged to be more difficult were also reported to be more long-standing ( $r = .53, p < .0001$ ) and more severe ( $r = .49, p < .0001$ ). Furthermore, the more difficult a respondent found her major issues to be, the more she tended to neglect them ( $r = .18, p = .03$ ). Finally, there was some suggestion that the more a participant neglected her major issues, the more long-standing her issues were ( $r = .17, p = .06$ ) and the more severe their current state ( $r = .14, p = .11$ ). That the patterns of relationship between the subscales are sensible lends some degree of assurance that the items may have been successful in tapping into their intended constructs.

Finally, the importance ratings for the most important problems and decisions follow sensible patterns. As can be seen in Table 2, mean importance ratings were at or near ceiling, and standard deviations were small, suggesting that the issues rated were, indeed, very important issues in residents' lives and consistently so. On average, the most important issue was rated more important than the second-most important issue, paired  $t(144) = 3.61, p = .0004$ . The test-retest reliability of IMMI remains to be determined; however, the data available thus far suggest that the IMMI is a valid and reliable scale tapping into respondents' most important life issues.

*Other factors likely to affect life functioning.* So that potential confounds might be identified and statistically controlled, a number of extraneous variables likely to be related to nearby nature, attention, or life functioning were assessed through self-report. These included participants' age, marital status, education, employment, income, household size, number of children, years in current apartment, years in public housing, importance of nearby nature or views in selecting an apartment, health, stress, mood, social integration, use of tobacco, use of alcohol, use of prescription drugs, and use of other drugs.

In addition, interview, household, and participant characteristics that might affect measures of attention or life functioning were assessed by the interviewers. These included the number of interruptions, level of background noise, level of privacy, and the participants' comfort in talking. Each

of these variables was rated on a 0 to 4 scale (0 = *not at all*, 1 = *a little*, 2 = *a medium amount*, 3 = *quite a lot*, 4 = *very much*).

## RESULTS

Results are presented in four subsections. First, the major life issues in participants' lives are characterized. Second, attentional capacity and management of major issues in this sample are characterized. Third, the central hypotheses are tested. And finally, a series of analyses explore a number of alternative explanations for the central findings.

### MAJOR ISSUES IN THE LIVES OF INNER-CITY PUBLIC HOUSING RESIDENTS

Frequency analyses of participants' most important goals, problems, and decisions provide a sense for the most common major challenges these individuals face. Although there was by no means complete uniformity in the issues reported across individuals, a few issues emerged repeatedly.

Among participants' most important goals, the most commonly reported were to get a job or to get some specific type of job (31%), to move out (25%), and to go to school or to go back to school (12%). An additional 11% of goals reported were goals that participants had for their children or families. Typical goals included getting a job, to be a kindergarten teacher, employment, moving out of projects, saving money to move, move out of the development, starting school in the fall, going back to school for GED, education, sending daughter to school, arranging day care for child, and better life for grandson.

In the collection of participants' most important "problems, worries, and concerns," the most commonly mentioned were parenting problems, money-related problems, and safety-related problems. Parenting problems (30%) included raising children right, being a good parent, keeping son out of gang, and daughter getting pregnant. Money-related problems (29%) included getting a job, financial, keeping bills paid, having food each month, not enough food for children, and running out of medicine. Safety problems (16%) included violence, making it home safe, and stray bullets in window, and of these, half (or 8% of all problems listed) concerned children's safety: for example, children getting shot at and children's safety while playing outside.

Participants' most important decisions centered around the same major concerns of children or parenting (26%), money or getting a job (19%), moving out (14%), and education (10%). In addition, a substantial number of decisions pertained to the management of household responsibilities (16%).

Participants reported choices such as whether to keep third child or give up for adoption, whether to put son (21 years old) out of apartment, whether to take time out for one kid so that they won't be "easy influence (sic) to do the wrong thing," what high school to send oldest child to, whether to go back to school, and whether to let children play downstairs (not safe).

Overall, participants' major life issues may be roughly characterized in terms of three themes: coping with poverty, coping with violence, and raising children under these conditions. It seems clear that the effectiveness with which inner-city residents manage these challenges will have important consequences for themselves, for their families, and for society at large. For the individuals and their children, the possible consequences of ineffective management of these issues include deprivation, incarceration, injury, and death. For society at large, the consequences of ineffective management of these issues include increased demands on social services, the health care system, and the criminal justice system, as well as the loss of human resources.

#### LEVELS OF ATTENTION AND MAJOR ISSUES MANAGEMENT IN THE INNER CITY

Participants' DSB scores provide some indication of the attentional resources in this inner-city population. According to Lezak (1983), scores of 4 or 5 on this version of the DSB test are within normal limits, depending on the individual's educational level. In this sample, the mean DSB score was 4.8, with a standard deviation of 1.1. Thus, taking into account the range of educational levels in this sample, DSB scores largely fell within normal limits. More striking and perhaps more important, however, is the wide distribution of scores within these limits, indicating substantial variation in attentional resources in this sample.

Participants' scores on the IMMI scale and subscales provide some indication of how effectively these individuals are (or perceive themselves to be) managing the major issues in their lives. On a 0 to 4 scale (0 = *not at all*, 1 = *a little*, 2 = *a medium amount*, 3 = *quite a lot*, 4 = *very much*), mean IMMI scale scores indicate that, overall, participants assessed their management to be moderately ineffective (see Table 3). On average, participants' responses indicate that they found their major issues to be somewhat difficult and long-standing, that they neglected these issues a little, and that these issues had quite severe consequences for their lives. Again, however, the central tendencies are less striking than the wide distributions in the scores. As the standard deviations in Table 3 indicate, there was a wide range of effectiveness in the management of major issues; participants differed substantially from one another in the extent to which they neglected their major issues and in how difficult, long-standing, and severe they judged these issues to be.



**TABLE 3**  
**Management of Major Issues, for All Participants**

	M	SD
Ineffective Management of Major Issues scale	2.10	(.53)
Difficulty subscale	1.98	.87
Neglect subscale	1.62	.72
Length subscale	2.36	.85
Severity subscale	3.13	.65

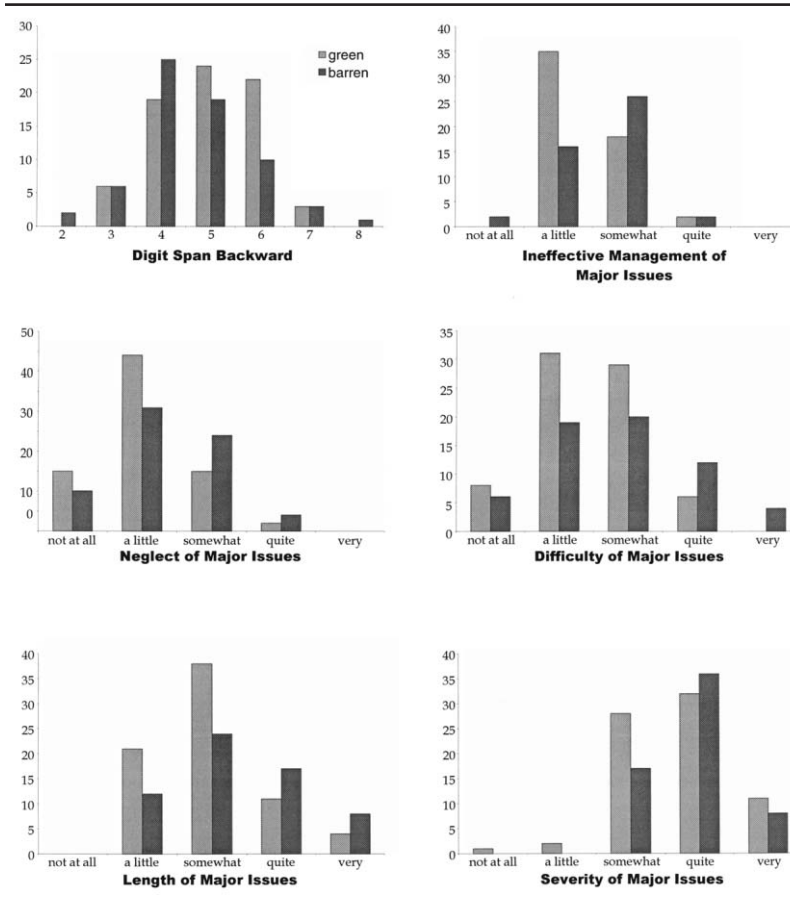
NOTE: 0-4 scale: 0 = *not at all ineffective* to 4 = *very ineffective*.

Together, these data suggest that levels of attentional functioning and life functioning range widely in this population. We may now ask whether variations in attentional functioning and in levels of nearby nature (and hence, access to attentionally restorative places and views) account for some of the variation in life functioning.

#### TESTING OF CENTRAL HYPOTHESES

To examine whether Attention Restoration Theory generalizes to the management of major issues and to relatively low doses of nature, each of the links posited in the theory was tested in turn. A series of analyses examined the relations between attention and the management of major issues (Hypothesis 1), nearby nature and attention (Hypothesis 2), and nearby nature and the management of major issues (Hypothesis 3). After testing each of the proposed links, mediation was tested according to Baron and Kenny (1986). Results are presented below: unless otherwise indicated, findings are significant at  $p < .05$ .

*Hypothesis 1.* If the effects of attentional fatigue on day-to-day life functioning generalize to the management of major life issues, attentional performance should be systematically associated with IMMI scores. Indeed, ordinary least squares (OLS) regressions indicate that performance on the DSB test significantly predicts IMMI scale scores ( $\beta = -.23$ ) as well as scores on the Neglect subscale of the IMMI ( $\beta = -.27, p = .001$ ). The direction of these relationships was as hypothesized: DSB performance was negatively associated with scores on the IMMI and IMMI subscales, indicating that the poorer a participant's attentional functioning, the more ineffective she was in managing her major life issues and the more she procrastinated in addressing these issues. These findings fulfill one of five statistical criteria for mediation: showing that the proposed mediator is significantly associated with the dependent variable.



**Figure 3: Histograms of Attention and Life Functioning Scores for Barren Versus Green Conditions**

NOTE: The bar graphs show the results for one measure of attention (Digit Span Backwards test [DSB]), a summary measure of life functioning (Ineffective Management of Major Issues Scale [IMMI]), and four subscales for life functioning.

*Hypothesis 2.* If the restorative effects of nearby nature on attention generalize to the low doses of nature in this context, residents living in Barren conditions should, on average, show more signs of attentional fatigue than their counterparts living in Green conditions. Figure 3 shows the distributions of DSB scores for participants living in these two conditions; as predicted, the distribution of scores in the Barren condition is shifted to the left, indicating that participants living in these conditions tended to score lower on DSB than did their counterparts. Indeed, mean DSB scores were significantly lower in

**TABLE 4**  
**Attentional Functioning and Management of Major Issues in Barren Versus Green Conditions**

	<i>Barren Condition</i>		<i>Green Condition</i>		<i>t Statistic</i>	<i>p Value</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Digit Span Backwards test	4.64	1.2	4.96	1.0	-1.74	.05
Ineffective Management of Major Issues scale	2.20	.58	2.00	.46	2.40	.01
Difficulty subscale	2.18	.99	1.81	.73	2.53	.01
Neglect subscale	1.72	.76	1.52	.67	1.76	.05
Length subscale	2.59	.89	2.17	.77	2.96	.005
Severity subscale	3.28	.59	3.01	.68	2.47	.01

NOTE: *t* tests are one-tailed.

the Barren condition than in the Green condition, differing by almost half a standard deviation (see Table 4). These findings fulfill a second criterion for mediation: showing that the independent variable is significantly associated with the proposed mediator.

*Hypothesis 3.* If the levels of nearby nature in this context are sufficient to measurably affect attention (Hypothesis 2), and if attention is an important resource for the management of major issues (Hypothesis 1), then the management of major issues may be more effective in individuals with greater access to nearby nature. Figure 3 shows the distributions of IMMI scale scores and IMMI subscale scores for participants living in relatively barren and relatively green surroundings. As predicted, the distribution of scores in the Barren condition is shifted right for each of these measures, indicating that residents living in Barren conditions assessed themselves to be more ineffective in managing their major life issues than did their counterparts. Table 4 confirms that IMMI scale scores and subscale scores were significantly higher in the Barren condition than in the Green condition. These findings indicate that participants living in relatively green surroundings were more effective in managing their major life issues overall. More specifically, participants living in relatively green surroundings procrastinated less in addressing their major issues, found their issues to be less difficult, and reported them to be less severe and less long-standing. Mean differences ranged from about one third to one half of a standard deviation. These findings fulfill a third criterion for mediation: showing that the independent variable is significantly associated with the dependent variable.

*Mediation testing.* If nearby nature enhances residents' effectiveness via its effects on attention, then the nature-effectiveness relationship should statistically depend on the nature-attention relationship. Specifically, if attention is the sole mediator of the nature-effectiveness link, then that link should disappear when attention is controlled; if attention is a partial mediator, then the nature-effectiveness link should diminish but remain significant when attention is controlled. An OLS multiple regression in which both greenness and DSB were used to predict IMMI scores indicates that, when DSB is controlled, the relationship between greenness and IMMI scores is no longer significant (unstandardized beta =  $-2.29$ ,  $p = .13$ ). This finding is consistent with a complete mediation interpretation and fulfills a fourth criterion for mediation: showing that the proposed mediator can account for the relationship between the independent and dependent variables. Moreover, this finding helps address an important question left open in previous research. One possible interpretation of previous findings is that the effects of nature on attention and effectiveness are simply two independent phenomena. This analysis squarely addresses that possibility and finds direct evidence against it.

This analysis also helps address another important alternative interpretation to the current findings, the possibility of spuriousness (Evans & Lepore, 1997). Some or all of the relationships found thus far could potentially be traced to some unspecified confounding variable, in which case, the nature-attention and nature-effectiveness links found here could simply be artifacts of this confound. To check for spuriousness, Evans and Lepore (1997) recommend seeing if the relationship between the proposed mediator and dependent variable remains significant when the independent variable is controlled. Consistent with the mediation hypothesis and counter to the possibility of spuriousness, DSB remained a significant predictor of IMMI with Greenness controlled in a multiple regression (unstandardized beta =  $-2.87$ ,  $p < .05$ ). This fulfills a final criterion for mediation: showing that the relationships between the variables in question cannot be attributed to some confounding factor.

Together, these findings are consistent with the proposed relationships between nearby nature, attention, and management of major issues. Attentional performance is systematically higher in individuals living in greener surroundings; management of major issues is systematically more effective for individuals whose attentional performance is robust and for individuals living in greener surroundings; mediation analysis indicates that the "effect" of green surroundings on the management of major issues may be fully mediated through attention; and the same analysis indicates that these relationships are not an artifact of some unspecified confounding variable.

## EXAMINATION OF SPECIFIC POSSIBLE CONFOUNDS

As Evans and Lepore (1997) note, "the best way to deal with spuriousness is to anticipate potentially spurious factors and build them into one's design and analysis" (p. 267). In this study, a substantial number of potentially spurious factors were anticipated and addressed. It seemed plausible that variables in each of the following six general categories might have systematic impacts on DSB performance and IMMI scores: demographic characteristics, household characteristics, well-being, substance use, social ties, and interview characteristics. Accordingly, a number of variables in each of these categories were assessed in the interview process; altogether, data were collected on 23 specific possible confounding variables. To test for confounds, then, a series of analyses examined relationships between each of these 23 variables and levels of nearby nature, attention, and effectiveness. Table 5 schematically depicts the results of this series of analyses, with Xs denoting the presence of a significant association.

In each column of the table, there are a number of Xs, indicating that DSB scores, IMMI scores, and the level of nearby nature were each significantly related to a number of the possible confounding variables.<sup>3</sup> An examination of the rows in the table finds no rows that contain three Xs, indicating that none of the potential confounding variables examined was significantly related to all three of the central variables in this study. Thus, among the potential confounds tested, no single variable can account for a complete set of relations between nature, attention, and life functioning found here.<sup>4</sup>

Could one of the possible confounding variables examined account for the link between attention and life functioning? There is one row in which two Xs appear. Participants' age was significantly related to both attention and major issues management: In OLS regressions, age was negatively related to DSB performance ( $\beta = -.20$ ) and positively related to IMMI scores ( $\beta = .26$ ,  $p < .01$ ), indicating that both attention and the management of life issues decline with age. To address this confound, age and DSB were entered as predictors of IMMI scores in a multiple regression. With age controlled, DSB scores remained significantly related to IMMI ( $\beta = -.22$ ). (Age likewise remained a significant predictor with DSB controlled,  $\beta = .21$ .) These findings indicate that the relationship between attentional functioning and major issues management cannot be attributed solely to their shared tendency to decline with age. Neither age nor any of the other 22 potential confounding variables examined can account for the relationship between attention and major issues management.

Might any of these potential confounding variables account for the differences in attention and major issues management between nature conditions?

**TABLE 5**  
**Relations of Attention, Life Functioning,**  
**and Nearby Nature to Potential Confounds**

	<i>Digit Span Backwards Test</i>	<i>Ineffective Management of Major Issues Scale</i>	<i>Nearby Nature</i>
Demographics			
Age	X	X	—
Education	X	—	—
Employment	—	—	—
Income	—	X	—
Household			
Size of household	—	—	—
Marital status	—	—	—
Number of children	—	—	—
Years in apartment	—	X	—
Years in public housing	—	X	—
Well-being			
Health rating	—	—	—
Health symptoms	—	X	—
Stress	—	X	—
Positive mood	X	—	—
Substance use			
Tobacco	X	—	—
Alcohol	—	—	—
Prescription drugs	—	—	—
Other drugs	—	—	—
Sources of social support			
Neighborhood social ties	—	—	X
General social ties	—	—	—
Interviewer ratings			
Number of interruptions	—	—	—
Background noise	X	—	—
Privacy	—	—	—
Perceived rapport	—	—	—

NOTE: X's indicate relationships significant with an  $\alpha$  of .05. In interpreting this table, it should be noted that the  $\alpha$  was set at .05 per comparison. Typically, the number and posthoc nature of these analyses would suggest a familywise  $\alpha$  to minimize the probability of a Type I error (false hit). In these circumstances, however, the concern is to minimize the probability of a Type II error (failure to detect a confound), and the greater sensitivity of a per comparison  $\alpha$  provides greater confidence that there are no undetected confounds among those tested. At the same time, significant relations in this table should be taken with a grain of salt; it should be noted that even in the absence of any true relationships among the various pairwise combinations tested, 69 comparisons with an  $\alpha$  of .05 per comparison would yield a mean of 3.45 significant relations arising solely due to chance (false hits).

Comparison of column 3 with columns 1 and 2, respectively, shows that although some social ties measures were significantly associated with nature

(see note 3), none of these measures were significantly related to DSB or IMMI. Thus, among the many potential confounding variables examined, the effects of nature on attention and major issues management found here cannot be attributed to demographic differences, differences in household characteristics, differences in well-being or substance abuse, differences in social ties, or differences in interview characteristics across conditions.

### DISCUSSION

In 145 adults randomly assigned to a series of architecturally identical apartment buildings, IMMI scores indicated that individuals who had some nearby vegetation were significantly more effective in managing their major life issues than were their counterparts living in barren environments. Furthermore, as would be predicted if this relationship were mediated by attention, (a) residents living in greener settings demonstrated reliably better performance on measures of attention; (b) IMMI scores of effective life functioning were directly proportional to attentional performance; (c) the relationship between vegetation and life functioning scores became nonsignificant when attention was controlled; and (d) the relationship between attentional performance and life functioning scores remained robust when vegetation was controlled (thus checking for spuriousness). Consistent with this, extensive follow-up analyses revealed no confounds due to either chance or systematic condition differences in demographics, household characteristics, well-being, substance abuse, social ties, interview characteristics, or attitudes toward nature. In the absence of detectable confounds, Attention Restoration Theory (Kaplan, 1995) provides the only ready explanation for these findings: Exposure to nature causes attentional restoration, thereby enhancing life functioning. Below, implications for the study of coping, the relationship between humans and the natural environment, and our understanding of the inner city are discussed in turn.

### CONTRIBUTIONS TO THE STUDY OF COPING

By examining a topic squarely in the domain of the coping literature—the management of major life issues—this study highlights and demonstrates the potential contributions Attention Restoration Theory can make to the understanding of coping.

One contribution of the theory and the findings here is to suggest that attentional resources play an important role in effective coping, giving possible

new insight into both intra- and interindividual differences in coping. That is, individual differences in the capacity to direct attention may be the source of (some) individual differences in coping style,<sup>5</sup> and fatigue-related fluctuations in attentional resources may explain heretofore mysterious inconsistencies in individual coping behavior—for example, avoidant coping in a normally problem-focused individual (e.g., Folkman & Lazarus, 1980). The finding that distractibility and daydreaming (two symptoms of attentional fatigue) are associated with procrastination in decision making (Harriott, Ferrari, & Dovidio, 1996) lends some support to these notions.

Another contribution of Attention Restoration Theory and the current findings is to suggest the physical environment as an important resource in coping. Research and theory on coping has focused almost exclusively on social support as an external resource for coping (Parker & Endler, 1996); this work suggests that the physical context matters as well and points to a possible new focus for intervention efforts. For example, one prescription for managing particularly difficult or demanding life circumstances might be for individuals to seek out attentionally restorative settings on a more regular basis (Canin, 1991; Cimprich, 1993). Another might be to avoid attentionally draining settings (Cohen & Spacapan, 1978; Kaplan, 1987) where possible. And perhaps by creating less mentally fatiguing, more attentionally restorative environments, city planners, public housing managers, and hospital designers could help people help themselves.

Finally, the work here makes a methodological contribution to the study of coping. The vast majority of coping measures focus on coping style—an individual's propensity to approach issues in a particular manner (e.g., avoidant, problem-focused, emotion-focused)—either in general or with respect to a specific single issue (see Parker & Endler, 1992). By contrast, the IMMI scale indexes both coping style and coping outcomes (through the Neglect subscale and Length, Severity, and Difficulty subscales, respectively) with respect to the respondent's most important life issues. By sampling multiple specific issues (the two most important goals, two most important problems, and two most important decisions), this technique provides a more representative sampling of an individual's coping than a single-issue measure can, without sacrificing the higher reliabilities attained when specific issues are used as referents (Carver, Scheier, & Weintraub, 1989). Thus, IMMI complements the existing repertoire of coping measures in a number of respects.

Initial analyses indicate IMMI to be a reliable and coherent measure, with a Cronbach's alpha of .81 and sensible patterns of association between subscales. One indication of IMMI's validity as a measure of effective life functioning is that IMMI scores are significantly predicted by a number of variables likely to either contribute to, or reflect, ineffective functioning:



poor health, stress, age, and number of years in public housing. In future work, it will be important to examine test-retest reliability, check for independent corroboration (from family members, for instance), and test for concurrent validity through comparisons with existing measures of coping or self-efficacy.

#### HUMANS AND THE NATURAL ENVIRONMENT

This work also contributes to our understanding of the relationship between humans and the natural environment. First and most obviously, it extends the empirical literature testing Attention Restoration Theory. As reviewed earlier, numerous previous studies have found positive associations between nature and attention, nature and effectiveness, or both. Is the nature-effectiveness relationship truly causal? And can it be traced to nature's effects on attention? One of the novel features of this work was the statistical testing of the mediation hypothesis embodied in Attention Restoration Theory; although mediation testing alone cannot conclusively establish causal links from nature to attention to effectiveness, the findings here substantially strengthen the case for such links. In future research, one way to further test the mediation hypothesis might be to expose participants to a series of attentionally draining stimuli and nature stimuli over time, then examine the resulting fluctuations in attention and effectiveness.<sup>6</sup>

A second contribution of this work to our understanding of the relationship between humans and the natural environment is to reinforce a theme that has woven through much previous research: the power of nature. It is striking that the presence of a few trees and some grass outside a 16-story apartment building could have any measurable effect on its inhabitants' functioning. It is all the more surprising that such a modest dose of nature could enhance an individual's capacity to manage the most important issues in her life, with an effect size comparable to that of major factors such as health and age. Previous research on dormitory and office views (Kaplan, 1993; Tennessen & Cimprich, 1995) has suggested that views of nature have benefits even when the views are quite familiar; the findings here suggest that the effects of nature do not habituate even with extremely long exposures, on the order of 10 years (see also Moore, 1981).

Evolutionary theory provides an interesting framework for interpreting these and previous findings on the power of nature for the human species. Consider the following. First, habitat selection theory suggests that organisms will tend to be drawn toward settings in which they are likely to thrive (e.g., Orians, 1986), and a voluminous literature has established the strong human preference for settings with natural elements (for review, see Kaplan

& Kaplan, 1989). Second, ethological research across a variety of species has established that animals housed in unfit habitats undergo social and psychological breakdown, showing disturbances in play, parenting patterns, and social behavior (for a review, see Wilson, 1971). And studies in Chicago public housing examining individuals randomly assigned to settings with extremely low levels of nearby nature are showing a similar profile of disturbances in each of these domains (Kuo & Sullivan, 1995; Kuo, Sullivan, Coley, & Brunson, in press; Taylor et al., 1998). Perhaps one interpretation for the human preference for relatively natural landscapes and the apparent effects of nature on blood pressure, heart rate, mood, day-to-day effectiveness, social behavior, cognitive functioning, and work performance (e.g., Canin, 1991; Hull & Michael, 1995; Kaplan, 1993; Lohr et al., 1996; Mooney & Nicell, 1992; Tennesen & Cimprich, 1995; Ulrich, 1981) is that nature is an essential component of a fit human habitat. Regular contact with nature may be as important to our psychological and social health as the regular consumption of fruit and vegetables is to our physical health.

#### BEHAVIOR AND FUNCTIONING IN THE INNER CITY

Theories regarding ineffective patterns of behavior and functioning in the inner city focus on people: on individuals, on the social context, and on such concepts as "a culture of poverty." This study contributes to our understanding of these phenomena by suggesting a different focus and a different diagnosis. That is, perhaps the pathology is in the place, not the people.

This author has previously suggested that the crowding, noise, and danger of poor inner-city neighborhoods are likely to contribute to chronic mental fatigue on the part of inner-city residents, particularly when juxtaposed with the attentional demands associated with poverty and single parenting (Kuo, 1992). Chronic mental fatigue, in turn, may contribute to a positive feedback cycle between ineffective coping behaviors and poor coping outcomes: Unremitting levels of attentional fatigue lead to the chronic neglect of pivotal life issues; as these issues are deferred, they become increasingly long-standing and serious, making them appear all the more daunting and contributing to their further neglect. Thus, the continual attentional wear and tear of the inner-city setting may contribute substantially to patterns of passivity and ineffectiveness that have often been attributed to the residents themselves. If a single mother living in attentionally overwhelming circumstances makes repeated efforts to pull herself up by the bootstraps and repeatedly fails, it is possible that she is weak or lazy, but it is also possible that she is simply exhausted.

In a context where countless programs directed at assisting individuals in their efforts to overcome poverty—some elaborate and expensive—have produced no detectable effects (Cisneros, 1995), this study identifies an easy-to-manipulate environmental feature that is clearly and strongly associated with more effective functioning. Although successfully addressing poverty will most likely require an array of interventions, of which environmental interventions might be a small part, certainly greening is a low cost intervention in comparison with most social service programs. And the literature on the many positive side-effects of community gardening in poor urban neighborhoods suggests that resident-based greening efforts could play a surprisingly valuable role in the arsenal of weapons against poverty. This study suggests that, in poor inner-city neighborhoods, planting a few trees may help provide individuals and families the psychological resources needed to “take arms against a sea of troubles.”

#### NOTES

1. Nearly half of the responses (47%) reflected the simple need for shelter: “just needed a place.” About 12% of responses regarded safety or cleanliness, 10% regarded access (to work, school, or family), 9% regarded cost, 8% regarded space or number of bedrooms, and 6% expressed the importance of having an apartment on a “low floor,” perhaps because of the frequency of elevator malfunctions. One participant mentioned sense of community.

2. Some readers may wonder why Greenness was dichotomized instead of being treated as a continuous variable. Because residents who shared a Greenness Rating often shared the same building as well, a regression using a continuous Greenness Rating variable to predict outcomes would inappropriately attribute variance due to building differences to the effect of greenness. By contrast, conducting an ANOVA on two nature “bins” allows the variance due to building differences to appear in both the within-treatment and between-treatment terms in the *F* statistic, avoiding the misattribution problem.

3. DSB scores were systematically related to a number of variables in addition to participant age. First, DSB scores were higher for those with more education ( $\beta = .43, p < .0001$ ), as would be expected (Lezak, 1983). Second, DSB scores were also significantly associated with positive mood ( $\beta = .19$ ), as measured by the vigor-activity subscale of the Profile of Mood States (short version; McNair, Lorr, & Droppleman, 1981). Third, DSB scores were lower for smokers than nonsmokers ( $\beta = -.18, p < .0001$ ), although not when education was controlled. And fourth, DSB scores were higher in interviews rated by the interviewer as having more privacy ( $\beta = .39, p < .0001$ ).

IMMI scores were systematically related to a number of variables in addition to participant age. As would be expected, poor life functioning was related to higher levels of stress ( $\beta = .24$ ) and poor health symptoms ( $\beta = .25, p = .01$ ), and although stress and health symptoms were both significantly related to age, the IMMI-stress and IMMI-symptoms relationships remained significant when age was controlled. Poor life functioning was also related to the participant's number of years in urban public housing in general and in their apartment in particular ( $\beta = .28, p <$

.005 and  $\beta = .21$ ,  $p < .05$ , respectively). And finally, poor life functioning was significantly related to income, although not when number of years in public housing was controlled.

Measures of social integration were significantly related to nature condition. Levels of nearby nature predicted higher scores on a composite measure of neighborhood social ties ( $\beta = .22$ ,  $p < .01$ ), as well as on two of its three constituent measures: socializing with neighbors ( $\beta = .21$ ,  $p = .01$ ) and knowing one's neighbors ( $\beta = .17$ ). For detailed presentation of these data, see Kuo et al. (1998).

4. Two of the relatively well-established psychological impacts of contact with nature are its impacts on stress recovery (Ulrich et al., 1991) and positive mood (e.g., Hull & Michael, 1995); thus, it is worth noting that neither stress nor positive affect were found to mediate the nature-effectiveness link found here. This link may simply be independent of stress and positive affect. It is also possible that physiological measures of stress would reveal effects that a self-report measure could not and that repeated measures of affect would reveal effects that a single-instance measure did not. In future work, these possibilities should be examined in settings where physiological measures and repeated measures over time are more feasible.

5. Currently, the right prefrontal cortex may be the best candidate for the location of the capacity to deliberately direct attention (Foster, Eskes, & Stuss, 1994; Heilman, Voeller, & Nadeau, 1991; Molle, Marshall, Pietrowsky, & Lutzenberger, 1995); an interesting prediction that grows from the ideas here is that individuals with weak right prefrontal activity should demonstrate greater propensities for procrastination and avoidant coping behavior.

6. If indeed the capacity to deliberately direct attention is housed in the right prefrontal cortex, it would be interesting to see if exposure to nature stimuli resulted in lower levels of activity in that area.

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