

The Role of Natural Settings in Crisis Rehabilitation: How Does the Level of Crisis Influence the Response to Experiences of Nature with Regard to Measures of Rehabilitation?

JOHAN OTTOSSON & PATRIK GRAHN

Swedish University of Agricultural Sciences, Sweden

ABSTRACT *We compare people greatly affected by a crisis with those less affected to explore how level of crisis influences their response to experiencing nature. A questionnaire comprising a validated protocol to evaluate frequency of stress conditions, the level of crisis retention, reorientation and rehabilitation potential was answered by 547 individuals. The questionnaire also comprises items on everyday activities. Our findings may be interpreted as follows: experiencing nature has a more powerful influence on the rehabilitation potential of people greatly affected by a crisis; taking a walk also has an influence, although not of equal importance; the social factor has more influence on the rehabilitation potential of people affected by a crisis to a low/moderate degree. Individuals who have many experiences of nature are less affected by their crisis than are those who have few such experiences. We suggest that the rehabilitative effect of nature is tied to its function as an enriched environment. During stays in natural settings, an interaction takes place between sensory stimulation, emotions and logical thought—an interaction that leads to a new orientation and new ways of seeing one's self and one's resources. This seems to largely be a question of how we human beings take in and process information.*

KEY WORDS: Restorative effects, affects, people in crisis, nature

Introduction

All people, during their lifetime, find themselves in stressful situations. Without a refuge, personal adversity can develop into a life crisis, resulting in severe depression and/or pain and burnout syndrome (Perski, 2002). Throughout the world, depression, crises and burnout syndrome are the cause of considerable human suffering, illness absence and premature death. The World Health Organization

Correspondence Address: Johan Ottosson, Department of Work Science, Business Economics and Environmental Psychology, PO Box 88, Swedish University of Agricultural Sciences, S-230 53 Alnarp, Sweden. Email: johan.ottosson@ltj.slu.se

(WHO) has made pain and depression due to stress priority areas. The organization reports that at least 120 million people are affected yearly and that stress-related illnesses are associated with excess mortality (WHO, 2004).

The connection between a life crisis, ill health and premature death may be seen in light of WHO's definition of health: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1948). Thus, health encompasses the individual's entire life situation: housing, friends, work, etc. Research also shows that, with few exceptions, about 60% of all causes of ill health, disease and premature death in the EU countries cannot be sought in simple relationships, for example, proximity to pathogenic bacteria or genetic factors (Knoops *et al.*, 2004). We are dealing with chains of causation that result in some becoming ill and others not (SOU, 1998). Causal factors that can exacerbate the effects of pathogenic bacteria may be found in people's habits, for example, smoking, a sedentary lifestyle, poor diet or insufficient sleep (*ibid.*).

Few studies have focused on the importance of the physical surroundings/network for people's health (Grahn & Stigsdotter, 2003). If an individual is suffering from a crisis, it is of interest to discover whether the physical and social environment can have a therapeutic function.

In ancient narratives, gardens, pastoral landscapes and natural environments with small lakes and meadows are depicted as places where you can take refuge—places to find shelter and relief from sadness and pain—places where you can be restored both mentally and physically. These narratives portray gardens and pastoral landscapes as healthy, healing places longed for both in life and beyond (Stigsdotter & Grahn, 2002; Gunnarsson, 1992; Prest, 1988). In the mid-1980s, some interesting research findings were published in the US: it appeared that gardens, parks and areas of natural greenery did indeed have beneficial effects on people's health (Kaplan & Kaplan, 1989; Ulrich, 1984; Ulrich *et al.*, 1991). The researchers called these effects 'restorative'.

Our research group has studied people of different ages, genders and socio-economic backgrounds. We have found that, irrespective of background, natural environments seem to be a significant link to a more stable surrounding world, which can help to make chaotic thoughts, feelings and senses more harmonious (Grahn, 1991; Grahn *et al.*, 2000; Stigsdotter & Grahn, 2003; Ottosson & Grahn, 2005a, 2005b). Of particular importance here is a study we conducted on residents in geriatric care, focusing on the influence of nature on elderly people's powers of concentration, blood pressure and pulse rate (Ottosson & Grahn, 2005b). We found that some important background variables were related to the elderly people's frame of mind (level of tolerance toward other people, level of helpfulness and number of hospital visits). This so-called psycho-physiological balance had a strong influence on how the elderly people responded to a stay in a garden, as measured by changes in blood pressure and heart rate.

Here, two statements made by Roger Ulrich are of special interest: "Persons who undergo medical treatment often feel psychologically vulnerable, which has been demonstrated to heighten their sensitivity to insecurity in an environment." And: "It seems likely that the restorative benefits of viewing nature are greatest when persons experience high levels of stress, such as those who are obliged to spend time confined in hospitals or other types of healthcare facilities" (Ulrich, 1999, pp. 36, 57).

In the present article, we describe a study in which people greatly affected by a crisis are compared with those who are less or not at all affected by a crisis.

We wish to test the following two hypotheses:

- 1) Being in a natural environment influences people greatly affected by a crisis more than people who are less affected.
- 2) Having contact with other people influences people greatly affected by a crisis more than people who are less affected.

Earlier Studies

Crises can give rise to increases in stress. Humans can generally manage moderate stress levels well and can also manage considerable stress for a limited period of time. However, we have known for decades that sustained stress, in which time for recovery has been scarce or absent, may have severe harmful effects on the cardiovascular system, causing cardiovascular diseases (Atkinson *et al.*, 1996). Hansson (1996) discusses the clear links between the psyche and physiological status, specifying psychological reactions within the framework of psycho-neuro-immunological theory. He points out a well-documented relationship between stress and infection: the systems are highly integrated. The immune system is able to sense potentially threatening bacteria and viruses that the nervous system cannot register. At the same time, the nervous system can intervene in the immune system. Following the introduction of this theory, scientists have tried to explain how mental stress can affect other bodily systems, not only immunological reactions, but also diseases of and pathological changes in muscles, the digestive system, other internal organs, nerve pathways, the hormonal system and the brain (Malt, 1999; Doctare, 2000; Währborg, 2002; Uvnäs-Moberg & Petersson, 2004).

Research on non-human animals has shown that early development in stressful environments can entail dramatic effects on brain development. Jewelfish that had developed in a cramped environment with far too many of their own species were compared with other jewelfish that had developed in isolation or in appropriate surroundings. Both the cramped and the isolated environments led to abnormal brain development (Coss, 1991). Studies show that the brains of adult rats and mice are also affected by stress (Eriksson & Wallin, 2004). The hippocampus is particularly sensitive. This part of the brain is responsible for sorting incoming stimuli, for certain memory functions and, not least, plays an important role in the degree to which depression arises or does not arise. Studies on rats show that, during prolonged periods of heightened stress, the dendrites of hippocampal neurons degenerate greatly and, in some cases, entire nerve cells die. Prolonged stress can cause cessation of neurogenesis—the process by which neurons are created from stem cell deposits—in the brain (*ibid.*). This causes the hippocampus to shrink.

Komitova *et al.*'s (2005) study of brain plasticity (the brain's ability to adapt and heal itself) in rats shows that, after experimentally induced brain injury, neurogenesis of nerve cells is activated by stem cells in the brain, and that these newly formed nerve cells are recruited to the injured area and attempt to repair this area. Following injury, factors such as having an 'enriched environment' as well as social contacts and physical and cognitive challenges were shown to stimulate cell regeneration.

Physical exercise alone, however, impaired regeneration of brain cells. The authors consider that the combination of social contacts and a physically stimulating environment that promotes feelings of security could be an important component in rehabilitation of brain-injured patients.

Research on humans is limited. In a study on children in school environments, Sapolsky (2003) shows that sensitive children react strongly to intense stimuli in the physical environment; such stimuli cause stress in these children. This results in an increase in cortisol from the adrenal cortex. Prolonged exposure to cortisol can damage the hippocampus, which can lead to impaired learning ability (*ibid.*). Research results also indicate that the physical environment can stimulate growth in parts of the brain (Maguire *et al.*, 2000). Moreover, research shows that neurogenesis occurs in the human hippocampus (Eriksson & Wallin, 2004). These findings have led Eriksson and Wallin (2004) to hypothesize that depression and fatigue reactions may result from impaired neurogenesis.

Natural environments may be seen as being particularly enriched with physical objects. Several studies have shown that natural environments affect people who are stressed, depressed and burned out. One kind of study has explored nature's ability to rapidly reduce stress via our most primitive emotions, our affects: Roger Ulrich (1999) argues that the visual impact of the environment itself may signal danger or safety, and that this is most important when 'persons experience high levels of stress'. An article he published in *Science* indicates that the view from a hospital over nature and green open spaces has a positive influence on recovery after surgery (Ulrich, 1984). His supporting findings (Ulrich *et al.*, 1991; Ulrich, 1993, 1999, 2001, 2006; Sherman *et al.*, 2005) show that the body reacts spontaneously, reflexively, within fractions of a second, to natural elements, whereas artifacts such as houses, streets, etc., do not trigger the same quick and strong reactions. Together with a number of researchers (Coss & Moore, 1990, 2002; Coss, 1991; Coss & Charles, 2004), he has related our more automatic, rapid reflex behaviors—the impulse to flee, stress, feelings of insecurity, the sense of danger and 'home feeling', etc.—to conceptions of *Homo sapiens'* first habitats. According to many of these scholars, our primeval habitat was on a savannah, in proximity to water (Ulrich, 1993; Coss, 1991; Coss *et al.*, 2003).

Another kind of study has investigated the ability of natural environments to help people relax after having dealt with large amounts of information. In one research project, Kaplan and Kaplan studied individuals who suffered from loss of mental capacity and exhaustion, and who were participating in an outdoor program in northern Michigan. Loss of mental capacity results in 'mental fatigue' (Kaplan & Kaplan, 1989). After spending time in the wilderness, the individuals appeared to have recovered. The fact that nature simultaneously offers rest and stimulates reflection is part of what makes it a 'restorative environment' (Kaplan, 1990).

The Kaplans' theory is that people treat information through two types of attention: directed attention and soft fascination (Kaplan, 2001). Directed attention, the mental process we use to deal with cognitive data, originates in a more 'modern' part of the brain. The Directed Attention System (DAS) sorts information that comes in through the thalamus, is further sorted in the hippocampus and finally dealt with in the frontal lobes of the brain. A fatigued DAS leads to decreased mental

energy/equilibrium. The DAS deals with short-term memory, executive functions and coping.

Executive functions refers to the individual's ability to deal with the decision chain:

- being able to see one's own situation and what one wishes and/or needs to do
- being able to prioritize among what one wishes and/or needs to do
- having the will and daring to carry it through
- being able to plan how to do it
- finally, being able to carry it through

People who are going through a life crisis—who are depressed—operate at a low level in the decision chain; they have a low-functioning executive function.

Coping refers to the ability to logically deal with and survive difficult circumstances without succumbing to one's immediate emotions, regardless of whether these difficult circumstances involve disturbing elements in the environment (Kaplan, 2001).

The DAS is a highly limited resource, which we can easily exhaust if we do not have opportunities for recovery. When the DAS is overextended, it functions poorly. Logical thought also becomes poorer, which causes us to react emotionally. When we are threatened or stressed, this relationship becomes particularly clear (Kaplan, 2001). Logical thought is suppressed. The demands of modern society mostly involve complex visual and auditory impressions, which may be difficult to interpret and overcome.

Humans can quickly and easily deal with millions of informational stimuli from nature: 'soft fascination' (Kaplan, 2001; van den Berg *et al.*, 2007). We understand within seconds what is relevant. The information in nature—as concerns threats, security, food, rest, etc.—can be interpreted via a variety of sensory impressions (vision, hearing, smell, etc.) that are easily dealt with by innate reflexes, information centers in the brain's emotion centers as well as by higher cognitive centers. We make rational decisions within fractions of a second without becoming fatigued. Thus, natural environments function well as restorative environments for the DAS. The Kaplans show that mentally exhausted individuals are strongly influenced by their physical surroundings (Kaplan & Kaplan, 1989), and the findings of these studies have been supported by other researchers (Hartig *et al.*, 2003; Staats *et al.*, 2003).

The Kaplans state that the restorative environment stimulates people's cognitive system, while Roger Ulrich discusses how effects on the physiological system are mediated by emotions (Ottoosson & Grahn, 2005a, 2005b). The theories of the Kaplans and Ulrich are used to explain the mental effects of stays in natural environments.

Our studies of people with different backgrounds have shown that nature seems to help them find an inner balance (Ottoosson, 2001; Ottoosson & Grahn, 2005a, 2005b).

Method

We were interested in studying how people suffering from a crisis responded to experiences of nature, compared to people who had been affected by a crisis to a

lesser degree or who had not been affected at all. We were interested in finding validated protocols for:

- measuring the degree to which people are affected by a crisis
- measuring restorative experiences, restorative activities and mood
- measuring people's potential for rehabilitation

We developed a questionnaire including background variables such as gender, age and socio-economic index (Statistics Sweden, 1995), and we included the following protocols:

The SCI-93 Protocol: Nyström and Nyström (1995, 1996) have developed this protocol, which is validated to measure people's symptoms in reaction to a crisis, their ability to cope with the crisis and their potential for recovery. This protocol has been used in studies of similar design (Tyni-Lenne *et al.*, 2002).

The protocol was developed to estimate the course of various reactions and phases a person normally experiences in a traumatic crisis: from acute shock to reaction, the grieving process, reorientation and rehabilitation (Nyström & Nyström, 1995, 1996). In this course, some people suffer from crisis retention, which means preservation of an acute state of crisis. If crisis retention persists, different mental, muscular and vegetative complaints may ensue. Moreover, such complaints are exacerbated the longer the crisis retention persists. The protocol was developed to examine and confirm where a person is in this course and his/her ability to move on (*ibid.*). The reliability and validity of the protocol are high.

According to the manual (Nyström & Nyström, 1995), the SCI-93 protocol can be used to identify the following phases in the course of a crisis:

- Questions concerning 35 different symptoms of crisis retention, such as jaw muscle tension and insomnia. The different symptoms are then divided into three parts: 'muscular symptoms', 'autonomic symptoms' and 'mental symptoms'. We have used these three parts as well as two specific symptoms: attention (from 'mental symptoms') and heart rate (from 'autonomic symptoms').
- Questions concerning the impact of the crisis on the person's everyday life.
- Questions concerning the person's reorientation: including questions on being able to intellectually and emotionally accept the loss or traumatic experience, to let go of what is behind you, accept what is new and see the possibilities that exist. Responses to these questions provide a measure of reorientation.
- Questions concerning the person's potential for rehabilitation. These include questions on intellectual and emotional acceptance of the topic; increased health and function. Perceived longing, strength and courage are also essential to a person's rehabilitation potential. Responses to these questions provide a measure of rehabilitation potential.

The RAS Protocol: Research projects within leisure sciences have defined different types of recreational activities (e.g. Anambutr, 1989; Frankenberg, 1980; Tinsley &

Johnson, 1984; Jansen & von Sadvoszky, 2004; Nilsson *et al.*, 2006; King *et al.*, 2007). Two main types of activity clusters have often emerged: social activities and nature-related activities. The literature suggests that nature-related activities more than others offer restorative experiences (e.g. Kaplan, R., 1973; Kaplan, S., 2001; Hartig *et al.*, 1991; Ulrich, 1999; Grahn & Stigsdotter, 2003; Staats *et al.*, 2003).

In her study of 36 recreational and therapeutic activities, Canin (1991) found that they could be clustered using factor analysis into eight different kinds of activities. Some activities were not especially restorative and others, such as 'community involvement' and 'focused relaxation techniques' (yoga, massage), were not in focus in this study. Of special interest in this study were three groups of activities: 'green activities' such as observing the landscape, clouds and animals, 'quiet activities' such as spending time visiting friends and 'active/nature aesthetic activities' such as walking, hiking and boating.

Cimprich (1990, 1992, 1993; Stark & Cimprich, 2003) and Gilker (1992) developed a protocol they call the Restorative Activities Survey: *RAS* (Gilker, 1992). The protocol contains both social and nature-related activities. We included this protocol, which has been translated into Swedish and used in earlier studies (Ottosson & Grahn, 1998), showing good validity. We chose three questions to be part of the present study. These questions were related to 'green activities', 'quiet activities' and 'active/nature aesthetic activities', respectively. Moreover, these questions resemble the questions used in our study on elderly people (Ottosson & Grahn, 2005a, 2005b):

Listed below, please circle the number that best describes how often you have done the activity during the past month, using the following scale:
"Walking in a natural setting (yard, park, neighborhood): 0 = not at all; 1 = rarely; 2 = sometimes; 3 = often; 4 = very often"

Below are listed some things that might be done many times during the day. Please circle the number that best describes how frequently you usually do these activities during the course of the day.

"Looking at a natural scene/wildlife (trees, clouds, water, squirrels, birds): 0 = not at all; 1 = rarely; 2 = sometimes; 3 = often; 4 = very often"

"Talking/being with friends: 0 = not at all; 1 = rarely; 2 = sometimes; 3 = often; 4 = very often"

The Fatigue Protocol. On the other hand, we wanted to include a question that measures a symptom that is the opposite of being restored. According to Maslach (2001), people in the health and social service professions often become mentally exhausted, as do hospital patients (Ulrich, 1999). What characterizes such mentally fatigued individuals (Kaplan, 1990) is that they may be expected to react more strongly in a social context, especially if they do not have opportunities for restoration: they are irritable and less likely than usual to help someone in distress (Kaplan & Kaplan, 1989). Canin (1991) used a protocol to measure *Fatigue*, including items such as impatience and irritation (Canin, 1991; Maslach & Johnson, 1981). This questionnaire resembles a self-rating questionnaire—The Profile of Mood States, *POMS* (McNair *et al.*, 1981; Gilker, 1992; Tennesen & Cimprich,

1995). We included this protocol, which has been translated into Swedish and used in earlier studies (Ottosson & Grahn, 1998, 2005b), showing good validity. In this study, we have chosen the following question:

Over the past few weeks, how often have you felt:

1 = never 5 = all the time

Critical of others: 1 2 3 4 5

Hence, in the questionnaire, we have two questions referring to a social factor: 'being with friends', and 'critical of others'. In our earlier study (Ottosson & Grahn, 2005b), we found that this factor was significantly related to elderly people's response to an outdoor visit, as measured by changes in blood pressure and heart rate. The above question batteries (RAS, POMS and Fatigue) have been used in US studies with a design similar to ours (Canin, 1991; Gilker, 1992; Cimprich, 1990; Tennesen & Cimprich, 1995; Kuo, 2001; Cimprich & Ronis, 2003; Stark & Cimprich, 2003).

Procedure

The questionnaire was completed by participants in various courses, the teachers of which we had contact with. The questionnaires were sent to the teachers one or two weeks before the lecture. The teachers ensured that they were distributed to course participants, filled out and collected. The questionnaires were later sent back to us. A cover letter explaining how the questionnaire should be filled out was also included. The study was approved by the ethics committee at Lund University.

The questionnaire was distributed to respondents who attended the lecture. They were required to fill out the questionnaire before attending (the lecture in itself was a standard lecture in a regularly offered course). In total, there were 19 lectures for nursing staff in their continuing education program (124 respondents), for students of medicine or nursing in ordinary courses (278 respondents) and for patients and/or people living in nursing homes in their selection of study programs (145 respondents). All in all, there were 547 respondents, 454 female and 92 male (1 missing).

Results

We wished to know how many respondents had experienced a crisis, how this crisis had affected them, whether it still affects them, their resources for reorientation and their potential for rehabilitation.

In the questionnaire, the participants were asked to answer these two questions in the SCI-93 protocol:

Have you experienced any difficult event, divorce, a death or any other severe loss where you felt you had been left alone/abandoned or lost something of value to you?

1. No (continue to Question 12)
2. Yes (continue below)

This event affected me:

1. Not at all
2. Somewhat
3. Moderately
4. Quite a bit
5. Very much

We found that 257 respondents had been affected by a crisis to a *low/moderate degree* (1, 2 and 3) and 217 to a *high degree* (4 and 5) (see Table 1). A SAS Chi-square analysis (SAS Statistics, 1996) showed that there were no significant differences between the two groups as regards age, sex, socio-economic status and stress. Table 2 shows the age distribution.

An SAS Pearson Analysis (SAS Statistics, 1996) was calculated to examine whether there were any significant differences between the two groups as regards how often they perform restorative activities and how often they show symptoms of mental fatigue, correlated to SCI reorientation and SCI rehabilitation potential (Nyström & Nyström, 1995).

Table 3a shows the results concerning respondents who were currently affected by a crisis to a *low/moderate degree*. Rehabilitation potential is significantly and positively correlated with 'experiencing nature' and with 'walks in natural surroundings', but not with 'being with friends'. Moreover, rehabilitation potential is significantly and negatively correlated with being 'critical of others'. There are no significant correlations between reorientation and restorative experiences/activities in natural surroundings.

Table 3b shows respondents who were currently affected by a crisis to a *high degree*. As in Table 3a, rehabilitation potential is significantly and positively correlated with

Table 1. Distribution of sex among people who are affected by a crisis to a low/moderate degree and those affected to a high degree

Sex	Low/moderate degree	High degree
Female	200	191
Male	56	26
Missing	1	0
N	257	217

Table 2. Age distribution among people who are affected by a crisis to a low/moderate degree and those affected to a high degree

Age distribution	Low/moderate degree	High degree
21–25	44	23
26–35	50	50
36–45	50	48
46–55	28	40
56+	30	25
N	202	186

Table 3a. SAS Pearson correlation. People who are affected by a crisis to a low/moderate degree in their everyday life

Pearson correlation	Experiencing nature	Walks in natural surroundings	Being with friends	Critical of others	<i>N</i>
SCI rehabilitation potential	0.23 <i>p</i> < 0.01	0.21 <i>p</i> < 0.02	-0.06 ns	-0.24 <i>p</i> < 0.01	126
SCI reorientation	-0.07 ns	-0.07 ns	-0.03 ns	-0.09 ns	204

Table 3b. SAS Pearson correlation. People who are affected by a crisis to a high degree in their everyday life

Pearson correlation	Experiencing nature	Walks in natural surroundings	Being with friends	Critical of others	<i>N</i>
SCI rehabilitation potential	0.33 <i>p</i> < 0.0001	0.23 <i>p</i> < 0.001	-0.04 ns	-0.10 ns	199
SCI reorientation	0.14 <i>p</i> < 0.05	0.14 <i>p</i> < 0.05	0.12 ns (<i>p</i> = 0.08)	0.07 ns	215

'experiencing nature' and with 'walks in natural surroundings', but to a much stronger degree than in Table 3a. There are no significant correlations between rehabilitation potential and the two other columns: 'being with friends' and 'critical of others', respectively. In contrast to Table 3a, we find significant positive correlations between reorientation and restorative experiences/walks in natural surroundings.

The results invited additional statistical calculations concerning connections between restorative experiences/activities and rehabilitation potential. We carried out an analysis of variance, SAS GLM (Table 4), in which all four variables were included in the model:

SCI Rehabilitation potential = 'Critical of others', 'Being with friends', 'Experiencing nature', 'Taking a walk'.

We found that the model was significant for both groups ('low/moderate degree' and 'high degree'), however the relationship was stronger for respondents who were currently affected by a crisis to a high degree.

If we look particularly at the differences in the Type III SS, which functions as a path analysis (every single variable comes in last in the model, thus showing which variable has most impact on the model), we see which of the four variables has the greatest effect on rehabilitation potential.

When examining and comparing the two groups in more detail, we see that, for those affected by a crisis to a low/moderate degree, the social factor (critical of others) played the most significant role. When examining respondents affected by a crisis to a high degree, we see that nature played the most significant role. Both Type

Table 4. Analysis of variance GLM. Comparison between people who are affected by a crisis to a low/moderate degree and those affected to a high degree. Dependent variable: SCI rehabilitation potential. Independent variables: critical of others, being with friends, experiencing nature and taking a walk in natural surroundings

GLM	Low/moderate degree	High degree
Model	$F = 3.62$ $p < 0.01$	$F = 5.69$ $p < 0.0002$
Type I SS		
Critical of others	$F = 7.55$ $p < 0.01$	$F = 2.01$ ns
Being with friends	$F = 0.71$ ns	$F = 0.72$ ns
Experiencing nature	$F = 4.60$ $p < 0.05$	$F = 19.23$ $p < 0.0001$
Walk in natural surroundings	$F = 1.61$ ns	$F = 0.79$ ns
Type III SS		
Critical of others	$F = 4.33$ $p < 0.05$	$F = 1.08$ ns
Being with friends	$F = 1.95$ ns	$F = 0.15$ ns
Experiencing nature	$F = 0.89$ ns	$F = 10.55$ $p < 0.002$
Walk in natural surroundings	$F = 1.61$ ns	$F = 0.79$ ns
N	126	199
Missing	131	18
Total	257	217

I and Type III SS show that experiencing nature has the most significant relationship to rehabilitation potential.

The results encouraged us to proceed with an analysis comparing how respondents affected by a crisis to a low/moderate degree and those affected to a high degree are affected by few or many experiences of nature (see Table 5).

We divided the questions ‘Looking at a natural scene/wildlife (trees, clouds, water, squirrels, birds)’ into two groups: ‘Few experiences of nature’, meaning that the respondents have responded 0, 1 or 2 to the question, and ‘Many experiences of nature’, meaning that the respondents have responded 3 or 4 to the question.

We chose to use the three parts of the SCI 93 protocol concerning symptoms of crisis retention (‘muscular symptoms’, ‘autonomic symptoms’ and ‘mental symptoms’), supplemented with the two questions concerning attention and heart rate (Nyström & Nyström, 1995). Here, the respondents were asked to rate how often they feel the following symptoms:

‘In my everyday life, I am bothered by:

- Muscle pain
- Dizziness
- Heart palpitations
- Sleeping difficulties
- And 31 other symptoms.

You are to indicate whether you are bothered: Not at all, Somewhat, Moderately, Quite a bit or Very much’.

The focus of our interest was to examine whether the factor of frequent or few 'experiences of nature' has any differential effect on those affected by a crisis to a low/moderate degree compared to those affected to a high degree (see Table 5a and 5b). The results in Table 5a show significant changes concerning symptoms of crisis retention: mental symptoms and attention. The differences in Table 5b, on the other hand, where both groups have many experiences of nature, show no significant change at all concerning symptoms of crisis retention.

Significant differences concerning mental symptoms are found in crisis retention among respondents affected by a crisis to a high degree (see Table 6), such that they are divided into two groups: one with few experiences of nature and one with many experiences of nature.

The results above may be interpreted to mean that 'experiences of nature' have the strongest effect on people who are greatly affected by a crisis. Crises often affect patients and personnel working in the health and social service professions: the respondents in this study.

Discussion

Our aim was to study whether susceptible people react differently to time spent in a natural environment compared with people who are less susceptible, and to study the importance of social interaction. We chose to study people who were affected by a crisis to different degrees.

Table 5a and b. Analysis of variance, SAS Anova. Differences in how affected people are by psycho-physiological complaints as a function of whether they have few or many experiences of nature in their everyday life

5a			
	Few experiences of nature		Significance
	Low/moderate	High	
SCI psych.	3.55	3.31	$p < 0.05$
SCI musc.	4.00	3.85	ns
SCI auton.	4.17	4.09	ns
Attention	3.77	3.46	$p < 0.05$
Heart rate	4.32	4.26	ns
<i>N</i>	180	144	
5b			
	Many experiences of nature		Significance
	Low/moderate	High	
SCI psych.	3.63	3.62	ns
SCI musc.	4.05	4.03	ns
SCI auton.	4.27	4.22	ns
Attention	3.92	3.75	ns
Heart rate	4.45	4.43	ns
<i>N</i>	73	73	

Table 6. Analysis of variance, SAS Anova. Differences concerning few and many experiences of nature among respondents affected by a crisis to a high degree

	High degree		Significance
	Few	Many	
SCI psych.	3.31	3.62	$p < 0.05$
SCI musc.	3.85	4.03	ns
SCI auton.	4.09	4.22	ns
Attention	3.46	3.75	ns
Heart rate	4.26	4.43	ns
<i>N</i>	144	73	

Our findings may be interpreted as follows:

- *experiencing nature* seems to have a more powerful influence on the rehabilitation potential of people greatly affected by a crisis;
- *taking a walk* also has a significant influence, although not of equal importance;
- *the social factor* seems to have more influence on the rehabilitation potential of people affected by a crisis to a low/moderate degree;
- *having access to nature* in everyday life can have a buffering effect on people's mental state. Individuals who have many experiences of nature are less affected by their crisis than are those who have few such experiences.

In our study, for those affected greatly by a crisis, experiencing nature seemed to promote restoration better than did the other inputs studied. Ottosson and Grahn (2005a) compared the effect of outdoor stays on wheelchair-bound as compared to non-wheelchair-bound people who were among the oldest old. There was no difference between how these two groups were affected by being out-of-doors. Thus, the difference in physical activity did not affect the results. It was the nature experience per se that influenced their concentration ability. Elderly people using wheelchairs received the same stimulation from going out into the garden as did those without wheelchairs.

The present results may also be compared with those of Ottosson and Grahn (2005b), who showed that one group of elderly people could be defined as having 'low tolerance of other residents', being 'not helpful in group activities' and having 'a high frequency of hospital visits'. These older individuals were most affected by a stay in a garden, as measured by changes in heart rate and blood pressure. Ottosson and Grahn interpreted their results as follows:

It is conceivable that a positive experience of natural surroundings in itself has a balancing or buffering effect...The experience can restore the individual to a better state of harmony. Time spent in the out-of-doors is, thus, especially important for individuals with a low psycho-physiological balance, individuals who easily lose their equilibrium or who find it difficult to make compensatory changes to restore harmony on their own. (p. 253)

Moreover, Hartig and Staats (2006) found that the more fatigued their study participants were, the more they favored a restorative walk in a natural environment, compared to a walk in a city center.

Our findings suggest that, during stays in an enriched environment, an interaction takes place between sensory stimulation, emotions and logical thought—an interaction that leads to a new orientation and new ways of seeing one's self and one's resources.

The interplay that emerges between our senses, affects/emotions and cognitive thought is complicated. Information about the surrounding world is taken in through all of our sensory organs. Impulses from sensory impressions are later integrated and processed in the brain. Processing occurs in the amygdala, via a rapid informational path—affects/emotions—as well as in the hippocampus, via a slower informational path—cognition. Finally, the information is linked together in the frontal lobes (Tranel *et al.*, 2000).

In physiological terms, affects are largely located in the older part of the brain, in the limbic system, which is the product of millions of years of evolution. Directly adjacent to the limbic system is an even older system, the brainstem (Bergström, 1992). Affects, particularly primitive impulses such as the impulse to flee or to seek food, have been important to the survival of the human race. These affects originate for the most part in the oldest parts of the brain. They give rise to very quick reactions in the nervous system, which in turn stimulate the autonomic nervous system and endocrine glands (Bergström, 1992; Hansson, 1996).

According to Tomkins (1995), there are six negative affects but only one neutral and two positive affects, because, with regard to human evolution, it has been most important for survival and procreation to avoid dangers and toxins as well as to develop socially acceptable behavior. If danger is signaled, for example by the presence of a predator, a message is sent to a specific area in older parts of the brain, where the affects and the sympathetic nervous system are activated. This triggers, among other things, the circulatory system and causes the release of a number of hormones, such as cortisol and catecholamines, and simultaneously shuts down kidney and digestive functions. The entire organism is mobilized for an emergency. This emergency reaction has been in place in the brains of mammals for a hundred million years and is of vital importance for survival (Tomkins, 1995; Bergström, 1992). But this basic reaction, intended for flight and attack, is also triggered by psychosocial challenges or by the threats we are exposed to in modern society. When the individual is challenged, the central nervous system takes command, which leads to a stress or fight/flight reaction (Atkinson *et al.*, 1996).

Jean Ayres (1983) argues that severe stress causes our entire informational apparatus—comprising senses, emotions and cognition—to function badly, which makes us feel insecure, which in turn causes us to become even more stressed. To change this, we must perceive ourselves as being safe and secure, thus causing the senses to become more integrated. This security is signaled particularly via the 'remote' senses of hearing, smell and vision (Ayres, 1983). Stress causes the cognitive brain to be less active, and the individual relies on and is controlled by affects. When under stress, he/she is more susceptible to signals that sustain or counteract these affects. Signals may sometimes consist of innate reflexes (Coss *et al.*, 2003) and, thereby, give rise to very rapid reactions. Roger Ulrich (1999) argues that the sensory

impact of the environment may signal danger or safety, and that this is most important when ‘persons experience high levels of stress’. The primeval home of humans was located in protective green surroundings; it was restful, without disturbing sounds and smells, and commanded a view of water and the surrounding terrain—predominantly lightly forested, open fields. We also found that experiencing nature seems to have a more powerful influence on the rehabilitation potential of people greatly affected by a crisis.

Searles (1960) points out that people in crisis need stable environments in order to feel well. In situations of crisis, the individual may need to revert to simpler relations. More complicated relations may be too difficult to handle. Most complex are our relations to other people. The simplest relations are those between inanimate objects, such as water, stones, and us. Plants and animals fall somewhere in between. Searles’s conception of nature as a link between the conscious and the subconscious is of special relevance in this context: contact with nature, according to Searles (1960), can contribute substantially to people’s recovery from critical situations of various kinds. Signals from nature spark creative processes that are important in the rehabilitation process. This, and being able to master these relationships, says Searles, helps to reduce anxiety and pain, restore the sense of self, improve our perceptions of reality and promote tolerance and understanding (Searles, 1960).

Ottosson (2001) wrote an introspective study of the strong relationship with nature he experienced outside a hospital in southern Sweden, during rehabilitation after a brain injury. While rehabilitating, he experienced nature on a daily basis. In this context, we could describe this as a ‘continuous remedy’. The description of his experience is one of affects and emotions concerning his relationship with different parts of nature. First the stone:

When he thinks back to the early days, right after the accident, he is surprised by how many of his impressions from the natural surroundings are connected with stones. The untouched stone with its blanket of lichen and moss in various shades of green and grey gave him a sense of security through its timelessness, its calm and harmony. It was as though the stone spoke to him: “I have been here forever and will always be here; my entire value lies in my existence and whatever you are or do is of no concern to me”. The stones did not speak to him in words, but in feelings, which made the relationship both deep and strong. The feelings calmed him and filled him with harmony. His own situation became less important. The stone had been there long before the first human being had walked past. Countless generations, each with lives and fates of their own, had passed by. (Ottosson, 2001, p. 167)

Strong affects and emotions are also attached to the sandy beach (Ottosson, 2001, p. 171):

The untouched sandy beach, clean and devoid of life, but with the constant motion of waves, called to him. Once there, he found it hard to leave. The waves that washed over the sand seemed like some eternal pulse, something that had always been there and always would be. The sound and sight of the waves against the sand filled him with calm and a sense of security—like the heartbeat

of the mother of an infant child. This feeling was so basic that he could never lose it, and knowing this reinforced feelings of security and eternity.

Individuals who are most affected are more prone to sense danger and to feel the impulse to flee. When people are affected by an acute crisis, the functioning of logical processes, through the DAS, is poorer. Thus, logical thought is poorer, which leads to a stronger influence from the emotions (Kaplan, 1990, 2001).

Our study shows that for those affected by a crisis to a low/moderate degree, the social climate seems to be most important: it has more influence on their rehabilitation potential. We suggest that, given somewhat more mental energy, the individual's need for nature will become less indispensable and specific, and his/her social needs and skills will become more apparent. Human beings have a fundamental striving to be part of a social context (Ekvall, 1988). Feelings of belonging are in focus.

Conclusion

We found that the factor of experiencing nature could have a more powerful influence on the rehabilitation potential of people greatly affected by a crisis. We also found that the social factor seemed to have more influence on the rehabilitation potential of people affected by a crisis to a low/moderate degree.

We would like to emphasize that having access to nature in everyday life seems to have a buffering effect on people's mental state. Individuals who have many experiences of nature are less affected by their crisis than are those who have few such experiences. Our results suggest that nature functions as a type of remedy, aid, resource or catalyst. If people in crisis have many nature experiences, they tend to experience an improved state of health.

We have interpreted our results by linking them to new and older research in the area of health and the physical environment. This seems to largely be a question of how we human beings take in and process information.

Current research indicates that people suffering from severe crises often show symptoms of acute stress and hippocampal effects. Recent studies on non-human animals with hippocampal damage have shown great effects of regeneration in the damaged regions in animals that are allowed to stay in enriched environments (Komitova *et al.*, 2005). Our theory suggests that the rehabilitative effect of nature is tied to its function as an enriched environment. Nature may be an important link in an enriched environment that can provide the harmony required for the body to repair disturbed neurogenesis in the brain.

Nature may be seen as a supportive background to various other forms of treatment. To be receptive, one must be secure. It is also a prerequisite for building a bridge between emotion and intellect, which can facilitate how one works through a crisis. When the rehabilitation process has progressed, social aspects play an increasingly important role.

The present results support findings from previous studies showing that those who are most ailing and most affected by a crisis have the greatest need for a supportive outdoor physical environment. For people in crisis, it would seem that salutogenic resources in the form of physical surroundings/network are of great importance.

Here we are referring to signals in the physical environment that mediate rest and relaxation. But where do we find such signals in and around, for example, contemporary hospitals? The verbal signal 'you are in secure hands' can hardly be emotionally understood in an environment that signals danger, disease and death via a number of senses—vision, smell, hearing, etc. (Ulrich, 2001). Prior to 1940, it was customary to build hospitals in beautiful, natural surroundings or to make great investments in laying out large hospital parks (Stigsdotter, 2005). Perhaps it is time for that approach again? However, the results we have presented here and our interpretations of them must be followed by new studies and new interpretations.

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