Healing Gardens: Design Guidelines For Landscape Architects

A Thesis

Presented in Partial Fulfillment of the Requirements for
the degree Master of Landscape Architecture in the
Graduate School of The Ohio State University

by

Virginia McGrath Salamy, R. N., B. G. S.

* * * * *

The Ohio State University
1995

Master's Examination Committee:                Approved by
Norman Booth
Jack Nasar
Larry Walquist

Adviser
Department of Landscape Architecture
Copyright by
Virginia McGrath Salamy
1995
VITA

March 29, 1950.......................... Born - Brooklyn, New York
1975............................................. A. A. S., R. N., College of Staten Island,
                              Staten Island, New York
1990............................................. B. G. S., Capital University, Columbus,
                              Ohio

FIELDS OF STUDY

Major Field: Landscape Architecture
# TABLE OF CONTENTS

VITA ................................................................................................................... ii
LIST OF FIGURES ............................................................................................. v & vi
INTRODUCTION ................................................................................................. 1
SECTION 1  STRESS AND ITS EFFECT ON HEALTH .................................. 6
INTRODUCTION TO SECTION 1 ........................................................................ 7

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>THE RESPONSE TO STRESS</td>
</tr>
<tr>
<td>II.</td>
<td>STRESS AND THE CENTRAL NERVOUS SYSTEM</td>
</tr>
<tr>
<td>III.</td>
<td>THE BODY/MIND CONCEPT</td>
</tr>
<tr>
<td>IV.</td>
<td>THE IMMUNE SYSTEM</td>
</tr>
<tr>
<td>V.</td>
<td>PERCEIVING AND COPING WITH STRESS</td>
</tr>
</tbody>
</table>

SECTION 2  PREFERENCE AND NATURE .......................................................... 51
INTRODUCTION TO SECTION 2 ......................................................................... 52

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>VI.</td>
<td>AFFECTIVE AND COGNITIVE RESPONSE TO ENVIRONMENT</td>
</tr>
<tr>
<td>VII.</td>
<td>LANDSCAPE PREFERENCE</td>
</tr>
<tr>
<td>VIII.</td>
<td>SENSUAL PERCEPTION OF NATURE</td>
</tr>
<tr>
<td>IX.</td>
<td>SENSUAL GARDEN ELEMENTS</td>
</tr>
</tbody>
</table>

SECTION 3  LIGHT AND COLOR .................................................................... 144
INTRODUCTION TO SECTION 3 ....................................................................... 145
CHAPTER

X. LIGHT ................................................................. 146
XI. COLOR ........................................................................ 159

SECTION 4 UNIVERSAL PRINCIPLES OF HEALTH AND DESIGN .. 185
INTRODUCTION TO SECTION 4 ............................................. 186

CHAPTER

XII. SPACE AND FORM .................................................. 187
XIII. ORDER ...................................................................... 205
XIV. UNITY ........................................................................ 216
XV. SCALE AND PROPORTION .......................................... 229

SECTION 5 DESIGN RECOMMENDATIONS ................................. 240

CHAPTER

XVI. THE HEALING GARDEN .............................................. 241
CONCLUSION .................................................................... 252
BIBLIOGRAPHY ................................................................. 255
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURES</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Selye's Physiological Model of Stress</td>
<td>12</td>
</tr>
<tr>
<td>2. Lazarus' Psycho/Social Model of Stress</td>
<td>16</td>
</tr>
<tr>
<td>3. CNS</td>
<td>22</td>
</tr>
<tr>
<td>4. Body/Mind</td>
<td>28</td>
</tr>
<tr>
<td>5. Immune System</td>
<td>34</td>
</tr>
<tr>
<td>6. Relaxation Response</td>
<td>45</td>
</tr>
<tr>
<td>7. Berlyne's Theory of Exploratory Behavior</td>
<td>60</td>
</tr>
<tr>
<td>8. Pleasure - Arousal Hypothesis</td>
<td>64</td>
</tr>
<tr>
<td>9. Ulrich's Theory of affective Response To Nature</td>
<td>68</td>
</tr>
<tr>
<td>10. The Kaplan's Theory of Cognitive Restoration</td>
<td>72</td>
</tr>
<tr>
<td>11. The Sense of Sight</td>
<td>88</td>
</tr>
<tr>
<td>12. The Sense of Hearing</td>
<td>90</td>
</tr>
<tr>
<td>13. The Sense of Taste and Smell</td>
<td>92</td>
</tr>
<tr>
<td>14. The Sense of Touch</td>
<td>95</td>
</tr>
<tr>
<td>15. Regular and Irregular Form</td>
<td>199</td>
</tr>
<tr>
<td>16. Spatial organization</td>
<td>200</td>
</tr>
<tr>
<td>17. Earle's Five Principles of Order</td>
<td>209</td>
</tr>
<tr>
<td>18. Ching's Additional Principles of Order</td>
<td>210</td>
</tr>
<tr>
<td>19. Earle's Seven Aspects of Unification</td>
<td>220</td>
</tr>
<tr>
<td>20. Earle's Seven Principles of Rhythm</td>
<td>223</td>
</tr>
<tr>
<td>21. Proportional Structures</td>
<td>234</td>
</tr>
</tbody>
</table>
22. A Healing Garden ................................................................. 251
Introduction

A garden is not just an outdoor space. It is a space with special meanings and values that surpasses the human experience. In its timeless journey it has left its mark on every culture, religion, era, and emotion that has touched the human species. Gardens give meaning to our rituals by joining our innate yearnings with the natural world. Gardens have power over our senses and can create a world unlike any other. They come in all shapes and sizes and are formed by a primeval need to be one with the universe.

It is time to address the garden as an important part of 20th century life and elevate it to the level of a life sustaining symbol. We need the presence of a garden in our lives to heal us from the stress of modern life and to return us to the joys and comfort of nature. We need a garden to restore us back to health!

This study proposes a remedy for stress that incorporates nature, in the form of the garden, into a therapeutic entity that produces well-being through the sensual interaction with the natural world. The garden, if designed properly, may have the capacity to create and enhance health on a daily, and seasonal basis. This may eventually lead to the continued and consistent return of well-being for most individuals.

This study has come to the conclusion that the following design qualities and elements should be incorporated into a garden to create restorative experience:
1- A pleasurable stimulatuion of the senses through a balanced design of
garden elements that produce interest through a rich, diverse, complexity.
2- A spatial organization that provides interest, order and balance through the
use of aesthetic design principles.
3- An open area, that is defined through the aesthetic and ordered
arrangement of garden elements, that allows an evaluation of the
environment.
4- An element of enclosure that produces interest, through the ordered and
balanced arrangement of garden elements, that creates a sense of mystery.
5- A garden enclosure that creates a spiritual haven for the senses through the
use of aesthetic design principles and garden elements.
6- A diversity of garden elements that contain affective and symbolic
properties that become enhanced through sensual garden design to create
interest, pleasure, and relaxation.
7- A harmonious relationship among light, color, texture, and form that
enhances the garden elements through the principles of aesthetic design.

The rationale for these recommended qualities and elements comes
from an analysis of the data related to stress, health, nature, and design. The
results of this analysis lead to design guidelines that address each
recommendation at length to produce specific design criteria based on the
need to reduce stress and enhance well-being.

Daily stress has been the blight of this century and several alternative
remedies are being evaluated as ways to reduce it. Very few stress reduction
techniques have incorporated natural elements into their programs as a way
of addressing this problem. Feeling close to nature and enjoying nature's gifts is one of the most positive experiences that an individual can encounter. This experience should be available to all who suffer from stress and want to embrace well-being.

Society is being driven by a technological force that is creating a culture that interacts with an unnatural environment on a daily basis. Everything we do is related to a machine or man-made technique that controls our behavior from the moment we arise in the morning to the moment we close our eyes at night. A loss of control over our lives is being experienced as we come within the closing of this Century. Increased stress and emotional alienation brought on by the affects of a technological society are causing us to live our lives at an unrealistic pace. This pace, which seems to have accelerated greatly within the past 20 to 30 years, is beginning to overwhelm us and create catastrophic illness. We need to be able to sense pleasure, not distress from our environment. We need to regain psychological and physical health from our environment. We need to return to a natural environment to repair our body and our soul.

For over twenty years several researchers have studied the affects of nature on stressed individuals. The view held by most researchers (Ulrich, Lewis, Kaplan & Kaplan, Parsons) is that there is a definite and definable relationship between health/well-being and reactions to perceived environments. Vegetation and other natural features seem to have characteristics that reduce stress and cause positive behavior that produces well-being. There is a need to have studies done in a natural setting that quantitatively analyze the affects of gardens on our health. In order to make this possible, a general set of design guidelines needs be developed. These
guidelines should set forth a criteria that uses design as an integrative process to create health and well-being in a garden setting. The purpose of this study is to develop and define these design guidelines so that a standard that addresses health through garden design is available for landscape architects.

The first section of this study begins by examining the theories on stress that have been found to be consistent with the physiological and psychological affects found most often in stress related illness. Each chapter ends with recommended goals that may be important for the landscape architect to consider if stress is to be understood. This gives the landscape architect an awareness of how stress affects health and what objectives and requirements are needed to produce a design that reduces stress. The section ends with a general summary.

Section 2 of this study explores and compares the theories involved in the environmental preference of nature so that a common thread that builds a relationship between the sensual pleasure of nature and health can be found. This enables the landscape architect to associate sensual garden pleasures with health and incorporate these findings into a design concept that initiates the healing process. Each chapter ends with recommended goals outlining the role of preference in landscape architecture. A summary of the findings puts a clear perspective on their similarities and differences.

Section 3 is devoted to the natural elements of light and color. Their importance and powerful affects on health and well-being are analyzed as well as their implications for affective design. This section makes it possible for the landscape architect to be aware of light and color as a primary design
tool that is necessary for the attainment of health and affective design. A summary as well as design recommendations that address the use and purpose of light and color end each chapter.

Section 4 reviews the aesthetic principles of design and compares them with and identifies them as the universal laws of health and harmony. This section gives the landscape architect the knowledge and ability to create a design concept that is multifunctional in its relationship to health and aesthetics in the pursuit of universal harmony. A summary ties the concepts together and each chapter is followed by specific design recommendations that thoroughly address each design principle/law of harmony.

The study ends with Section 5 which places the important design features, that are synthesized from the data, into recommendations that form the concept of a “Healing Garden”. This is followed by a conclusion that explores the findings and relates them to landscape architecture and health.
SECTION I

"Future shock...the shattering stress and disorientation that we induce in individuals by subjecting them to too much change in too short a time.

-Alvin Toffler-

STRESS AND ITS EFFECT ON HEALTH
Introduction To Section 1

Health is an on-going, interconnected psychological and physiological process that occurs when a balance of systems (homeostasis) is present in the body. Contemporary living seems to expose us to daily amounts of stress that hinder our ability to maintain that balance. Finding a way of coping is important in alleviating the affects felt by stress as illness may result. Alternative natural methods, such as gardens, are being considered by many as a therapeutic plan in the reduction of stress. Getting back to nature may be a means to refurbish the mechanisms that are responsible for maintaining a balance that is so important to health.

Several researchers such as the Kaplans, Ulrich, Parsons, Lewis, and others suggest that being close to nature boosts the emotional health of most individuals. "The firmest conclusion is probably the fact that, although not contingent exclusively on a natural setting, restorative effects are enhanced by the presence of natural features." (Perry, 1988:9)

This section begins by discussing the important physiological and psychological models of stress that describe the effects and patterns caused by exposure to environmental stress. This is outlined so that an understanding of how health is effected by stress becomes apparent to the landscape architect. A complete review of the organic systems involved in stress interaction is examined so that structural information can be analyzed and incorporated into an understanding of how stress effects the physical body. This analysis should be useful to the landscape architect so that an understanding of
physiology and healing can be linked to design. This should aid the landscape architect in the design process to benefit the client’s need for stress reduction.

The role of the central nervous system and immunity in response to stress is examined. Stress reduction techniques and general coping mechanisms are reviewed and compared to several studies that discuss the importance of stress reduction in producing health. The results of these studies are compared with theoretical approaches that may have the ability to substitute a natural environment as a healing alternative.

**Stress**

Stress can be described as an adverse condition brought about by stressors in the environment that cause undue anxiety and harm on an individual basis (Selye, 1956). An adverse condition can be in the form of mental, emotional, and physical trauma. Stressors in the environment are any form of stimuli that is perceived as harmful or detrimental to an organism. Each organism reacts to stressors according to an internal makeup which produces certain coping mechanisms that are effective for that organism. This internal makeup differs for each individual and therefore makes both stress and coping a specific, rather than, a general process (Lazarus, 1966 and 1991). For example, the same stressor, such as traffic, may cause different reactions in the same person during different times of the day. Heavy morning traffic may cause a low to moderate amount of stress while moderate evening traffic may be perceived as extremely stressful due to a full and tiring day of work. The landscape architect needs to be aware of this so that designs are personal rather than general.

Several theories and studies have been presented regarding the phenomenon of stress. Selye’s theory of physical adaptation and Lazarus’
psycho/social theory are the important and significant models of stress that are found to be appropriate references for this study. They address stress in terms of specific responses. This section on stress begins by analyzing these theories so that a clear understanding of their scope and applications in stress management is apparent and useful in synthesizing design concepts for landscape architects.
CHAPTER I

A garden should be created to activate peace of mind, allow for passive pleasures, and produce relaxation that reduces the physical and psychological reactions to stress.

The Response To Stress

This chapter begins with an analysis of the physical harm stress causes the body and describes the body’s response to a stressful situation so that the landscape architect can incorporate this knowledge into a garden design that reduces stress. Once this has been established the psycho/social aspects of stress are included in the analysis to broaden the scope on stressful responses. The landscape architect needs to be aware of the physical and psychological affects produced by stress so that a design can include these findings in a concept that addresses stress reduction. Without this knowledge a design concept may not be able to fully integrate the multifaceted aspects of stress and produce the desired result of health. A garden designed to alleviate the full discomforts of stress is a primary goal for the landscape architect who is designing a healing garden.
The Physiological Response to Stress

Walter Cannon (1932), a physiologist who was one of the first researchers on stress, theorized about the effects of the physical environment and the physiological responses that resulted from experiencing environmental stimuli (Selye, 1956). He believed that stress, especially in an intense form, set forth an imbalance in the body that eventually led to an advanced deterioration of health (Hobfill, 1988, Selye, 1956). This imbalance, according to Cannon, was caused when an internal mechanism (which he referred to as homeostasis) that monitored the body’s innate functions lost its stability. The “fight or flight” syndrome or “emergency reaction”, as labeled by Selye, takes over and activates the sympathetic nervous system to send messengers (neuropeptides) to strategize a coping mechanism (Baum, Singer, and Baum, in Evans, 1982, Selye, 1956). Cannon felt that a complete halt in functioning would take place within the human organism if coping strategies were not initiated to deal with acute and chronic stress (Hobfill, 1988).

Hans Selye (1956), considered the founder of the modern stress theory, was greatly affected by Walter Cannon’s hypothesis and devoted his career to the study of stress and the physical conditions it produced (Hobfill, 1988). He became interested in the etiology of stress while investigating the effects of acute and chronic diseases that presented the same symptomology (Zales, 1985). He defined stress as:

“...the wear and tear produced in the body by any type of exposure or, ...simply as ‘the non specific response of the body to any demand’."
(Selye in Hamilton and Warburton, 1979:12).

The “General Adaption Theory” (GAS) (fig. 1) was created by Selye in order to understand the physiology involved in reactions to stress. If its
SELYE'S PHYSIOLOGICAL MODEL OF STRESS

1. Alarm Reaction
   - Mild Tension
   - Neglect
     - Minor Illness
     - RECOVERY
   - RECOVERY

2. Stage of Resistance
   - Resistance
   - Adjustment
     - Adaptation
     - Lowering of Resistance
     - Weakened Reaction To New Stresses
   - RECOVERY

3. Stage of Exhaustion
   - Long-Term Resistance
   - Total Depletion of Energy
     - Recurrence of Stages 1 & 2
     - Alleviation of Stress
       - Continued Stress
       - RECOVERY
     - No Resistance
       - Death

Figure 1-Selye's Physiological Model of Stress
implications are understood by landscape architects it may open up an awareness to design that combines an understanding of human needs and environmental responses. The "General Adaption Theory" states that long term stress creates a condition of jeopardy within our bodies that makes it almost impossible for us to remain healthy and conquer illness. Our physical defense mechanisms go into overdrive and do not recover unless stress is removed (Selye, 1956), (Baum, Singer, and Baum, in Evans, 1982), (Rice, 1987), (Hobfill, 1988).

Selye broke the "General Adaption Theory" into three stages:

1) **The Alarm Reaction** causes a mild tension in the body that is often overlooked and neglected. If this continues for sometime without relief the body may fall prey to illness.

2) **The Stage of Resistance** causes the body to adjust and adapt to the stressors and recover. However, there is a lowering of resistance that remains and causes a weaker reaction to new stressors.

3) **The Stage of Exhaustion** causes a total depletion of energy if the stressors are intolerable or continue for a long period of time. This causes a recurrence of the first two stages. If the stressors are not alleviated death may be the outcome (Baum, Singer, and Baum, in Evans, 1982, Rice, 1987, Selye in Hamilton and Warburton, 1979, Selye, 1956, Weiner in Zales, 1985).

These physiological responses to stress, which cause increases in heart rate, blood pressure, central nervous system activity, and stress hormones, are controlled by the adrenal glands and if utilized over a long period time will malfunction.

Selye's explanation of the autonomic nervous system's reaction to stress gave us an insight into how the body adapts to change. Both Cannon
and Selye found stress to be general in form and its reaction to be non-specific (Selye, 1956). This theory later met with some controversy. Many colleagues considered Selye’s definition of stress to be medically induced and incomplete in regard to other disciplines such as psychology and sociology (Holfill, 1988, Lazarus, 1966, Rice, 1987, Weiner in Zales, 1985). “In Selye’s subsequent writings the line between the beneficial (‘defense’) and the pathogenic effects...become blurred.” (Weiner in Zales, 1985:26)

“As influential as Selye’s theory has been, it must now be viewed as too narrow. One major weakness is that it does not encompass the psychosocial factors of critical importance to understanding human stress.” (Rice, 1987:26)

“However his lack of insight into psychological phenomena accompanying stress and his lack of attention to individual differences that might be products of this psychological processes limit his relevance to current thinking on psychosocial stress” (Holfill, 1988:6)

Selyes’s findings may have been one-sided in explaining his concepts on stress. However, this may have been due to his medical background which was conducive to understanding cause and effect in terms of anatomy and physiology. Also at the time he was researching (1950s) psycho/social development was not a strong factor in most theories related to medical research. Selye’s concepts have had an enormous impact on the study of environmental stress by laying a foundation on which further research could develop and build into a comprehensive analysis of the definition of stress. Contemporary research has evolved from his assessments of stress into most new theories regarding psychological stress.
The Psychological Response to Stress

Going beyond Selye’s model for the physiological basis of stress some researchers turned toward the inclusion of the psycho/social aspects involving stress. The psycho/social component of stress was modeled after our ability to evaluate the environment through the cognitive process. This is a very important concept for landscape architects because design elements effect the perception of most individuals by portraying an environment that can be perceived as familiar or affectually stimulating. This perception is related to both cognition and affect. However, cognition brings memory and experience into the realm of perception and may be one way to judge an environment as unstressful. It may arouse familiar feelings associated with memories and experiences of former settings that seemed to induce relaxation and satisfaction. Selye’s model seemed to be based more on emotions and sensation produced by exposure to environmental stimuli (a deeper discussion of affect will take place when preference is discussed).

An environment is first perceived by an individual as a place or setting that brings about feelings that are personal and significant for that individual. Perceptions of an environment cause reactions that affect behavior. Perception is a part of the cognitive process that brings awareness of an environment into play (Kaplan & Kaplan, 1989, Parsons, 1991, Ulrich, 1983).

Richard Lazarus (1966) was one of the first researchers to bring the process of cognition into the study of psychological stress (fig. 2). Cognition (environmental cognition) begins when an individual experiences the environment after sensation has taken place. Personality makes the process of cognition possible as a separate and distinct event. According to Lazarus (1991), cognition involves knowledge and appraisal. “Knowledge” is
LAZARUS’ PSYCHO/SOCIAL MODEL OF STRESS

PERCEPTION OF ENVIRONMENTAL STRESS

Emotional
- Sensation
- Control Emotions
- Adaptation to Environment

Knowledge & Appraisal

Cognitive
- Personality
- Knowledge & Appraisal
- Experience
- Alleviation of Stress
- Analyze Personal Feelings of Environment
- Primary Appraisal
- Secondary Appraisal
- Perceive Threat

Chose Best Coping Mechanism for Perceived Threat

Figure 2--Lazarus’ Psychosocial Model of Stress
the concept of understanding our needs and how they apply to the
environment both generally and personally. It is a build-up of experiences
and assessments that have shaped how we view the world. "Appraisals"
analyze knowledge and personalize it so that it has individual significance.
"Primary appraisal" opens the door to emotional involvement on a very
basic level. Simply, a threat is perceived and what kind of a threat it is or
how the threat effects the organism is taken into account (Baum, Singer, and

"Secondary appraisal" involves the ability to decide what coping
mechanisms will work best for each stressful situation. Both "knowledge"
and "appraisal" are factors in emotional responses to stress, (Baum, Singer,
and Baum, in Evans, 1982, Hollfil, Lazarus, 1991) According to Lazarus,
emotions are very complicated and intricate feelings that cause changes in
behavior. They are by-products of the "person-environment relationship"
(Lazarus, 1991:40) and are tied to both psychological and physical health.
"Appraisal" and "coping process" are joint products of personality and
environmental variables.

"The task of appraisal is to integrate the two sets of antecedent
variables-personality and environment-into a relational
meaning based on the relevance of what is happening for the
person's "well-being". (Lazarus, 1991:39)

According to Lazarus, "appraisal" plays a part in the strength and scope
of our emotions. Lazarus suggests, that if one's emotional health is strong an
individual will be able to control the outcome of environmental stress
without causing unneeded emotional turmoil and involvement.
"Appraisal" is responsible for this adaptation. Our emotions rely on the
appraisal process by innately analyzing a situation and personalizing it so that
it is relevant to our needs. In other words it involves both the conscious and subconscious mind in an integrative process (Lazarus, 1991).

It seems evident that Lazarus' descriptions of stress and the reactions it produces are very similar and quite complimentary to Selye's GAS. However, his model adds a psychological component to the theory that seems to address the complexity of stress and merge both the psychological and physical aspects of stress into a unified theory

**Recommendations for Stress Reduction In A Healing Garden**

1. Based on Selye's interpretation of the physical discomforts and harm that can be caused by stress, the landscape architect should evaluate a garden space for its ability to reduce physical tension. After an initial evaluation, a set of goals for reducing the physical reactions to stress should be determined. These goals should address the need for relaxation through a reduction in stressful stimuli such as noise, unpleasant views, high degrees of complexity without interest or pleasantness, and the like. These goals may be accomplished with design guidelines that are developed in later chapters which integrate design principles and garden elements into a functional and therapeutic design concept that reduces stress.

2. As Lazarus suggests, the cognitive process and emotional feedback play a major role in how an individual perceives the environment. Design elements should be assessed for their stress reducing qualities that effect the psychological make-up of an individual and structured into the design to produce well-being. This is addressed in Chapters VI & VII. If certain features of the garden affect us at the cognitive level then perhaps a positive response could be prompted from certain environmental stimuli. This response might be able to produce a decrease in the stress level and therefore be viewed as a
pleasurable and emotionally uplifting experience that can produce a feeling of well-being in certain individuals. The challenge is to discover what types of environmental stimuli can produce the desired response and what individuals would be responsive to it. This introduces a component to the design process that adds a factor of psychological structure to the design concept. This requires design principles and garden elements to be responsive in alleviating mental and emotional stress. This is addressed in Chapter IX, and Sections 3 & 4.

3. An important goal of the landscape architect in deciding what types of environmental stimuli can produce positive behavior is to begin with a personal interview of the user(s). This may be called the “Holistic Interview” because it addresses the physical, emotional and spiritual needs of the user(s). This interview may allow the landscape architect to create a health promoting design that feels personal (important to self-esteem), gives a sense of control (vital to health) to the client, and encourages interaction (stimulation) with the senses. In the “Holistic Interview,” the landscape architect should attempt to gain the following information from future users:

* Individual likes and dislikes regarding the natural environment, garden style, design elements, and the like
* Coping mechanisms used in adapting to stress
* Expectations of what the garden means and how and when it might be used
* How the garden may create an atmosphere of relaxation and well-being to meet the client’s needs

This helps the landscape architect understand what qualities of a garden are found to be relaxing by that particular user.
CHAPTER II

A garden should cause the body to relax by absorbing nature’s tranquil affects, so that the nervous system may produce endorphins for a natural high.

Stress and The Central Nervous System

Stress causes the nervous system to react to stimuli and situations. The reactions of the nervous system can cause changes in behavior and immunity. These changes literally happen at the cell level and are responsible for every action and reaction in our bodies to stress. The garden can act as a natural tranquilizer that reduces stress through a gentle stimulation of the senses that activates the nervous system to inhibit the production of stress hormones. If the stimulation is effective in producing enhanced pleasure it may cause natural opiates within the brain to be released. This causes a relaxing effect and naturally reduces the response to stress. A design concept with the goal of increased relaxation through the decrease of stimulation to the nervous system is what the landscape architect can achieve through an understanding of the physiology involved in a reaction. Physiological reactions play an important role in how we react to stress. Sensation and perception is our first reaction to the environment which is perceived through the senses. This chapter outlines how the nervous system sets into place the initial response to stress that the body
provides.

The nervous system is made up of two parts that are responsible for how we react to situations. The voluntary nervous system controls our voluntary actions. For example, placing a hand in ice water causes us to immediately withdraw it once the sensation is felt. The nerves in the fingers send signals to the brain which activates the nervous system to cause us to lift our hand out of the cold water. The involuntary nervous system controls involuntary actions such as, breathing, heartbeats, and snoring. We are unaware of its actions and rely on it to function in a normal manner. If we were aware of it we would end up in a stimulation overload because we would feel every internal mechanism that controls our body.

As sensation and perception take place they set in motion a series of psycho/physiological responses that begin with the central nervous system or CNS (fig. 3), which consists of the brain and spinal cord. The brain is responsible for controlling all bodily functions. If it stops working we die. If it becomes impaired the body suffers innumerably. The well known phrase "brain dead" truly means that someone consciously dead and only the very primitive bodily functions that the CNS controls keeps them alive. However, although we are capable of living we are not capable of expressing life (Carlson, 1991, Giordano and Everly, Jr., 1986, Ornstein and Sobel, 1987).

The peripheral nervous system or PNS (cranial and spinal nerves) is responsible for communicating sensory data from the brain to other parts of the body. The PNS has two parts: 1) the somatic nervous system (SNS): directs the movements of the skeleton via muscles by synthesizing sensations that have been elicited from our perception of environmental stimuli 2) the autonomic nervous system (ANS): which is regulated by the hypothalamus (a
Figure #3

**CNS**

**BRAIN**
*Controls All Bodily functions*

**SPINAL CORD**

**PNS (Cranial-Spinal Nerves)**

- SNS
- AWS

**Voluntary Reactions**

**Involuntary Reactions**

- Muscle Movements
- Arousal

- "Fight or Flight Syndrome"

- Hormones into Bloodstream

**Physiological & Psychological Reaction**

- Let Down Period

- Deep Relation

- Relaxation
small, complex element that is part of the brain), which governs the responses (survival behaviors) that control glands and activate hormones. These two systems combine to form the physiological reactions we have to stress. The SNS is associated with our voluntary reactions to stimuli while the ANS is associated with our involuntary reactions to stimuli. The ANS is composed of two divisions: 1) the sympathetic division, which controls states of arousal 2) the parasympathetic division, which controls states of relaxation (Carlson, 1991) (Giordano and Everly, Jr., 1986), (Ornstein and Sobel, 1987).

It is the sympathetic system that controls our reaction to stress in the form of the “fight or flight” syndrome. The hypothalamus is responsible for distributing hormones into the bloodstream so that the heart and muscles have enough stamina to fight off stress. When our forbearers were faced with a stressful situation (often based on a need to survive) they had a major physical, as well as psychological, reaction. This involved the neuromuscular and cardiovascular systems which set up an involuntary reaction (based on survival) that caused a “fight or flight” reaction to occur. After the threat was over there was a let down period which ended in deep relaxation.

Modern humans do not have that luxury. When a threat is perceived they react like their forbearers and begin the “fight or flight” syndrome. Due to contemporary life, we are often unable to attack the stressors or run away from it. This causes stress to build up, and if not released become a potential danger or threat to well-being (Benson and Stuart, 1992, Carlson, 1991, Giordano and Everly, Jr., 1986, Ornstein and Sobel, 1987). A physical as well as psychological remedy must be sought to release the tension of stress. A way of releasing this tension may be through exercise, such as gardening or walking in a natural environment. Often mild exercise is prescribed as a way
of treating stress. It is an easy way to reduce tension by keeping the muscles limber and relaxed. Relaxation causes a reduction in the release of stress hormones into the bloodstream by the hypothalamus.

The hypothalamus, located in the brain on top of the pituitary gland and connected to it vascularity, is the agent responsible for responses to stress. (It also acts as a correspondent with the immune system by giving feedback through neurotransmitters that travel via the nervous system). Stimulation of the hypothalamus can result in either a parasympathetic response (inhibition) or a sympathetic response (activation) to stress. For example, the lowering of blood pressure in response to relaxation would be a parasympathetic response and the increase in blood pressure in response to overstimulation would be a sympathetic response.

These responses cause the neuromuscular system to respond by either contracting or relaxing. As stated before reaction in the form of the "fight or flight" syndrome is involuntary. However, to counterbalance this reaction a voluntary or conscious effort must be taken into account in order to bring the syndrome back to a level of moderation (Carlson, 1991, Benson and Stuart, 1992, Giordano and Everly, Jr., 1986). This effort is known as the "relaxation response" (Benson and Stuart, 1992:33). Research reports that long-lasting or permanent damage to the nervous and immune systems can result as a consequence of several "fight or flight" reactions to modern stress. This is because stress hormones ACTH, cortisol and adrenaline are constantly being released at a rapid rate into the bloodstream. When they reach a level in the blood that is too high, and they cannot be assimilated, they cause damage to the body.
The nervous system (the pathway for body/mind interaction) is responsible for an innate response that produces a natural analgesia (Ornstein and Sobel, 1987). The body/mind produces endorphin, an endogenous opium that produces analgesia (a decrease in response to pain), in reaction to stress caused by environmental stimuli. This is a natural reaction produced by the CNS to counterbalance "overload" created by reactions to stress. Opiate receptors were found in the brain by Pert, Snowman, and Snyder (1974). Their experiment consisted of withdrawing cells from rat brains, incubating them with radioactive naloxone (opiate inhibitor) and dihydromorphine (synthetic opiate) and causing these cells to become radioactive. The findings resulted in the conclusion that both drugs bind with cells in the brain and therefore opiate receptors are a part of the brain's neural activity (Carlson, 1991, Pert in Moyers, 1993).

Endorphins are naturally produced during periods of exercise through deep breathing. Its the body's way of dealing with the stress produced by activities such as increased exercise. The "natural high" that a runner experiences from exercise is the result of endorphins. Nature is also able to produce this "natural high" in some people.

**Recommendations for Central Nervous System Relaxation In The Healing Garden**

1. A simple understanding of the mechanisms involved in the CNS can aid the landscape architect in designing a space that is capable of helping the body relax and release natural opiates to reduce stress. Reduction in the amount of stimuli that increases a negative reaction of the CNS is an important goal for the landscape architect to consider when implementing a garden design that
reduces stress. Chapter IX, and Sections 3 & 4. address the design principles and elements that make this possible.

2. Relaxation may be achieved through meditation and mild exercises, such as Yoga and Tai Chi, which activate muscle relaxation through gentle, balanced movements. A goal of the landscape architect may be to create garden spaces that allow for the performance of these exercises. This would encourage an interaction of the CNS with the natural environment and increase the body’s ability to relax naturally. Chapter IX, and Sections 3 & 4. address the design principles and elements that make this possible.

3. A meditative space that is quiet and hidden away from garden traffic and outside disturbances allows for quiet contemplation and introspection to take place. This may produce a profound relaxation, through deep breathing and lowered brain wave pattern production, which may activate the “relaxation response” to cause a reduction in stress and endorphin release.
CHAPTER III

The garden is a spiritual haven where the body and mind can connect and become one to create a holistic approach to healing.

The Body Mind Concept

Our psychological, physiological, emotional and spiritual behaviors are governed by our body/mind (fig. 4). The central nervous system is the vehicle that transmits all communication between the body/mind. This process and each component of this process overlaps with and touches upon the other. The body/mind, a term used to describe the holistic process of thought and reactive behavior that encompasses both the body and mind, is responsible for how we perceive and react to the world. It controls cognition (thinking) and feeling (emotion) which in turn controls behavior (Moyers, 1993, Goldman and Gruin, 1993).

To create a garden that is capable of healing through a holistic approach to design begins with a thorough comprehension of how cognition and emotion form our behavior. Once these processes are understood a garden plan can be developed that integrates design principles with garden elements to form a spiritually connected space. Environmental stimuli that produces this space interacts with the body/mind and causes a holistic response. This is
how it works.

Stimuli transmits information to our brains which send chemical signals to our bodies. This constant interaction between mind and body (or body/mind action) produces a chemical energy that is life. This energy is responsible for all the interactions and reactions that one encounters in daily living. These interactions and reactions are products of our emotions which produce and become this energy. (Goldman and Gruin, 1993, Moyers, 1993).

There has always been a spiritual connection between humans and the universe ever since our species first emerged on this earth. The belief that a soul, the spiritual component of the body, is ultimately responsible for how we act and behave can be traced back to our earliest history.

As early as 500 B.C. Alcmæon of Croton hypothesized that the brain is the center for all mental activity and Empedocles hypothesized that it was the heart. These theories came to be known as “the brain hypothesis” and “the cardiac hypothesis” (Kolb and Wishaw, 1990 : 326) The “the brain hypothesis” was supported by Plato (c.400 B.C.) since he felt that the head was vertically in line with the heavens and therefore in touch with the soul. Aristotle (c.350 B.C.) favored “the cardiac hypothesis” because he felt that emotions (what he considered to be the heart) and mental activity emanated from this structure due to the warm-blooded nature of man (Kolb and Wishaw, 1990). Two very important physicians, Hippocrates (c.400 B.C.) and Galen (c.175 B.C.), based their belief of “the brain hypothesis” on several experiments and medical practices they conducted. “The brain hypothesis” seems to have been the stronger of the two because it has been taken more seriously by the scientific community (Kolb and Wishaw, 1990, Sutcliffe & Duin, 1992).
The French philosopher Rene Descartes (1596-1650) is responsible for what became known as the "modern" concept of mind, body and soul. His theory distinctly separated body, mind, and spirit into three different aspects of humanity. He called the mind "the rational soul" and believed that it contained none of the characteristics of the body which he labeled as a "machine" that functioned mechanically (Kolb and Wishaw, 1990). He developed the theory of "the pain pathway"; the sensation of pain felt by the body that is interpreted into pain by the brain. This led to further research and the concept of a neurological pathway between the body and the brain (Kolb and Wishaw, 1990, Sutcliffe & Duin, 1992)

Modern medical treatments and theories have been based on Descartes' assumptions. Treatment of illness has relied on the practice of getting rid of disease symptoms not on setting up goals to enhance health. A new paradigm is unfolding. Current medicine is under the assumption that the body and mind are united not separate. Alternative medical treatments are being studied and sought after in order to broaden the scope of traditional medical treatments. These remedies are treating the whole being not a part of that being. This new medicine is called "body/mind" medicine. "...it's really very basic. It's bringing a whole body together to prevent disease or help the healing process." (Smith, D. in Moyers, 1993:49)

The body and mind are so intertwined and unified that one cannot literally function without the other. They are one and the same not two separate systems. "It makes more and more sense to speak of a single integrated entity, a body-mind." (Pert in Moyer, 1993, p. 174) The body-mind therefore reacts to stress, not the body or the mind. Our psychological, physiological, emotional and spiritual behaviors are governed by this process
and each component of this process overlaps with and touches upon the other.

Our emotions govern behavior and are responsible for behavior that can either enhance or destroy our health.

"Attitudes, beliefs, and emotional states ranging from love and compassion to fear and anger can trigger chain reactions that affect blood chemistry, heart rate, and the activity of every cell and organ in the body-from the stomach and gastrointestinal tract to the immune system." (Pelletier in Goldman and Gruin, 1993:19)

Scientists are uncovering data that suggests that emotions are responsible for our overall health.

"The studies...are part of mind/body medicine: an approach that sees the mind-our thoughts and emotions-as having a central impact on the body’s health.” (Goldman and Gruin, 1993:5)

Emotions are felt to have a strong influence on how the immune system functions. According to Candice Pert they play a major role in health and well-being. She feels that neuropeptide or “messengers”, amino acid chains that carry messages from the brain to other parts of the body, and their chemical receptors are responsible for and related to emotional reactions (Goldman and Gruin, 1993, Pert in Moyers, 1993,).

The limbic system (the seat of emotional behavior in the brain) contains a huge reservoir of neuropeptide receptors. These neuropeptides seem to be interrelated or interactive with emotional states. (Goldman and Gruin, 1993, Pert in Moyers, 1993) Approximately sixty neuropeptides are believed to be responsible for causing emotional responses that involve physical reactions (Lonsdorf, Butler, and Brown, 1993). The emotions have two distinct classes: 1) scientific, where measurements evolve into formulas,
and 2) non-scientific, where qualities cannot be measured or categorized.

"There are aspects of mind that seem to have qualities that seem to be outside of matter." (Pert in Moyers, 1993, :182) "We can measure the chemical reaction that gives rise to an emotion, but we can't look under a microscope and say, "That's grief." (Pert in Moyers, 1993:187) "Undoubtedly, in man with his highly developed central nervous system, emotional arousal is the most common cause of stress..." (Selye in Hamilton and Warburton, 1979:15)

However, few of us are aware of the internal factors that cause the process of chemical reaction. So, in interpreting stress we must be aware of how our body/mind is affected.

By spiritually addressing the need for tranquility and peace of mind the landscape architect is practicing holistic healing through the integration of health and design.

"Our view is that the meaning of the garden (as well as the larger landscape of which gardens are a part) can only be understood today as a whole, as an ecology of interrelated and connected thoughts spaces activities, and symbols." (Francis and Hester, Jr., 1991:2)

**Recommendations For Body/Mind Awareness In The Healing Garden**

1. An awareness of the body/mind principle may help the landscape architect make design decisions based on a holistic approach to stress. The garden like, the body/mind, must be treated as a whole. It must be designed so that an integration of space, function, color, texture, and form unite and express the garden as a haven that holistically soothes the soul. Chapter IX, and Sections 3 & 4. address the design principles and elements that make this possible.
CHAPTER IV

A garden is a space that welcomes interactions with nature and friends. It should create an atmosphere that is conducive to interpersonal growth and awareness.

The Immune System

The immune system, which is responsible for the body’s maintenance of health, is linked to the body/mind via the central nervous system. To function properly it must be able to fight off disease with a moderate amount of effort. An understanding of the dynamics behind this system is necessary for the landscape architect to continue the expansion of a knowledge base for stress reducing design.

The immune system (see fig. 5) sets up an assault on all foreign substances that enter the body. These substances (viri, bacteria, allergies, etc.) are attacked by lymphocytes (white blood cells that produce immunity) because they are perceived by the body/mind to be intruders. The B-lymphocyte creates its own substance, an antibody, to get rid of or kill the intruder commonly known as an antigen. Each antibody has a specific target antigen that it attacks. The T-lymphocyte originates in the thyroid and is not
treat their nausea. Even when administering the saccharin water without the an attacker. It does not make antibodies. Instead it attacks the antigen alone or with the help of other lymphocytes. The T-lymphocyte functions either as a “helper” or as a “suppressor” cell. The “helper” initiates antibody production in other lymphocytes while the “suppressor” blocks antibody production. This function creates a system of checks that keeps the immune system in balance. If the “helper” - “suppressor” equilibrium is disturbed than health declines. (Kiecolt-Glaser, Glaser, in Goldman and Gruin, 1993). “For optimal health, the helper/suppressor cell ratio should be in balance.” (Kiecolt-Glaser, Glaser, in Goldman and Gruin, 1993:43)

Research on immunity falls into the category of psychoneuroimmunology. Psychoneuroimmunology is the term used to describe all forms of intricate communication that operate among our neural, endocrine, immune and behavioral systems (Ader, Felton and Cohen, 1991), (Goleman and Gruin, 1993). Research has suggested that the immune system is somehow linked and dependent upon the nervous system for both its ability to perform and secure homeostasis. Robert Ader, a researcher at the University of Rochester, has made significant contributions in this field and is considered a leader in the study of psychoneuroimmunology. Several of his experiments, including the first which laid the foundation for the science of psychoneuroimmunology, involve the immune systems ability to induce healing.

Ader (1990) discovered that the immune system has the capacity to “learn” behavior. In his first psychoneuroimmunological experiment he conditioned several rats to become nauseated to saccharin treated water. Ader noticed that some of the especially healthy rats were dying. He found the
culprit to be the immunosuppressive drug he had administered to them to immunosuppressive drug the rats reacted the same way. Ader concluded that the rats’ immune system had been conditioned to associate saccharin water with the immunosuppressive drug.

Ader collaborated with Nicholas Cohen (1991), an immunologist at the University of Rochester, to test his hypothesis. Drs. Ader and Cohen concluded that a straightforward connection exists between the nervous and immune systems. (Ader in Moyers, 1993, Goleman and Gruin, 1993). “The experiment was a direct and rather dramatic demonstration between nervous system function and immune function.” (Ader in Moyers, 1993:241)

Drs. Janice Kiecolt-Glaser and Ronald Glaser, a husband and wife team at The Ohio State University, have done several studies on stress and its affect on health. They have found through several controlled studies that stress plays a major role in impairing the effectiveness of the immune system. Kiecolt-Glaser and Glaser (1991) studied the effects of stress on medical students at OSU. Their results showed that stress hormone levels were higher during examination periods than during non-examination periods. Their conclusion infers that stress causes a lowering in the effectiveness of the immune system.

According to Kiecolt-Glaser and Glaser (1992), relaxation, the reverse state of stress, can cause an increase in the effectiveness of the immune system. They monitored the effects of hypnosis and relaxation training on a group of medical students before an examination. The medical students who took their coping techniques seriously and practiced regularly showed a significant positive change in the effectiveness of their immune function during examinations and performed significantly better on the tests.
Immunity can also be affected by interpersonal relationships. Janice Kiecolt-Glaser and Ronald Glaser state that both loneliness and dysfunctional relationships can impair the functioning of the immune system. According to Sociologist James House, several epidemiological studies measuring stressful social relationships show a decrease in the effectiveness of the immune system. He suggests that there is a strong correlation between social isolation and early death. He feels this correlation is similar to death from smoking or heart disease. He also states that studies suggest "social integration" is a strong component to a healthy life (Goldman and Gruin, 1993). The social interaction involved in horticultural therapy and community gardens would therefore increase health and happiness which increases immunity. "Residents tell of the friendship and closeness that develops among gardeners; 'we share our produce and ourselves.'" (Lewis in Francis and Hester, Jr., 1991:248)

According to research studies, when individuals have positive, rather than negative, social interactions they tend to be healthier and happier and are able to handle stress more competently. Lewis suggests that gardens can offer this positive experience by reinforcing a social bond. Kiecolt-Glaser and Glaser (1991) found that medical students who had strong social ties had less pronounced negative immunological effects than those medical students who considered themselves to be lonely. Having appropriate support available in the form of strong social bonds seems to alleviate the strength and control of stress hormones that are released in the body during times of increased stress (Kiecolt-Glaser and Glaser in Goldman and Gruin, 1993).

Seymour Levine of Stanford University experimented with squirrel monkeys and found that anxiety was lessened and the amount of stress
hormones in the monkeys blood was lowered by half when they shared a stressful experience together, rather than alone. Another experiment by Levine showed no increase in stress hormones when monkeys were in a group of five. This and several other studies indicate the importance of social interaction in coping with stress. Collins Baum and Singer (1983) found that emotional coping, in the form of expressing feelings with others, showed lower stress levels than logical or analytical coping where a plan of action was followed. This usually led to independent coping rather than a shared coping situation. Gardening has been shown to strengthen social bonds. Community gardening produces higher self-esteem and pride in one’s accomplishments, as well as a feeling of belonging (Kaplan & Kaplan, 1989).

According to research, anxiety and depression are known to cause a decrease in immune function. Keicolt-Glaser and colleagues at OSU found that “life change events” showed a decrease in immune function for several medical students. Stephen Locke, a researcher in immunology, studied undergraduates at Harvard University for levels of NKCA (natural killer cell activity), which measures immunity at the cell level, during states of increased stress. Locke drew the conclusion that “poor coping” (low levels of NKCA) was responsible for harmful affects on the immune system (Locke in Ornstein and Sobel, 1987). A suppressed immune system will cause a decrease in health. If it is not put back into balance it will cause a continual decrease in health which eventually will lead to a breakdown of all body systems (death). This is what happens in Aids.
Recommendations For Maintaining A Balanced Immunity In The Healing Garden

1. Since an effective immune system is important to the control and reduction of stress, the landscape architect should be familiar with the process of immunity. This knowledge can only enhance and support the creation of a functional design for therapeutic outcomes. The landscape architect needs to determine what garden elements and design principles are appropriate and necessary in creating a space that reduces stress through balanced immunity. Future chapters address how this is possible.

2 Interpersonal relationships seem to lower stress and strengthen immunity. Encouraging these relationships should be a goal of the landscape architect when designing a healing garden. Future chapters address how this is possible.

3. Maintaining a garden may require the help of other individuals. The landscape architect may want to include a maintenance schedule or suggest group activities to encourage garden participation. For example, in the spring and summer planting annuals and perennials, in the fall leaf cleanup and bulb planting. By observing these garden rituals a loving bond is enhanced among family and friends that causes an increase in the effectiveness of the immune system that is necessary for the existence of good health.
CHAPTER V

A garden is the perfect place to unwind and relax by using nature as a coping strategy for the reduction of stress.

Perceiving and Coping With Stress

Perception of Stress

As research suggests stress is responsible for poor immunity and anxiety. Anxiety affects the nervous system by causing it to work in overdrive. The nervous system seems to be the main vehicle of activity that involves sensation, perception, emotion, and immunity. Before coping mechanisms for stress can be incorporated into a healing design the landscape architect needs to be familiar with the perception of stress and personal preference for an environment.

Reaction to an environment is through perception. Perception of stress is a by-product of one's emotional stability. Stress may be perceived as a "challenge" or a "threat" (Coyne and Lazarus in Baum & Baum, Singer in Evans; 1982). When stress becomes a challenge there is a feeling of control over the situation and the outcome is predictable. When stress is viewed as a threat a loss is perceived and the mechanisms we have adapted for coping break down and malfunction. This feeling of control is very important to the
success of one's health. Patients have the ability to control their response to stress and without this sense of control disease will result (Seigel, 1990).

Lazarus and Cohen describe "daily hassles" as everyday stressors that do not seem to cause particular harm or adaptation. However, when these "daily hassles" reach a chronic level adaptation is impaired an imbalance in our functioning emerges (Lazarus in Baum & Baum, Singer in Evans, 1982). This may result in a delayed pattern of harm that causes irreversible damage unless equilibrium is restored. If the harm were perceived as of dilemma proportions then the body would adapt quickly, the damage would be done, and recovery would begin. Slow, intermittent damage from stress is more detrimental to the body and psyche (Baum & Baum, Singer in Evans, 1982, Selye, 1956).

"Attitudes and beliefs" (Baum & Baum, Singer in Evans, 1982) are responsible for reactions to stress. How we respond to the environment is directly linked to our perception of a situation and our "attitudes and beliefs" that coincide with that situation. "Attitudes and beliefs" can be in the form of culture, religion, society, and the like.; any outside factor that influences our thinking (cognition) and feelings (emotions) that pertain to a situation or event. "Attitudes and beliefs" can be challenged by an environment or experience that is not familiar. "Psychological stressors may precede the physical event, last longer than the event, and continue to evoke stress after it is past." (Baum & Baum, Singer in Evans, 1982:18) Richard Lazarus suggests, "appraisals" of the environment are made when one feels threatened. These "appraisals" have the ability to induce coping strategies that depress the perceived threat to a level of capability. (Baum & Baum, Singer in Evans, 1982)
An environment that produces a reduction in psychological stressors and enhances psychological and physical well-being is a necessary element in the quest for stress reduction and facilitation of wellness. This environment can be produced in the form of a garden. A garden designed to reduce stress and facilitate healing through an increase in environmental stimuli that have a positive effect on perception.

"But perhaps the quintessential microrestorative environment, the one that most closely brings together the multiple themes of the restorative experience into a small, single, intensely meaningful space, is a garden." (Kaplan and Kaplan in Francis and Hester, 1991:243)

Relaxation brought about through nature or what the Kaplan's refer to as "restorative experience" is a way of reinforcing an innate relaxation technique that communicates to our emotions the need to unwind and restore our health through the complex and familiar power of nature. According to both Lewis and the Kaplans; the simple act of gardening helps us understand how nature works and how we are a part of its unique scheme.

"Plants communicate universal life qualities to those who tend them, displaying rhythms different from those of the man-built environment...plant growth is steady, not erratic and bizarre. The gardener sees a predictable continuous flow of change from seedling to mature plant and learns that change need not be disruptive but can be part of a dynamic stability." (Lewis in Francis and Hester, 1991:248)

The concept of gardening is very important in reducing both psychological and physical stress. It should be an important consideration for the landscape architect to include in the design of a healing garden so that stress can be released through an emotional and physical bond with the garden.
Coping Strategies

Stimuli in the environment are responsible for producing environmental stress. The factors involved in this process are termed stressors (for the purpose of this study stressors that cause a change in the healing process and a block to continued wellness will remain a primary focus). They produce physical and psychological changes that are controlled by coping mechanisms. These mechanisms need to be available and in working order for the body to be able to function in the presence of stress.

Individuals who are continually bombarded by stressors usually are more receptive to stress and its negative effects since there already is a depletion of health due to the conditions of continued stress without a period of recovery (Evans, 1982, Hobfoll, 1988, Lazarus, 1991, Selye, 1956). In order to be in charge of stress and its effects the emotions must be controlled so that a balance of internal systems is achieved and homeostasis (inner balance) results. Without this balance stress can dominate the internal systems and cause dysfunction in the form of illness and disease. Emotional health balances life and relationships and reinforces the ability to control stress and conform to daily situations that add stress to our lives (Humphrey, 1986).

Richard Lazarus (whose research focuses on stress and the environment) analyzed the affects of stressors on individuals and found that it was the way the threat was perceived, not the actual consequences of the threat, that made an impact on how we react to stress. This conclusion led him to establish the stress theory of cognitive appraisal and coping.

Cognitive appraisal is the ability to analyze and assess a situation and categorize it as stressful. Coping is the ability to direct the effects of stress into a positive reaction that leads to an emotional relief and let-down period that
induces recovery (Hobfoll, 1988).

Reactions to stress are highly individualized as are coping responses. According to Lazarus, several factors such as biological, social, cultural, religious beliefs, and the like, are responsible for how stress is perceived and interpreted. Individuals may react to the same stress differently on a daily, monthly, or yearly basis. Previous experiences, available information, and social adaptiveness also may influence responses. In responding to stress these variables can become important influences on which strategies will be used for coping.

If part of our physical environment could be manipulated to appear tranquil and aesthetically pleasing, would it not reduce stress and promote wellness? Would it not set forth a pattern of intuitive coping mechanisms that cause very little disturbance when activated? Would this be considered a "gentle environment" or a "Healing Garden". According to research an experience with nature seems to lower stress in most individuals (Kaplan, Lewis, Ulrich, Perry). A respite with nature may be one way to cope with stress.

**Stress Reduction**

The "relaxation response" (fig. 6) a term created by Dr. Herbert Benson (1975), a cardiologist, is the natural counterbalance to stress. It induces the parasympathetic nervous system to take control and place the body into a state of calmness and tranquility. Respirations, heart rate and metabolism decrease allowing deep relaxation to follow. Achieving this response can restore health and reverse the effects of both chronic and acute stress (Benson and Stuart, 1992, Jaffee, 1980).
RELAXATION RESPONSE

BRAIN

- Release of ACTH Cortisol Adrenaline into Blood Stream Causes "Flight or Fight" Syndrome
- Release Stress
  - No Damage to Body
- Relaxation Response
- Release of (natural opiates) Endorphins into Blood Stream
  - Causes Relaxation
    - Released During Exercise, Deep Breathing and Meditation
  - No Damage to Body

Figure #6

Figure 6-Relaxation Response
Dr. Benson believes the “relaxation response” to be an innate physiological mechanism that can be manifested to bring about positive psychological and physiological changes. By placing oneself into a quiet relaxed state and bringing to mind a former pleasant experience, such as a walk in the woods, sitting by a lake, viewing a pretty garden, and the like, one can begin the “relaxation response”. This is followed by a tensing and then relaxation of the muscles and a constant awareness of one’s breath. Very soon a feeling of complete peacefulness takes over and a state of sleep is often induced. This is very similar to the “sponge” exercise in Yoga where deep breathing and relaxation are absorbed into the body while in a supine position.

Research has suggested that “a decrease in anxiety, stress related symptoms, negative thoughts, concentration and awareness as well as enhanced performance and efficiency” (p.38) are results of the “relaxation response” (Benson and Stuart, 1992, Jaffee, 1980). As suggested by the Kaplans a “restorative experience” can have a profound effect on one’s ability to relax and restore vital energy to the body. “The findings indicated that workers with a view of natural elements, such as trees and flowers, felt that their jobs were less stressful ...” (Kaplan and Kaplan, 1989:162)

Dr. Keicolt-Glaser and colleagues (1991) established the fact that immunity can be improved by the use of relaxation techniques. The relaxation technique showed an increase in immunity in regard to coping with stress (natural killer cells were increased) (Ader, Felton and Cohen, 1991, Ornstein and Sobel, 1987).

Exercise is also another way to increase the effectiveness of the immune system and reduce stress. Dr. Benson feels that the “relaxation
response" can be incorporated into a daily exercise regime such as walking, swimming or jogging. By focusing on one's intent to relax while exercising in a repetitive fashion lends itself to enhanced health (Benson and Stuart, 1989).

For exercise to be effective in reducing stress (or as some refer to it as a 'stress buster') it must be moderate and ongoing. If exercise is strenuous and intermittent it can cause more harm than good. We've all heard of the weekend athlete and the problems he/she encounters from too much exercise without conditioning. According to Dr. Benson, the effects of moderate exercise, that adheres to a frequent, ordered regime, are very conducive to good health. They include: increased cardiac output, a lowering of blood pressure, increased pulmonary function, increased longevity, increased metabolism, elevated endorphin levels, decrease in tension, increase in relaxation, increased immunity, increase in stamina, increase in self-esteem, decrease in anxiety, and the like.

All these factors contribute significantly to the alleviation of stress (Ader, Felter, Cohen, 1991). Exercise can be more conducive to eliminating stress when performed in a natural environment. Dr. Benson states that walking in a natural environment increases the effectiveness of the 'relaxation response'.

"Take the example of walking, an activity that lends itself well to the relaxation response...You will find yourself more aware of the smell of freshly cut grass, the warmth of the sun, the sight of birds and butterflies, and the gentle flow of thoughts." (Benson and Stuart, 1989:121)

A jog through the park or working in the garden are activities that employ exercise as a stress reducer. These exercises do not have to be strenuous or take up a lot of our time. They do however, give us the
opportunity to be in touch with nature. By combining exercise with nature a double dose of stress reduction can be received. "The immediate outcomes of contacts with nearby nature include enjoyment, relaxation, and lowered stress levels." (Kaplan and Kaplan, 1989:173)

**Recommendations For Coping Strategies In The Healing Garden**

1. An awareness of the impact perception has on feelings and behavior may help the landscape architect determine goals that may be incorporated into a stress reducing design. As previously stated, a determination of the types of stimuli that are perceived as stressful is a very important aspect if a therapeutic design is to be affective. The garden (physical environment) should be manipulated by the landscape architect to appear tranquil and affectively pleasing so that a perception of relaxing stimuli is perceived. This can be done through evaluating and assessing the effect design principles and elements have on health. Future chapters address how this is possible.

2. The inclusion of gardening activities in the design concept ensures a positive interaction with natural stimuli. By designing a garden that requires care, the landscape architect is encouraging moderate exercise, an emotional bonding with nature, interpersonal relationships, and reduction of stress.

**Summary**

Stress is an inevitable part of life and remains a constant detriment to health. The physiological response theorized by Selye in the 1950s laid the foundation for an understanding of the biological aspects involved in an innate reaction to stress. Richard Lazarus incorporated Selye’s model of stress into a psycho/social perspective that addresses both emotion and cognition. According to Lazarus, knowledge helps us understand the environment and
appraisals evaluate our adaptation to it.

The central nervous system is the communicator that formulates our exposure to stress into a psycho/physiological response. This response incorporates all aspects of the body/mind into its structure. Emotion and cognition are central to this response and because of this, the affects of stress can be very potent. When stress reaches an unbearable level, the body is forced to adapt by forming coping mechanisms that will hopefully relieve this pressure. If stress is not released, the immune system will become impaired and illness will result. Coping with the "daily hassles", as suggested by Lazarus, is extremely important to achieving constant health.

When we perceive stress as a "loss of control" our health suffers. This is due to our psychological inability to control the stress which leaves us weak and inept. Attitudes and beliefs contribute to this dilemma by associating stressful stimuli with former memories and experiences. Without the appropriate coping mechanisms stress will cause a longterm reduction in health and well-being.

Coping with stress can be achieved through relaxation. Bonding with nature seems to be a consistent source of relaxation. Studies have also linked the return of health with an exercise regime. Gardening (a form of exercise), as well as exercising in the outdoors exposes one to nature (a natural tranquilizer). Gardening is becoming a consistent choice among some people who want to reduce stress (Kaplan & Kaplan, 1989). The need to alleviate stress is a high priority for most people. New alternatives for treating stress are being reviewed for their effectiveness.

Understanding the mechanisms involved in stress as well as stress reduction techniques should become a high priority for landscape architects
so that design can alter stress and produce affective health. An important consideration in garden design, when the primary focus is to reduce stress, should be addressing the psychological and emotional needs of the users. A thorough comprehension of the mechanisms involved in stress and stress reduction must be understood before a design concept can be created.

As landscape designers become more aware of stress and its impact on health a new set of design criteria will emerge that will place health and well-being as a primary goal of design. Hopefully, this criteria will incorporate a holistic approach to design that will continue to direct future landscape design. Future research needs to continue addressing the importance of stress reducing gardens as an alternative method of stress reduction through both qualitative and quantatative analysis.
SECTION 2

"Beauty in things exists in the mind which contemplates them."

-David Hume, 1742-

PREFERENCE AND NATURE
Introduction To Section 2

The relationship between perception, the environment, and health is quite complex. We perceive the environment through our senses which act in unison to produce a sensation. When we perceive something to be pleasing we respond in a positive manner. Environmental preference is an important component in health and well-being. Our perception of the environment effects our health by causing us to react to environmental stimuli either in a positive or negative manner.

It is important for the landscape architect to understand perception of an environment when considering a design for health and well-being. If the process of preference is not understood then it is impossible to fully grasp the enormous impact the sensual experience has in healing. Designs may be compromised and appear perceptually dead.

Different theories regarding the process of preference are reviewed in this section. The effects of natural scenes vs. urban scenes are discussed and analyzed for their relationship to health in a natural setting. The elements that contribute to the “Restorative Experience” are outlined and associated with concepts of healing through gardens.

The senses have the first exposure and reaction to an environment. Their role and relevance to health and nature is explained and related to an aesthetic experience. The psychology and physiology of sensation are important factors in understanding the totality of sensation. An explanation of their power in a sensual experience is defined. As the senses are

52
stimulated they cause changes in behavior. The elements of a garden that cause stress reduction and pleasurable reactions are considered in their relationship to health. Emphasis is placed on describing and understanding landscape preference so that criteria can be established for design that integrates health with garden preference.
CHAPTER VI

The garden should be designed to effect the emotional and cognitive processes to produce positive responses that promote pleasure and well-being.

Affective and Cognitive Response To Environment

Affective Preference

Affective preference can be described as a process of innate selection based on qualities that ascribe pleasing and/or beautiful values to what is perceived. Aesthetics are a very important part of one’s daily experience. They can make the ordinary spectacular and add interest and completeness to life. Without aesthetics life would be dull, mundane and lack expression. Aesthetics are the life-blood of the senses. Yi-Fu Tuan, in his book *Passing Strange and Wonderful* describes aesthetics as ... “feeling—not just any kind of feeling, but “shaped” feeling and sensitive perception.” (1993:1) Aesthetics help us experience the world as an oppulent feast for the senses.

Healing is promoted when a situation is found to be pleasing and satisfying. Our feelings are guided by our senses’ interpretation of stimuli. Feelings created by a sensual interaction with the environment become instrumental in forming both our present and future behaviors. How we perceive the world is a direct result of our sensory and cognitive experiences.

54
According to Tuan (1993:1), a pleasing landscape must impact our senses and provide us with a "shaped" feeling of what we are experiencing. How we arrive at this feeling is of primary importance to the landscape architect because it directs and guides design decisions that will impact the design concept and our feelings of well-being. To design a garden that promotes health the landscape architect should be familiar with and have a clear understanding of the theories regarding affective preference that are found to have merit among current researchers. This discussion begins by exploring a recent theory regarding aesthetic preference proposed by Dr. Edward O. Wilson, a science researcher at Harvard University. This theory addresses the biological drive inherent in the human species to seek out and respond favorably to pleasurable environments and situations.

**Biophilia**

Recent research suggests that humans respond to the environment by establishing a cohesive bond with the life that surrounds them. There seems to be an innate need to communicate with and be nurtured by a physical environment that is biologically and emotionally supportive. The desire to be close to and interact with nature may have an evolutionary basis for human beings. Edward O. Wilson (1993) has termed this concept the "Biophilia Hypothesis". This hypothesis seems to have originated from both a cultural and hereditary aspect which Wilson refers to as "biocultural evolution". According to Wilson, we use symbols as a means to express emotion and have patterned our brains to respond to situations by relying on archetypal wisdom that has survived throughout history. Nature has always been represented through symbolic form. Symbolism is a very important part of the affective and cognitive responses to nature.
Symbolism expresses a concealed meaning through the representation of words or images that are familiar and related to the human psyche. It is an intangible concept that transfers meaning among objects. The symbolic word or form may have several interpretations that are deep and unexplainable to the conscious mind.

“What we call a symbol is a term, a name, or even a picture that may be familiar in daily life, yet possess specific connotations in addition to its conventional and obvious meaning.” (Jung, 1964:20)

Carl Jung, an early 20th Century psychoanalyst, interpreted dreams through symbolism. His book *Man and His Symbols* explores the meanings behind, and the sources involved in symbolism. Dreams often contain symbolic references to nature and according to Jung we experience our selves through the subconscious in symbolic form. This form can be very sensual because our senses interpret our experiences with the world and record them in our unconscious mind. Our dreams are the vehicle that express our emotions through symbolism. (Jung, 1964)

Symbols are very powerful expressions of infinate truth and wisdom. They subtlety communicate what we are looking for and what is right for us. They show us “the way” if we will follow. “Below the level of the conscious mind there is nothing but energies and symbols.” (Swan, 1992:132)

Jung implies that our mind has evolved and adapted to modern society through the same evolutionary process as the body. In its evolvement it has captured the remnants of a subconscious history that relates to the animals and the earth. This history is the basis for forming what Jung refers to as “archetypes”, “primordial images” that result from experiences and are stored
in the subconscious; both intuition and intelligence are needed to understand symbols. This is the history that Wilson is referring to in his "Biophilia Hypothesis" and it seems to be brimming with images of nature.

According to Jung symbols fall into two categories, natural and cultural. Natural symbolism developed unconsciously, and is stored in and is part of the psyche. An example would be Mother Earth. Cultural symbolism is a transformation of human intellect and used to reinforce and establish religious and cultural traditions. An example would be rituals. Wilson is referring to both categories by his term "biocultural evolution". Jung implies that contemporary society has lost its unconscious identity and link to the universe because we no longer connect with nature or seek it out to nurture our souls. Wilson's theory seems to be related to this concept.

"No voices now speak to man from stones, plants, and animals, nor does he speak to them believing they can hear. His contact with nature has gone, and with it has gone the profound emotional energy that this symbolic connection supplied." (Jung, 1964:95)

According to Joseph Campbell, a scholar of Comparative Mythology, people are seeking out a spiritual experience with a higher power and they want to find it in their physical environment. This assumption is very similar to what Wilson describes as "biophilia". They need to feel whole and symbols can relate to this search for spiritual nurturing. The garden seems to be a natural setting that can aid and encourage spiritual renewal and fulfill the "Biophilia Hypothesis.".

Biophilia seems to suggest that the physical, emotional, and spiritual facets of human life cannot be fully balanced and complete without consistent exposure to the natural environment. This could be interpreted to mean that
health and harmony can never be truly achieved without bringing nature back into our lives.

"The human need for nature is linked not just to the material exploitation of the environment but also to the influence of the natural world on our emotional, cognitive, aesthetic, and even spiritual development." (Kellert & Wilson, 1993:42)

Is nature preferred because it symbolically reminds us of a nurturing experience that ensured the survival of our species? Did that early experience cause us to prefer certain environments that consistently maintained that experience? What is it about the environment that makes us seek it out for physical and emotional comfort? Is interest caused by natural stimuli symbolically related to biophilia? Research on the topic of biophilia is conceptual at present and it is preliminary to base assumptions on its strength without further research to confirm its validity. However, it adds an important component to the search for the mechanisms involved in why we seem to prefer nature over man-made environments when given the choice.

Nature seems to have a considerable affect on our emotional needs. Research suggests (Ulrich, 1993, Lewis, 1991, Kaplans, 1989, Parsons, 1991, and others) that contact with a natural setting, whether active or passive, has a considerable positive impact on our health. Our emotional and cognitive behaviors are important factors in response to an affective experience. The innate need to be close to nature may begin with these processes. There are different theories regarding their importance and place within this experience.

**Exploratory Behavior**

D. E. Berlyne (1960), an environmental psychologist whose research extended into attention and exploratory behavior in the late 1940s, introduced
a theory of behavior and perception that explored the impact of affective preference on behavior. This theory (fig. 7) led to the introduction of neurophysiology as a component in the behavior process when addressing the role of affect. Berlyne decided to examine the characteristics of art that define its "structural factors" (231) and the "collative variables" (231) that cause responses to these characteristics.

According to Berlyne, stimuli must have a certain degree of diversity or complexity to cause arousal of the senses. Once arousal is initiated behavior becomes exploratory and directed at specific sources of stimulation. In the quest for stimulation an organism seeks pleasure that is consistent, exciting, and sensually satisfying. Stress is perceived by an organism when stimulation is either decreased or increased to levels that do not incite rational exploratory behavior. Berlyne suggests boredom and tedium increase if diversity is absent. Conflict results from added complexity. It produces a "visual tension" that alleviates any momentary languor. Conflict must dissipate and equalize in order to continue with a harmonious visual perception of the stimulus (Graves in Berlyne, 1960).

Berlyne proposes that rhythm, a design principle as well as a law of universal health, is related to the design principles of unity and order because of its propensity to add strength and cohesiveness through repetitions, patterns and a general structural organization. Rhythm seems to be consistent and controllable and we innately bond with it because it corresponds with the natural cycles of life such as circadian rhythms, the change of seasons, and the like. It has the ability to influence the outcome of arousal through its continued modulation that allows arousal to remain consistent (Berlyne, 1960). This consistency or what Berlyne refers to as
Figure #7

Figure 7-Berlyne’s Theory of Exploratory Behavior
"perceptual balance" (243) is an important part of adding pleasure to an aesthetic experience. Because most stress results from a high degree of arousal it might be reduced through "specific exploration" of moderate and balanced stimuli. Boredom, which causes a tedious and monotonous stress, may be alleviated by the addition of a richly diverse stimuli that causes interest which motivates exploratory behavior. Interest causes pleasure and without it exploration may not be enhanced. If a setting is not interesting it may appear boring. The garden would be a good example of diverse stimuli that causes interest and specific exploration conducive to the reduction of stress. By balancing the effects of natural diversity health can be enhanced.

This assumption is very important for the landscape architect to understand in regard to health. With health being a "balance of systems" any variable that adds balance to an affective experience would be instrumental in reinforcing that continuum of balance that is so necessary in maintaining health. Berlyne's theory (1960) outlined in Conflict, Arousal, and Curiosity is relevant to this study because it led to the development of theories relating to nature and restoration. It is important for the landscape architect to be aware of this theory because it defines several design variables such as order, rhythm, pattern, unity, and the like, which can be used to develop a design concept that addresses specific behavior responses to these variables and their implications for health.

Wohlwill (1974), a psychologist who studies behavior and environment, examined Berlyne's theory and seems to agree that unity can be an effective equalizer in an affective experience. Berlyne infers that once an equilibrium has been established, after the initial impact of curiosity and the peak of complexity have been reached, order sets in. However, according to
Wohlwill there does not seem to be a standard for this equalization.

"There are good reasons to distrust a unidimensional conception of complexity, and to suspect complexity in the sense of diversity may well be altogether unrelated to the structural aspect of this construct. To deal effectively with the latter, however, we shall have to devise ways of operationalizing order, possibly in terms of the redundancy contained within a configuration of elements, and to examine its role in interaction with information content in the diversity sense (cf. Mindus, 1968)."  (Wohlwill, 1974:50)

What Wohlwill is interested in is determining when and how this affectual order reaches equilibrium and what aspects of the stimuli produce arousal. He suggests that Berlyne's hypothesis infers that exploratory behavior is relative to the conflict produced by environmental stimuli. So according to Wohlwill, if stimulation is high diversity may be complex and arouse exploration due to a perception of excitement, unpredictability, and complexity. Once this arousal is experienced as satisfying and pleasurable it is sought after for affirmation. However, Wohlwill implies that the input of cognition is unclear in this structure and a necessary addition for the evaluation of an affective environment. He implies that it is a requisite for the complete and total equilization of complexity. Without cognition it seems that interest and excitement may not be analyzed for their significance to a preferred environmental experience.

Even though Wohlwill is critical of Berlyne's theory he still feels that it is an essential factor in forming a premise for further research regarding affect in environmental aesthetics. The theory does begin to address certain emotional likes and dislikes that are universally apparent about how we feel when experiencing certain environmental variables. Contemporary research in environmental psychology uses this theory as a basis for interpreting affect
and environment as well as landscape preference.

**Pleasure-Arousal Response**

Mehrabian and Russell (1974), environmental psychologists whose research on emotional responses to perceived environments led to the "pleasure-arousal hypotheses", labeled pleasure, arousal, and dominance as the three most important emotional reactions to environmental stimuli. Their theory seems to be based on Berlyne's implications regarding complexity and arousal. Mehrabian's and Russell's theory (fig. 8) states: an environment that is approachable creates pleasure, interest and calmness; avoidance is created by disinterest, displeasure, and stress. According to Mehrabian and Russell these emotions can act separately or in different combinations. The theory suggest changes in the environment and personality preferences or tendencies affect the reactions of pleasure, arousal, and dominance felt by an individual in a certain environment (these same variables are inherent in the stress reaction). "These emotions, in turn, strongly influence such key behaviors as the desire to approach or avoid a setting." (Gifford, 1987:59)

The more desirable (interesting, exciting, and pleasurable) an environment appears the more it draws one in to experience it. Our visual sense is believed by some to be more astute than our auditory sense in terms of recognizing pleasure. However, in recognizing sensual arousal both senses contribute greatly to the perception of pleasure. This was discovered in a study done in 1982 by Gifford and Ng (Gifford, 1987). It seems that not only vision and hearing but all the senses combine their essence into a sensual experience when confronting arousal. Doesn't the sense of touch add a depth to the arousal felt by touching someone or something? Isn't a baby content to
PLEASURE-AROUSAL HYPOTHESIS

CIRCUMFLEX OF EMOTION

Pleasant

Relaxing

Interesting

Boring

Stimulating

Unarousing

Arousing

Uninteresting

Complex

Depressing

Unpleasant

Illegible

Figure #8

Figure 8-Pleasure-Arousal Hypothesis

Adapted from RUSSEL, WARD & PRATT (1981)
be held by its mother? Isn't a lover's experience pleasurably enhanced by tactile stimulation? For both these experiences the sense of touch seems to be more dominant than the other senses. However, the emotion of dominance seems to have been an issue in the pleasure arousal-hypothesis because Russell decided to consider the aspects of emotion, or affective appraisals, on settings rather than their impact. This would introduce the contribution of cognition to environmental perception.

Russell eliminated dominance from the theory in a study with Ward and Pratt in 1981. He arrived at a model that places the emotions of pleasure and arousal into a "circumflex" according to their intensity (Gifford, 1987). This model (fig. 8) is being used by environmental psychologists to examine "appraisals" of the environment and the emotions that correlate with them.

Mehrabian maintains the original premise that the three emotions of pleasure, arousal, and dominence are responsible for affect in the environment. The findings of the "pleasure-arousal hypotheses" suggest that the degree of pleasure that is perceived from an environment is responsible for the amount of arousal an individual experiences. This is very similar to Wohlwill's interpretation of Berlyne's arousal theory.

According to Mehrabian and Russell high levels of complexity do not cause stress as long as they are perceived as providing pleasure; an unpleasant setting either contains too much or too little complexity and becomes pleasant if a moderate amount of complexity is added. The challenge for the landscape architect is to decide what characteristics of stimuli provide pleasurable feelings and incorporate them into a design concept.
These studies by Mehrabian and Russell are important for landscape architects to be familiar with in order to design an environment that understands the emotional response to a setting. The circumflex of emotion, as Gifford suggests, is responsible for whether an environment is experienced or avoided. As a landscape architect, one of the first steps in the design process should be to evaluate the emotional impact a space has on its users. This will lead to an understanding of what elements are needed to produce a space that is inviting and capable of offering a positive (pleasurable) experience. Once this space defines a soothing affect; the “circumflex” should be referred to for other emotional aspects that will carry a theme of pleasure and enhanced well-being throughout the design.

**The Affective Response**

Roger Ulrich, the associate dean for research at the College of Architecture Texas A&M University, is responsible for several studies connecting the designed environment with health and well-being. Ulrich (1983) suggests that emotional arousals or what he refers to as “affect” can produce behavior by the perception of the environment. His assumption is influenced by the theories of psychologists such as Berlyne (1960-the role of arousal in aesthetic preference), Lazarus (1966-psycho/social theory of stress), Izard (1971-cross-cultural emotions), Mehrabian and Russel (1974-pleasure-arousal hypothesis), and Zajonc (1980-separation of affect and cognition in regard to preference).

Ulrich suggests, that the senses initiate emotional responses and that feelings are pre-cognitive. According to Ulrich, vision (which he considers the premier sense) along with taste, sound and smell cause sensations that elicit affect when stimulated by an interesting and pleasurable experience.
Ulrich is attempting to connect interest and the pleasure associated with it to an aroused state that creates a lasting “psychophysiological restoration.” (95) His framework seems to rely heavily on Zajonc’s (1980) theory on separation of affect and cognition in regard to preference. This theory suggests that emotional reactions are the result of directed preference (Parsons, 1991).

According to Ulrich’s affective theory (fig. 9) the first impact that the physical environment has on the viewer is heavily influenced by their emotional state the instant before the visual experience takes place. This includes the input of cognition and memory which influence preference. Cognition and affect become separate as their input is enlisted to analyze the experience. Ulrich classifies affect as the more dominant in the process of environmental preference. (Mehrabian felt that affect was a dominant emotion that effected the perception of an environment.) The two aspects merge when behavior becomes evident. Behavior can be assessed, according to Ulrich, by the affective reaction to a natural environment.

The problem with this model as Parsons (1991) (a researcher working with Ulrich) suggests, is there is not a clear definition of nor a precise function for the cognitive process. Ulrich presents cognition as lacking the impact of affect and seems to feel that it will only come forward when the affect to a preferred stimulus is energetic and forceful (Parsons, 1991). This can be interpreted as only powerful or prolonged responses to stimulus bring cognition into play. Is it possible that cognition has more than one mode of response? Is the role of cognition to stabilize the emotional reaction, which can vary like the environment from moment to moment? Is cognition responsible for the perception of diversity and interest in the environment? Does cognition analyze how we feel about an experience? The aspect of
ULRICH'S THEORY OF AFFECTIVE RESPONSE TO NATURE

- Affective State
- Exposure to Environment
- Emotional Response
  - Stimulation
  - Post Cognitive Stimulation
- Stimulation of Visual Perception
- Cognition
  - Experience
  - Memory
  - Post Cognitive Stimulation
    - Analyze Experience
    - Reaction
    - Adaptation

Figure #9

Figure 9-Ulrich's Theory of Affective Response to Nature

Adapted from ULRICH (1983)
cognition needs maturation and more scope in order to reinforce Ulrich’s theory of the supremacy of affect in regard to aesthetic preference (Parsons, 1991).

"Ulrich has taken the first step in outlining the relationship between environmental affect and cognition by asserting that initial affective processing is primary to cognition." (Parsons, 1991:12)

Cognition, as Parsons suggests, seems to need a more extensive review. Cognition brings a thought process into focus that adds meaning and connection to the act of having a “feeling” about something. It adds an element of intellectual balance to the moment of impact. Cognition helps the senses understand the “feeling” they experience and relies on memory to enhance its affects. Without cognition assuming a larger role in the affective response it may lack totality and closure. Is cognition only a delayed reaction to a sensory experience? Even if affect seems stronger and more potent in the response would it be a response or just an outcome if cognition were not present?

Kolb and Wishaw (1990), scientist in the field of neuropsychology, suggest that there may be a waiting period between the initial reaction and the final analysis of some preferred stimulus because the appraisal needs to be supplemented by extra input from the experience. The conversion of sensory data seems to take two paths. The first processes data instinctively when an insignificant amount of experience is available. The second requires prior learning and experience in order to process the data because it may appear more complex (Kolb and Wishaw, 1990).

By using the patients' visual fields as predictors of visual responses they were able to separate the "affective" and "objective" characteristics of stimuli and their pathways (Kolb and Wishaw, 1990). According to Kolb and Wishaw a third category of characteristics may exist that converts "subjective feeling" into memory thus opening up the amygdala (seat of emotions) for further review.

"It seems likely, however, that there will be separate modules for different aspects of overt behavior (facial expression, porosity) and perhaps for cognitive processes as well". (Kolb and Wishaw, 1990: 612)

Further research is needed to clarify and support this theory.

For stimuli to produce a lasting reaction that is pleasurable and will ultimately create health the role of cognition must be addressed. Research is very promising at the present regarding cognition's role in environmental preference.

**Cognition and Restoration**

If affect is considered an important part of the selective process regarding preference in nature then the next step is to look at the role of cognition in adding to and completing this process. How does cognition enhance and lengthen the sensual experience? How is interest perceived in the environment? Is cognition's input important in enhancing health?

While designing several parks and residential communities Frederick Law Olmsted (1865) came upon the notion that nature had the ability to create a feeling of restoration and wholeness that relieved the body and mind of daily pressures. He felt that nature had the power to transform a tense and overworked individual, who suffered from mental stress, into a relaxed, and competent state of mind.
Research conducted by the Kaplans, a husband and wife team at the University of Michigan, involves the affect the natural environment has on our psychological health and well-being. They have used Olmstead’s theory of mental restoration and Berlyne’s theory of exploratory behavior as a foundation for their research on the “restorative experience”. Stephen a professor in psychology and Rachel a professor in natural resources, have spent several years compiling and analyzing data that pertains to personal reactions to the natural environment.

The Kaplan’s book *The Experience of Nature* is pivotal in understanding the relationship between the natural environment and psychological health. They indicate that exposure to nature reduces stress through mental restoration. The Kaplans label this phenomenon the “Restorative Experience.” It has been suggested that the state of our psychological health, which is emotionally and cognitively driven, influences the potency of our immune system (Ader, 1991, Keilcott-Glaser, 1991). If the Kaplan’s theory about “restorative” experiences is correct than the immune system could be strengthened by such an experience.

According to the Kaplans, restoration can be expressed cognitively, as well as affectively, and there are four components that make up the “restorative experience.” This is based on research conducted in 1983 by Kaplan and Talbot regarding wilderness effects on psychological health. The wilderness experience was able to reduce mental fatigue resulting from long exposures to focused tasks (Kaplan & Kaplan, 1989).

The four components that make-up the “restorative experience” (fig.10) are extent, fascination, action and compatibility. According to the Kaplans extent, which creates the feeling of experiencing the dimension of
THE KAPLAN'S THEORY OF COGNITIVE RESTORATION

Exposure to Nature

Appraisal of Natural Environment

Extent

Restorative Experience

Compatibility

Fascination

Interest

Excitement

Action

Cognition

Perception

Behavior

Meaning

Acceptance & Immersion in Natural Environment

Reduced Stress

Existing in a "Whole Other World"

Connection

Scope

Figure #10

Restoration

Adapted from ULRICH (1983)

Figure 10-The Kaplan’s Theory of Cognitive Restoration
existing “in a whole other world”, can only be authentic if connection and scope are present. If we do not feel connected to or a part of this experience we may not relate to it or benefit from it. If the experience is positive, memories of former experiences with the natural world may emerge. A link with our emotions forms giving us the opportunity to understand how we relate to and fit in with this experience. By conceptualizing this experience scope becomes apparent (Kaplan & Kaplan, 1989).

Fascination is described as the ability to create a curiosity. This curiosity causes an unintentional focusing of our attention on stimuli in the environment through interest and excitement. This concept seems to be based on Berlyne’s theory of exploratory behavior (1960). The Kaplan’s imply that fascination can be effective if it is strengthened by extent. This causes us to have a meaningful exploration of the experience and relate it to our sense of significance within the environment.

Action is the behavioral result of how we perceive our surroundings through cognition and how that perception is influenced by both personal and environmental factors. This is similar to Lazarus’ theory of the psycho/social response to stress. Action with the perceived environment can solidify the “restorative experience” by causing us to make decisions and adjustments about how we will interact with the environment and what meaning it holds for us (Kaplan & Kaplan, 1989).

The ability to be part of or be connected to something without any constraints is how the Kaplans characterize compatibility. When this aspect is present it adds the dimension of total acceptance and emergence in the “restorative experience”.

The Kaplans infer that appraisals are made when information is
gathered and assessed while viewing the landscape. This seems to be based on Lazarus' psycho/social model of perception. According to the Kaplans, understanding the environment is a cognitive task and depends on knowledge and experience. If one cannot understand how to function in an environment than behavior changes. They suggest for a landscape to be understood it must be coherent and legible. Stephen Kaplan implies that information from the landscape has a profound impact on environmental preference. Humans have the tendency to be curious about their environment and they need to understand it (this may be an innate need associated with Wilson's concept of biophilia). Information is an important component in human interaction with the environment. It causes a cognitive process to develop that assesses and interprets the environment in terms of stimuli that may or may not cause pleasure.

It seems to become salient that environmental preference is driven by both an affective and cognitive response, and the reason we prefer is simple, yet complex and still undergoing theoretical changes. There is clear evidence from these studies that the environment is assessed in terms of affect and cognition. They all seem to relate perception to the need to draw continued pleasure from the environment. Continued research, hopefully will develop a clearer definition.

Once these theories are understood it makes sense for the landscape architect to combine their affects into a meaningful design. This can be done by using natural elements in a design that will stimulate both, the emotional and cognitive processes to produce the desired results of enhanced health and well-being.
Recommendations for influencing The Affective and Cognitive Response to Nature In The Healing Garden

1. Create a garden that offers interest through a degree of diversity that is found to be pleasurable. Remember, a low or high amount of complexity may be stressful if it is not perceived as interesting. The goal of the landscape architect is to create pleasure through diversity which causes interest. If a garden is not interesting it may not hold our attention and cause boredom. If a garden appears to be too complex it may cause an increased arousal of the nervous system. A moderate amount of complexity seems to cause an interest in the viewer and may be perceived as pleasurable. However, according to Mehrabian and Russell, and others, if an environment is complex and offers interest, it is usually perceived as pleasurable. Perceiving pleasure is a means of producing health and well-being. Future chapters address how this is possible.

2. Use form, light, color, and texture in both a forceful and subtle way to address certain emotions. This may be considered a form of affective symbolism. For example, to address love (love of oneself and others), which is necessary for healing, boldly display symbols such as red roses. The color red is symbolic of the heart, the rose’s perfume reminds one of loving and comforting times, and sitting under arbors or trellises where roses climb affect one with a feeling of security and spiritual love. A subtle example of addressing love would be to use a pink rose or a water feature with quiet sounds that has rose petals floating on the surface along with other emotionally stimulating water plants such as Lotuses and Lillies.

3. Design a garden to address emotion by using the pleasure-arousal hypothesis as a guide. Refer to the circumflex of emotion when interviewing
a client. Find what garden and design elements stimulate or depress pleasure. Use only those elements that increase pleasure and integrate them into the garden.

4. Use garden elements such as favorite flowers and trees, or a stone path that evoke childhood memories. This stimulates the cognitive process. Future chapters address how this is possible.

5. Stimulate the senses to offer relief from mental fatigue by creating diversity in the garden. The interest level of the garden elements should evoke a pleasure that is conducive to relaxation. Chapters VIII & IX address how this is possible.
CHAPTER VII

A garden should reawaken our primordial experiences with nature and produce an environment that is innately preferred for pleasure.

Landscape Preference

Evolutionary Theory

Is our preference for certain landscapes evolutionally driven? Does this evolutionary component factor both affect and cognition into its scope? Several researchers seem to think so. They feel that landscapes that favored openness and ease of circulation, such as the savannas of Africa, were the preferred environments of humans. These environments became conducive to early man’s needs and offered stress relief from environments that fostered danger and unpredictability (Appleton, 1975, Heerwagen & Orians, 1992, Orians, 1980, 1986, Wilson, 1984).

According to Orians and Heerwagen, the need to see predators while hunting and gathering and having the availability to escape was tantamount to survival. This required both an emotional and cognitive component that evolved within our species. Also, the need to be close to a body of water was essential not only for survival but for other needs such as bathing, cleaning kills, cooking, and the like. These landscapes enhanced productivity because
of their dispersed placement of trees, groves of vegetation and close availability of natural products (Orians in Penning-Roswell and Lowenthal, 1986). “Therefore, savanna environments should have been of higher quality for early human existence than either wetter or drier habitats”. (Orians in Penning-Roswell and Lowenthal, 1986:11)

It appears that the landscape we feel comfortable and safe in enhances our ability to survive. Do we find this landscape to be aesthetically pleasing because of an innate component that evolved out of survival needs? If a species survives then are they not considered to be healthy? Do most aesthetically pleasing landscapes make us feel healthy because they remind us that we have survived? Are urban environments stressful because they lack the survival initiative we feel in natural settings?

According to Orians, created landscapes are very similar to savannas. He also states that “tree shapes” that are found in savanna environments, which Orians refers to as “highly productive habitats”, are preferable to those found in moist or arid locations. In a study conducted by Orians (1984), trees that resemble those found in “highly productive habitats” were discovered to be preferred over trees in wetter or drier habitats. “Trees in the habitats judged to be economically optimal are broader than they are tall, have canopies wider than they are deep, have small, compound leaves, and have trunks that are short relative to the total height of the trees.” (Orians in Penning-Roswell and Lowenthal, 1986:12)

A recent study on preference and tree shape (Summit & Sommer, 1994) based on Orian’s theory (1980), and Orians and Heerwagen theory (1992), suggests that trees resembling the Acacia tree of the African savanna are mostly preferred. Orians and Heerwagen implied, if these trees were found to
be healthy then the environment was conducive to health because a natural ecosystem existed.

Summit & Sommer (1994) found that short trees with large canopies were preferred by most people. This supports Orian's and Heerwagen's (1992) original premise that tree preference is evolutionary and effects landscape choices. These studies are preliminary and are not fully representative of cross-cultural evaluations. More research needs to be applied before a general theory on tree shapes and preference can be assumed. However, it is a promising premise that does seem to warrant further studies.

It seems that these trees may be preferred because short trees with large canopies also provide comfort and safety by offering us coverage from the elements and providing a “feeling” of protection and security, much like a roof over our heads (Summit & Sommer, 1994). This as, Summit and Sommer infer, is similar to Appleton’s Prospect-Refuge Theory (1975) which suggests that the preference for a secure environment is evolutionary. Security allows us to feel positive about a situation and health results with positive feelings. Being in a state of health ensures survival of a species.

Orian's belief that savanna-like landscapes are found to be affectively pleasing is based on the assumption that a high degree of pleasure is reported when people experience these landscapes. Is the pleasure due to an association with evolution as Orians suggests, or is it security as Appleton suggests, or is it the diversity in the landscapes appearance that Berlyne might suggest or is it a combination of these and other theories. Future research needs to evaluate the characteristics of pleasure that cause us to respond favorably to an environment. Pleasure is one factor that may produce health and it is a quality that is essential in a healing design. The landscape architect
needs to understand the dynamics of a pleasurable response so that design principles and garden elements may be used to accomplish this. Most people do not live within close proximity of savanna-like landscapes. In order to get pleasure from the landscape they rely on parks in an urban setting. There are not enough parks to expose individuals to feelings of pleasure and satisfaction on a daily basis. The scope of a park is usually broad and not always a personal space. The garden is an excellent alternative to a park when pleasure and satisfaction are needed.

Preference for Natural vs. Urban Environments

Several studies comparing the affects of the urban and natural environment on individuals experiencing stress seem to suggest a preference for natural settings. Urban environments lack the green space needed by most people to feel comfortable and secure. The affects of urban views can be stressful when feelings of familiarity and comfort are lacking (Ulrich, 1983, Kaplan, 1978). The significance of nature to human health and well-being has been suggested by several researchers. Nature, especially vegetation, affects us biologically as well as aesthetically. It is found to be evolutionary, culturally, and emotionally important to our well-being. Olmsted (1865) felt it responsible for boosting our mental health. Ulrich (1981), Ulrich and Simmons (1986) suggests that views of vegetation are therapeutic for stressed individuals and have been found to lower stress levels by fostering enhanced feelings of pleasure and satisfaction. Honeyman (1987) concluded that the lack of vegetation in an urban setting caused increased stress. Because most vegetation is not found to be mentally fatiguing (it usually produces low to moderate arousal states) it has the ability to reduce environmental stress. (Wohlwill, 1976). Natural settings are also found to produce physiological
changes that reduce stress under laboratory conditions (Ulrich, 1983). Views of trees and nature are important elements in healing design (Ulrich, 1992).

Several researchers (Hartig, Mang, & Evans, 1991, Kaplan & Kaplan, 1989, Ulrich, 1981) suggest that views of vegetation are found to be psychologically soothing and preferred by most people in urban settings. A recent study (Thelen, 1995) suggests that the amount of vegetation in an urban space defines how that space is liked. It was found that the higher the degree of vegetation the more the space was preferred. These results are similar to Honeyman’s (1987) theory of stress reduction and vegetation.

Most studies comparing the affects of a natural versus urban setting expose individuals to pictures or slides to find a common preference. Ulrich and Kaplan consistently find nature to have an increased preference in their studies. All urban spaces do not cause stress. According to Nasar (1989) perceptions of urban spaces are effected by their environmental qualities as well as other factors.

“For example, judgments of the prominent dimensions or order, naturalness, or complexity may be influenced by nuisance factors, such as dilapidation, signs, wires, and poles.” (Nasar, 1989:39)

Those urban spaces that bring elements of nature into their design can provide pleasure. This can be in the form of buildings that contain symbolic motifs of nature in their interior and exterior structures, vegetation, natural colors and light, textures and patterns that are naturally stimulating to the senses. Nature can be an unconscious element that is embedded in urban design and produce health by being consistent in its symbolic effects. Vegetation increases the liking potential of cities when added to urban spaces (Cooper-Marcus, 1982; Nasar, 1983). Several studies suggest that most cultures
prefer natural views with a high degree of vegetation over urban views (Kaplan et al., 1972, Ulrich, 1977, Wohlwill, 1976, Zube et al., 1975). Nature is usually preferred by most people when they are exposed to it and it usually produces a positive effect.

Ulrich (1984) examined the reactions of post-surgical gallbladder patients as they viewed either vegetation or a brick wall from the window in their hospital rooms. The patient's who viewed a natural setting exhibited speedier recoveries, required less pain medication, and requested fewer nursing services than the urban viewers. This was evidently a clear and innate reaction to the soothing and therapeutic actions offered by a scene enhanced with vegetation. Feelings of well-being have been produced by natural settings and have increased the coping ability of those experiencing the space (Ulrich, 1984).

Ulrich (1979) experimented with slides depicting urban and natural scenes and recorded two different groups reactions to them (1 group was shown urban slides, the other nature slides). He found that stressed individual's reaction to the slides depicting natural settings was more favorable than that of urban settings.

"The results for the anger/aggression factor suggest mild improvement in well-being associated with the nature exposures, and a tendency for the urban scenes to aggravate feelings on this dimension." (Ulrich, 1979, p.21)

Nature scenes also reduced fear and produced an affect of well-being. The urban scenes increased feelings of sadness, tended to aggravate feelings of anger/aggression, and produced an effect of decreased well-being. The urban scenes did not hold the viewer's attention as well as the natural scenes (Ulrich, 1979).
"According to psychological theories, a reduction in arousal or activation produces pleasurable feelings if an individual is experiencing stress or excessive arousal.” (Berlyne, 1971:81-82, in Ulrich, 1979:21.)

According to Kaplan, making sense of an environment requires a logical format and legibility. Kaplan, Kaplan & Herzog (1980) found that subjects who viewed slides of urban and natural scenes showed a preference for nature.

In a photo questionnaire, Kaplan (1985) rated the preference for urban and natural spaces. She concluded that preference was not necessarily for open, natural areas but for the relationship perceived by the housing community’s interaction with nature. Some of Kaplan’s findings included: 1) an illusion of mystery 2) a balance of vegetation and buildings 3) neat and orderly vegetation 4) views of large trees and woods. Kaplan suggests that preference is personal and involves complex methods of identity. However, she states that for most people nature is a preferred element in an urban setting. It connotes feelings of well-being for most people who are exposed to it (Kaplan, 1985, 1989).

If preference is personal and complex and is drawn to elements that bring about pleasure then it may be possible to find an urban setting to be healing if it addresses a relationship with nature?

Although these studies confirm the importance of nature for stressed individuals they can only address the visual importance of natural contact. These studies concentrated on the subjects viewing nature through slides or pictures, not the actual placement of subjects in a natural setting.

What they do not measurably tell us is whether the impact, of a natural setting, would be enhanced and by how much if subjects were interacting
with nature either passively or actively. Would all the senses be involved in this reaction and equally meld together to produce a response? Would this response be emotionally driven or a combination of affect and cognition? What is it that causes us to have a positive response to nature that unlocks the process of healing?

Landscape architects need to be aware of the positive influences of nature on health. This will enable them to continue to design a space that incorporates natural elements with the client’s perception of health. A stress reducing design can be very simple. However, it must rely on the restorative effects of nature to accomplish continued stress reduction.

**Recommendations Addressing Environmental Preference In The Healing Garden**

1. Create a positive passive interaction with nature by allowing a view of the garden from inside a building to be affectively pleasing. This usually causes a pleasurable response for those who are able to enjoy a pleasant view during the day. It creates relaxation and a release of stress through a perception of pleasure.

2. Create a positive active interaction with nature by allowing the garden to be used daily, when permitted, and maintained seasonally by the client. This reduces stress through a positive connection with nature (biophilia).

3. Create an illusion of mystery in the garden by causing spaces to visually disappear. This can be accomplished by using winding paths, partially obstructed views, sounds and fragrances that need to be sought out, and enclosed spaces. This is a concept that Rachel Kaplan found was important to most in her questionnaire.
CHAPTER VIII

A healing garden awakens the senses with natural pleasures that heal and restore the soul.

Sensual Perception of Nature

This chapter discusses the role of sensation in perceiving the natural environment. Aspects of the sensual experience, the physiological process of sensation, and the sensual involvement with nature and the garden are discussed and related to well-being. This knowledge is very important for the landscape architect because it is through the senses that we relate to the garden, which if designed appropriately can cause us to heal. Sensual arousal to the point of consistent pleasure produces health and this should be a goal of the landscape architect. With an understanding of both the psychology and physiology of sensation design principles can be incorporated into a design that creates pleasure and well-being.

Sensual Arousal

The world is assessed through the senses. Sensual perception causes us to react and adapt to our environment. Behavior is a function of how we sense our physical and psychological surroundings. The senses evolved as a means to heighten our awareness of the world and ensure survival (Soule,
1992). For health to exist and be a consistent factor in our lives our senses must be able to function and compensate during environmental exposures.

When the senses are aroused they seek affective pleasures. It is healthy to pursue pleasure. Each sense alone and in unison has this ability. The senses also alert us to danger and unhealthy situations. Without sensual communication health becomes precarious and our whole being is affected. Landscape architects must be aware of the primary role the senses play in perception, behavior, and health. Each sense must be thoroughly understood not only for its connection to perception and health but for its function and relationship in respect to the other senses. An important consideration in a healing design is to emphasize the sensual experience to produce positive behavior which results in health. In order to understand the totality of sensation an overview of each sense's physical mechanisms needs to be reviewed so that the emotional response it elicits is clearly comprehended. This total concept of a sensual experience will aid the landscape architect in the design approach to a healing garden that combines nature and sensitivity into a design concept for stress reduction.

The Physiology of Sensation

The physical environment is experienced through the senses as cognitive and emotional evaluations that produce reactions to what is perceived. When stimuli is experienced it is interpreted as a singularly unique experience. However, that experience is really the result of several sensory inputs working in unison to make up that one experience (Kolb & Whishaw, 1990, Carlson, 1991). For example, when one senses a flower to be pleasing it happens instantaneously. All the feedback from the senses, such as fragrance, color, texture, and the like, go into that appraisal and bring forth the
perception of an aesthetically pleasing flower.

Sensory receptors, cells or neurons that transmit sensory information from the environment to the brain, are present in all the senses. Their job is to process the flow of electrical energy transmitted from light, sound, and touch, and the chemical reactions from taste and smell into an electro-chemical reaction that affects the cell’s membrane of the sensory organ. When this affected change is transferred to the brain sensation is perceived.

Each sense has specialized receptors that are able to convert energies into reactions that are specific to that sense. Light waves, also known as radiant energy, are processed by the eyes. Mechanical energy (energy created by movement, ex: vibrational changes, pressure changes) is processed by the skin and ear, and chemical energy is processed by the nose and mouth (Kolb & Whishaw, 1990, Carlson 1991).

When a flower is looked at, picked and smelled in the garden each sense’s receptor cells act upon the experience by converting the energies transferred by the flower into a single sensual encounter. This encounter is described in terms of each sense’s physiology as a presentation of how the mind and body work together in synthesizing and categorizing information.

**Vision**

The eye (fig. 11) is a major sensory organ that captures most of the stimuli from the environment. When it gazes upon a flower it sees both its form and color. The transparent cornea, the eye’s outer layer, permits the flower’s light rays to enter the eye. The light rays infiltrate the pupil, the small black opening in the iris (eye color), and cause the iris to open and close according to the amount of light emitted by the flower and surrounding
THE SENSE OF SIGHT

Figure #11

Figure 11-The Sense of Sight
environment. This is done by muscles in the iris that receive messages from the parasympathetic nervous system. If a large amount of light enters the pupil the muscles will cause the pupil’s opening to decrease in size, if a small amount of light enters the pupil the muscles will increase the opening. After the iris has adjusted the proper amount of light onto the lens, located at the rear of the iris, the perceived image of the flower is focused onto the retina which contains light-sensitive or photo-receptive cells. These photoreceptive cells are known as the rods and cones.

Night vision or the ability to see in the dark is controlled by the rods. Day and color vision, as well as visual acuity, which makes it possible to differentiate form is controlled by the cones. The cones (red, yellow and blue light sensitive varieties) are compactly nestled at the rear of the retina while the rods are dispersed throughout the edges of the retina. The light waves of the flower are analyzed by the cones and separated into distinct recognizable colors (light waves) and forms that can detect shape and texture. The cones, or photoreceptive cells, convey their message about the flower to nearby bipolar cells (neuron with two functions: to receive and relay messages to other cells) and this causes an electrical charge which is transmitted to ganglion cells (central nervous system cells) which in turn project the electrical message to the brain via the optic nerve to the visual cortex (Netter, 1986, Kolb & Whishaw, 1990, Carlson, 1991). When the brain gets this visual message it instantly translates it into a red rose.

Hearing

The ear (fig. 12), an other important sense that is also felt to be equally as important as vision in sensory perception, catches sound waves (created by stimuli that cause the air to pick up their vibrations) that are
mechanical in nature. The speed of sound is close to 700 miles per hour and if vibrations fall into the scope of 30-20,000/second our ears perceive sound (Kolb & Whishaw, 1990:192). There are three variations in sound: pitch (degree of sound), loudness (fullness of sound) and timbre (tone of sound).

Unlike the eye, which blends colors together and identifies a single color, the ear is capable of deciphering all incoming tones and identify each one separately. When a bird chirps in the garden it creates sound waves that are captured by the outer ear (which is uniquely shaped to pick up vibrations from the air) and channeled through the auditory canal where they oscillate against the ear drum. Three tiny bones called the ossicles, located in the middle ear (behind the eardrum), pick up the sound waves of the chirps that are tapping against the eardrum and push the waves in an alternating motion which activates the basilar membrane into deflecting the hair cells (cell receptors). This deflection transmits an energy that is picked up by the hair cells in the cochlea, part of the inner ear, and attaches to bipolar cells that transmit sound information to the brain via the cochlea nerve (Netter, 1986, Kolb & Whishaw, 1990, Carlson, 1991). When this circuit is complete sound is perceived and immediately identified as the song of a Robin.

Taste & Smell

The senses of taste and smell (olfaction) (fig. 13) are different from the other senses because they react to chemical sensations rather than electrical. They are usually interchangeable and rely on each other to fully grasp how we react to stimuli in the environment.

For example, if we are presented with a bowl of strawberries, the odor or fragrance is an indication of how it may taste and whether or not, it can provide us with a pleasurable or unpleasurable sensation. When we decide
THE SENSE OF TASTE & SMELL

TASTE

TONGUE

Taste Buds

Sweet

Sour

Salty

Bitter

Solitary Tract (3 Nerves)

Brain

Taste

SMELL

NOSE

Receptor Cells

Nasal Hair Cells

Supporting Cells

Basal Cells

Olfactory Bulb

Olfactory Tract

Brain

Taste

Figure #13

Figure 13-The Sense of Taste and Smell
to taste the strawberries, their flavor (combination of taste and smell) again
alerts us as to whether or not we should proceed. Tastebuds are the receptors
for taste and are categorized as four different types: 1) sweet 2) sour 3) bitter 4)
salty. They help identify various tastes which are either good or bad for us
and they seem to have an evolutionary component. Sweet and salty tastes
possess nutritive values while bitter and sour usually warn of poison and

The nose contains the receptors for smell. These receptors are made up
of three different cell types: 1) receptor cells (nasal hairs cells) pick up the
fragrance of the rose as it is sniffed through the nasal mucosa which acts as a
protective barrier 2) supporting cells surround and support the receptor cells
3) the basal cells form the base for the receptor cells. Since the nasal receptors
do not react specifically to smells it is unclear as how smell is detected (Netter,

When one smells a rose in the garden its aroma or fragrance is picked
up by the nasal mucosa as the air, filled with the fragrance’s chemical
makeup, blows past one’s face. This sensation (smell) causes a synapse in the
olfactory bulb which causes axons to travel the olfactory tracts to the brain
where the fragrance of the rose is perceived with split second precision

Both electrical and chemical sensations cause changes in behavior and
are activated by the senses. When a reaction to a sensation causes pleasure
then our behavior (in the form of the reaction) is guided by the result of the
sensation. So if the fragrance of the rose elicits pleasure, then we “feel”
pleasure, and our mood becomes pleasant, and causes us to be a pleasant
person.
Touch

The sense of touch (fig. 14) is activated on both an exterior and interior level. This includes the brain's ability to perceive and differentiate changes in touch, pressure, temperature and pain when handling a rose in the garden. This analysis is known as somatosenses and consists of a diversified group of receptors. Somatosenses involves three groups of tactile sub-senses: 1) the skin, (external organ receptor for touch) 2) kinesthesia (perceived movement due to muscle and joint activation) 3) innate or internal sensors that perceive changes in organs due to sensations of touch and pressure.

Several different receptors react to certain forms of energy. For example: mechanical energy, formed by the movement of muscle groups, causes stretch receptors to activate the kinesthesia sense and we become aware of how we move or how we need to move to perform a certain task (Netter, 1986, Kolb & Whishaw, 1990, Carlson, 1991).

This becomes apparent when one bends down in the garden and reaches for a rose from the rosebush. In doing so six types of receptors are activated and cause the sensation of touch to be felt. They are: 1) joint receptors and 2) muscle and tendon receptors which make us aware of the position we need to take (bending) and the muscles we need to use in order to reach the rose 3) hair receptors that react to a. shallow oscillations of energy released by the separating of the rose from the rosebush b. slight bending of hair as the rose touches the skin 4) touch receptors to respond to the feel of the rose against the skin especially when the rose contains dew which in turn causes 5) temperature receptors to become aware of the differences between coolness and warmth as the skin touches the moist rose. When a thorn on
THE SENSE OF TOUCH

SOMATOSENSES

Skin

Touch Receptors

Kinesthesia (Muscle & Joint Activation)

Internal Pressure & Fine Touch

Pain Receptors

Muscle & Tendon Receptors

Temperature Receptors

Joint Receptors

TOUCH NEURONS SEND MESSAGES

Spinal Cord

BRAIN

TACTILE FEELING

Figure #14

Figure 14-The Sense of Touch
the stem prickle a finger 6) nociceptors, or pain receptors, become active and cause the finger to withdraw from the stem due to the sensation of pain. These receptors form synapses (connections) with axons (part of a neuron that sends impulses) and send messages up the spinal cord to the brain (Netter, 1986, Kolb & Whishaw, 1990, Carlson, 1991).

**Sensual Arousal**

The world is assessed through the senses. Sensual perception causes us to react and adapt to our environment. Behavior is a function of how we sense our physical and psychological surroundings. The senses evolved as a means to heighten our awareness of the world and ensure survival (Soule, 1992). For health to exist and be a consistent factor in our lives our senses must be able to function and compensate during environmental exposures.

When the senses are aroused they seek aesthetic pleasures. It is healthy to pursue pleasure. Each sense alone and in unison has this ability. The senses also alert us to danger and unhealthy situations. Without sensual communication health becomes precarious and our whole being is affected. Landscape architects must be aware of the primary role the senses play in perception, behavior, and health. Each sense must be thoroughly understood not only for its connection to perception and health but for its function and relationship in respect to the other senses. An important consideration in a healing design is to emphasize the sensual experience to produce positive behavior which results in health. By understanding the dynamics of sensory perception the landscape architect will be able to identify and analyze the natural stimuli in a garden that is preferable and sensually stimulating. This will lead to a design that fosters health and well-being through a subtle interaction with garden elements through sensual stimulation.
Vision

According to Tuan, the visual sense alerts us to the depth and breadth of the world. Our eyes trace every nook and cranny of the environment. The sense of vision has the ability to see and feel at the same time. Cognition is enhanced by this "tactile vision" that enables us to visually touch and explore an object and categorize it as an experience that is placed in our memory (Ackerman, 1990, Tuan, 1993). According to Ackerman, seventy percent of the sense receptors are found in the retina. It seems appropriate to suggest that vision may be the primary sense for most people in assessing preferable settings. By closing one's eyes we become immediately aware of how important vision is as we feel lost and disoriented without it.

Vision is the primary sense in our search for safety and shelter. Our ancestors needed to see what was beyond and about before a decision was made for settlement. Health can be determined through vision as it alerts us to unhealthy colors, textures and patterns in our environment as well as ourselves. If an environment looks diseased then it is a predictor of disease for those who experience it. Vision allows the patterns and textures of the landscape to have interest and meaning (Appleton, 1990, Cox, 1991). Details of landscape elements come alive and symbolic overtones are implied that can affect health and well-being, when meaning is inferred in an experience.

Because our vision is limited to full spectrum light we can not visually experience different light frequencies that go beyond the full spectrum (Ott, 1963, Liberman, 1991, Gimbel, 1994). We cannot see the electromagnetic energy of a landscape but we may be able to feel it. Every living object on this earth has an electromagnetic energy field that interacts with those it comes in contact with. Kerlian Photography is able to capture this on film (more on
this in the discussion on touch).

Landscape elements are deciphered by our eyes into shapes, textures, colors, patterns, arrangements and the like. We place them into cognitive categories according to familiarity and experience. These categories are referred to in assessing a landscape's attraction, beauty and meaning (Cox, 1991). When we find these elements to be visually pleasing we seek them out for further enjoyment and health. Recommendations addressing the sense of vision are in Sections 3 & 4.

**Smell**

The human sense of smell is far less advanced than in most other species. For instance, it is ten to twenty times less effective than a dog's sense of smell. This is due to the anatomy and physiology of the nasal system which is much smaller and less intricate than most mammals (Ackerman, 1990). Because the visual sense became more acute in our survival needs (we use vision for hunting, rather than smell) the nose evolved into a less significant or secondary organ. It has a distinct role in nutrition and survival which ensures a healthy species. When food is found it is smell that predicts whether it is edible or not (vision is not always capable of doing this).

Smell is of primary importance in the aesthetic experience. According to Tuan, Western Civilization has placed this sense after sight and sound because of an inability to enjoy (feel) sensuality. Sight and sound seem to objectively analyze a situation. Smell immediately refers it to a subjective, sensual feeling.

Animals and plants rely on smell for reproductive purposes. The sweet smell of pollen entices the honeybee to carry it from one plant to another. Sometimes only a smell has the capability of alerting a male animal
hat a female is in estris. Human’s wear perfume to attract sexual interest.

Smell has a deep relationship with emotions and is usually described in terms of personal feelings rather than object description. For example, the fragrance of a rose smells “sweet” while it feels soft and looks pretty. Smell helps us prefer certain objects or situations. Before a baby is visually able to recognize its mother, its sense of smell alerts it to whom its mother is. Knowing its mother’s smell gives the baby feelings of comfort and security, which is tantamount to its health and development. The mother is also able to detect her baby’s smell on objects used by the baby.

Fragrances and odors can take us back in time. We remember childhood experiences by smell, memories of former places are evoked by smell, and subliminal odors that activate hormonal responses are sensitive to smell. When people lose their sense of smell they become depressed and lose weight. Without smell sensual experiences are lessened and one feels that they are missing out on life. Food loses its taste if we cannot detect an aroma. If you have ever tried to eat something while pinching your nostrils tight you will not be able to recognize the taste. Without the sense of smell homeostasis is thrown off balance and we lose an important aspect in the quest for holistic health.

**Fragrance**

Fragrance is an olfactory quality that is of a sweet and pleasant nature. Fragrance in the garden usually describes plants and other garden elements that stimulate the sense of smell to react in a positive manner. This reaction can cause pleasure and sensual harmony which produces healthful feelings in most individuals. Scent preferences are highly personal and specific to state of mind and appropriateness of a situation. For example, most
individuals like the smell of perfume. However, some chose strong odors, others weak odors. Since most perfumes are produced or copied from natural products they remind us of nature and the pleasurable feelings that flowers bring most people. By placing a few drops of perfume on our bodies we feel as beautiful as the flowers that created the scent. We are emotionally bonding with nature by using perfume.

Fruits and flowers were found to be highly preferred fragrances when compared to scents of unnatural products (Moncrieff, 1966). Because we are familiar with most aromas in nature we feel comfortable and familiar with them and refer to them for past remembrances. According to Tuan, odor is insideous, we inhale it quickly, become intoxicated by it, and are controlled by it as it lingers and empowers us. The importance and attraction of fragrance in our lives is an innate response, as Wilson would describe as, the need to be one with nature through biophilia.

Incense was and still is a common practice that releases an enhanced fragrance into the environment. Several cultures and religions used it and continue to use it as a peaceful offering to a higher power. Eastern cultures equate paradise with the scents in the garden. Tuan suggests, this is because the perfume of flowers is associated with gardens which are associated with the harmony and tranquility offered by heaven. He also indicates, Christian society finds the visual experience of a garden to be more pleasurable since the ability to sensually react to aromas has been neglected for several centuries in the western world. However, this attitude is increasingly changing by the recent introduction of aromatherapy into western culture as a beauty aid, spiritual practice, and healing remedy for stress relief.
Fragrance and Health

The early Egyptians, Greeks and Romans believed that maintaining healthy odors for the body was related to assuring healthy odors in the atmosphere. Aromatic fires were prescribed by Hippocrates, Galen, and other physicians to rid the air of polluting substances by releasing natural products with disinfecting qualities into the heavens. This became a widespread practice in Europe to rid the population of the deadly air associated with the plague (Le Guerer, 1992).

The use of aromatic plants became very common in early cultures as a medicinal treatment for healing. They were used to flavor foods and drinks, as poultices, and as embalming agents. Their healing properties were used and continue to be used through aromatherapy. This treatment captures the essential oil of plants and releases it into the environment in the form of a spray. It is becoming more and more frequently used as an alternative to drug therapy (Steele, 1993). The brain is immediately affected by scent and the body’s chemistry can be changed through the power of smell. “For this reason, psychiatrists and psychologists are taking great interest in the safe mood-changing potential of essential oils”. (Bremness, 1994)

The garden is a natural healing alternative that abounds with aromatherapy. After a heavy rain fragrance abounds in the garden. This is due to the chemical structure of water that holds fragrances and releases them with movement, such as breezes. Garden architecture, such as arbors and pergolas, allow scented flowers to be located near our face to enhance the therapeutic properties of scent. Hedges and other garden enclosures potentially place us in a space that can be filled with fragrant aromas that are
inescapable. Minter suggests providing barriers in the garden that will prevent breezes from causing the fragrances to drift away. However, one may also skillfully use prevailing breezes to carry scents into a space from another area. This adds a subtle fragrance that heightens the sensual experience of a garden space. The garden has the ability to act as a therapeutic room for sensual encounters that produce wellness. A sunken garden, as well as a conservatory, Minter suggests, can capture scents and keep them available as beneficial remedies to ward off stress. The aromas of plants remind us of happier times and can be a natural mood enhancer that lifts us out of a depressing state (Minter, 1993).

**Natural Fragrances**

The garden is abundant with natural fragrances. The sweet scent of flowers, the rustic smell of the earth, and the woody scent of trees are examples of the varied aromas available in nature. According to Tuan, we tend to view nature in a highly visual context and seem to neglect the importance of its olfactory experience. Understanding and appreciating odors is a very important part of the sensual experience as well as conducive to continued well-being.

Odor, like aesthetic preference, can be cultural. Perfume was discovered as a cultural identity for societies. According to Tuan, strong odors are preferred in the Orient, whereas Light odors are the preference of Anglo-Americans. "Scents capture the aesthetic-emotional quality of place." (Tuan, 1993:69). Culture and ritual are steeped in symbolic gestures that use fragrance as apart of their myth. Symbolism is another way in which fragrance is used as a cultural, religious, medicinal, and sexual entity.
The landscape architect must incorporate the therapeutic power of scent into the design of a healing garden. An experiment at Sloan Kettering Memorial Hospital suggests that certain aromas (heliotropin) reduce patient’s anxieties before medical procedures (Steele, 1993). This conclusion suggests that scents may have the ability to cause a positive reaction to stress. A garden carefully designed with this premise in mind can only enhance the healing aspect of fragrance in the garden.

**Recommendations Addressing Fragrance in The Healing Garden**

1. Use scented species of plants that extend aromas across a distance (10-50 ft.). This attracts the user to move forward into the space, walk through it, and create “mystery” by enhancing the need to explore. Mass the plants for a perfumed effect. Plants that fall into this category are the following: Nicotiana alata, Matthiola longipetala, Lilium regale, Philadelphus coronarius, Daphne burkwoodii, Daphne mezereum, Daphne odora, Lobularia maritima, Syringa vulgaris, Fritillaria imperiales, Argyrocytisus battandieri, Rhododendron luteum, Iris germanica, Crambe cordifolia, Gardenia augusta, Osmanthus fragrans, Osmanthus heterophyllus, Aurinia saxatalis, Erysimum cheiri, Azara microphylla, Lavandula augustifolia, Lavandula stoechas, Hyacinth orientalis, Monarda fistulosa, Jasminum x grandiflorum, Trachelosperum Jasminoides, Pieris japonica, Lonicera fragrantissima, the citrus blossoms of fruit trees, most of the Viburnum species.

2. Use scented species of plants that attract individuals when they are up close or nearby (1-10 ft.). These plants made be placed near the house or a seating area in the garden. This encourages an intimate and close interaction with the garden and excites one to enter as well as continue the journey into a
healing environment. This is important for flowers whose fragrances are concentrated, and cause a subtle pleasure through personal contact. To experience intimate contact with these plants place them in an enclosed garden space. This lends itself to a spiritual encounter that is enhanced by fragrance. To experience an exhilaration from these plants place them next to a path so that they encourage interest and a gentle stroll through the garden. An arch covered with fragrant climbing roses set along a path is a good way to have someone “stop and smell the roses.” To experience relaxation in an open space place these plants within a trellis or pergola so that they encourage us to stop and inhale the therapeutic scents that are soothing and stress reducing. Placing seating under these garden features prolongs the sensation and encourages relaxation. Plants that fall into this category are the following:

Iris danfordiae, Rosa moschata, Jasminum sambac, Perovskia species, Clethra alnifolia, Jasminium polyanthum, Viburnum carlesii, Viola odorata, Paeonia suffruticosa, Clethra alniflora, Calycanthus floridanus, Narcissus cyclamineus, Cestrum nocturnum, Buddleia davidii, Abelia chinensis, Corylopsis pauciflora, Lilium regale, Cistus x purpureus, Skimmia japonica, Loropetalum chinense, Myrtus communis, the rose species, (according to Cox, red roses seem to have heavier fragrances than paler colored roses), Prunus laurocerasus, Convaleria majalis, Syringa vulgaris, Wisteria floribunda, Pittosporum tobira, Syringa meyeri, Weigela florida “Mont Blanc”.

3. Use scented plants that require crushing and handling in order for fragrance to be experienced. This causes intimate contact and association with the plants and garden. It also awakens memories of pleasurable sensations. The leaves and petals on these plants usually need to be crushed to experience
the texture and fragrance. To experience intimate contact with these plants place them in an enclosed garden space. This lends itself to a spiritual encounter that is enhanced by fragrance. To experience an exhilaration from these plants place them next to a path so that they encourage interest and a gentle stroll through the garden. To experience relaxation in an open space place these plants within a trellis or pergola so that they encourage us to stop and inhale the therapeutic scents that are soothing and stress reducing. Plants that fall into this category are the following: Myrtus communis, Choisya ternata, Salvia officinalis, Mentha spicata, Cistus ladanifer, Houttuynia cordata, Pelargonium odor-atissimum, Rosa primula, Rosmarinus officinalis, Pelargonium tomentosum, Aloysia triphylla, Pelargonium nervosum, Ocimum basilicum, Chamaemelum nobile, Mentha requienii, Vitex agnus-castus, Pelargonium crispum, Pelargonium graveolens, Artemisia abrotanum, Thymus vugaris, Galium odoratum.

4. For evenings use plants that have predominately evening scents so that a healing garden can be enjoyed in the evening through the creation of a relaxing atmosphere. Plants that fall into this category are the following: Cestrum nocturnum, Hosta plantaginea, Brunfelsia americana, Brugmansia candida, Hoya carnosa, Mattiola longipetala bicornis, Burgmansia versicolor.

5. Do not use plants that admit a repulsive odor, such as Hawthorn, Pyracantha, and the Bird Cherry, in a healing garden. This will cause stress and anxiety.

6. Use plants that add fragrance in the winter for healing to be effective during the colder months. Plants that fall into this category are the following: Rhus aromatica, Corylopsis pauciflora, Lonicera fragrantissima, Osmanthus heterophyllus, Chimonanthus praecox, Hamamelis mollis, Hamamelis
virginiana, Sarcococca hookeriana humilis, Viburnum fragrans.

7. Use scented plants that hang, such as vines, to create a relaxing environment. These plants can be placed on buildings, garden architecture, and the like. They can be used in creating a fragrant meditative enclosure in the garden. Plants that fall into this category are the following: Gelsemium sempervirins, Jasminum polyanthum, Jasminum officianale, Clematis armandii, Beaumontia grandiflora, Trachelospermum jasminoides, Trachelospermum asiaticum, Lonicera japonica, Wisteria floribunda, Wisteria sinensis, Jasminum nitidum, Decumaria barbara, Lonicera periclymenum, Clematis paniculata, Hoya carnosa, Jasminum grandiflorum, Lonicera halliana, Clematis montana.

8. Take advantage of prevailing breezes that disperse fragrances. Place fragrant plants in southwest areas of the garden. This causes the warm summer breezes to capture the scents (warmth causes the essential oils of plants to be more potent) and move them throughout most of the garden. In the winter scent is more prominent from evergreens, such as pines, and flowers mentioned in guideline six. Place them along a north and northwest area so their scents travel farther with the stronger winds.

9. For fragrances to stay close by place fragrant flowers away from heavy breeze patterns. Place scented plants in an eastern and southeastern part of the garden in the spring and summer and a south and southwest area for the fall and inter.

**Taste**

Taste is a sense deeply intertwined with smell. In order for something to taste good we must be able to smell it. We usually do not place too much emphasis on taste as an aesthetic experience. However, when it includes the
act of eating it becomes a very potent and sensual event (Tuan, 1993). Eating combines the sense of sight, smell, taste, sound and touch. According to Diane Ackerman, taste is a social sense. Cultures and relationships can't exist without it. Because taste brings people and nutrients together it is a sense that fosters emotional as well as physical health.

The landscape first provided us with rudimentary food before we evolved into a hunter-gatherer society. The trees, vegetation, and plants that nourished us also supplied us with medicinal herbs. These plants and herbs ensured our survival and health. We not only have a physically nurturing experience with the landscape but a spiritual, and symbolic relationship that has given us life and health for thousands of years. No wonder we see the natural world in such sensual terms!

**Garden Tastes**

The garden can be quite unusual and extraordinary in its culinary pleasures. Healthful, balanced eating is an important part of health. An herb and vegetable garden is one way to ensure that freshness and diversity is available for one's eating enjoyment. Gardening for taste is an enjoyable activity that brings the whole family together in a positive manner. Aside from the importance of stimulating the senses, a culinary garden brings much more than mere herbs, fruits, and vegetables to our tables. It brings forth a spiritual message that touches all who come in contact with the garden. We are brought closer to nature by creating this garden through a mental, emotional, and physical interaction. The fruits of our labor give us pride, self-esteem, and a feeling of accomplishment. The meals we prepare with nature's bounty are a creative process that awakens all our senses and uses our energy to nurture others. The enjoyment of the meal is both satisfying
and rewarding to all who partake. Health and harmony are by-products of this spiritual encounter.

For those who prefer, a culinary garden should be an option presented by the landscape architect as part of a healing garden. We often tend to neglect this sense when designing a garden for health and well-being. Vegetation that bears fruit is another way to excite the sense of taste. These plants may be mixed in with other plantings so that they become a part of the overall garden scheme. However, they should be placed carefully because their dropped fruit can cause considerable stains and unwanted animal activity. Placing these plants away from buildings, garden architecture, and path proximity is important for those who are fussy about aesthetics. However, they should not be placed too far away from paths and buildings, or seating areas otherwise they cannot be reached and enjoyed.

Plants with berries add a seasonal interest, attract birds and other wildlife, as well as supply tasty treats. Children also find them stimulating, their colors are usually bright and vibrant, and fun to pick and eat, as well as supply us with Vitamin C. Another benefit of taste in a healing garden is to grow herbs and spices that can be used in teas to induce relaxation. The leaves and flower petals can be dried for use all year round. It is spiritually uplifting to know that you have created your own natural tranquilizers that can be used in times of stress. For more on herbs for culinary and medicinal purposes the following authors are recommend: David Hoffmann, Lesley Bremness, Richard Mabey, and Nicola Peterson.

Reccomendations Addressing Taste in The Garden

1. Use plants that are noted for their culinary properties, such as appetite stimulation, digestion enhancement, antibacterial and preservative qualities,
and exciting tastes. Place these plants close to a door so that retrieving does not become problematic. Plants that fall into this category are the following: Pimpinella anisum, Ocimum basilicum, Monarda didymus, Carum carvi, Allium schoenoprasum, Cuminum cyminum, Borago officinalis, Laurus nobilis, Anthriscus cerefolium, Rosmarinus officinalis, Aloysia triphylla, Tropaeolum majus, Salvia officinalis, Artemisia dracunculus, Myrrhis odorata, Mentha piperita, fruit trees, Thymus citiodorus.

2. Use plants that are noted for their sweet properties and exciting tastes. Plants that fall into this category are the following: Ribes nigrum, Ribes sativum, Fragaria virginiana, Rubus phoenicolasius, fruit trees, Sambucus canadensis, Prunus serotina.

3. Plant a vegetable garden that uses a variety of vegetables including salad greens, tomatoes, cucumbers, and other common staples. Place this area within close proximity to a building.

4. Use grapevines, such as Vitis vinifera, as affective coverage for pergolas and trellises.

5. Plant edible berries such as strawberries, huckleberries, cherries, and blackberries along paths so that tasting can be part of the inner garden experience. Place them slightly off “the beaten path” so that stains do not cause a problem.

6. Plant culinary herbs and edible berries in pots next to areas that are frequently used for sitting and relaxing. They will add to the healing ambience of the garden by creating a nurturing feeling with a special treat.

7. Plant herbs that can be made into teas to enjoy in the comfort of a “tea area”, a special area designated for comfort and tranquility where tea can be sipped and viewed at the same time. It can be placed close to a building or
hidden in a garden enclosure. Fragrant plants would also add to the ambiance. See fragrance guideline two. Some herbal teas are mainly used for stress reduction due to anxiety and nervous tension. Plants that fall into this category are the following:
Chamaemelum nobile, Nepeta cataria, Scutellaria laterifolia, Valeriana officinalis, Borago officinalis, Tilia cordata, Hypericum perforatum, Stachys officinalis, Lavendula augustifolia.

**Hearing**

The ability to hear creates a world of sound that lifts us to emotional heights of splendor. The sound of music permeates our bodies and causes emotional responses that sometimes cannot be controlled. Noises alert us to events in the world. Without the ability to hear most movements cannot be detected, sounds cannot be heard, and we cannot properly express ourselves. Babies are comforted by the sound of their mothers voice and heartbeat. When you have a puppy some say that it will sleep through the night peacefully if you place it in a bed with an alarm clock. This is to mimic the sound of its mother’s heartbeat and by doing so causes the puppy to feel secure and loved.

The dangers and pleasures of an environment are made clear to us through sound. The sound of water gently tapping upon rocks is soothing while the sound of a fast and heavy wind may be anxiety producing. Noises that make us uncomfortable cause a high degree of stress in most individuals. Glass and Singer (1972) found that continual exposure to intermittent annoying noise, such as airplanes, was more stressful than a daily singular exposure to a harsh noise.
The tone of one's voice is an indicator of mood and can acquaint us
with a person's intent. Without understanding a language, anger, happiness,
disinterest, and the like, can be interpreted from the tone of voice. The
sounds of nature are important indicators of the health of an environment.
If the chirping of birds or voices of local fauna are not heard the landscape is
considered lifeless. We need these natural sounds for continued well-being
in the form of a sensual bond with nature.

Healing Sounds

Nature is abundant with sounds that are familiar, and generally
therapeutic. One of the prettiest sounds of the natural world is the chirping
of birds. The rustling of leaves against a brisk wind, the soft cascading of
water on rocks, as well as the gentle scat of the squirrels in the trees are other
sounds that endear us to nature.

Sound is energy, and soothing, harmonious sounds help produce a
healing environment. Sound can be introduced into a healing garden either
naturally, as with birds, human songs and garden elements such as water and
vegetation, or mechanically. Examples of this would be windchimes, musical
sculptures, electronic music, instrumental music, and the like. Healing
sound contains melody and is fluid. It reaches a harmony through interval
which creates a balanced rhythm (Gimbel, 1990). According to Theo Gimbel, a
healing researcher, "live sound" is the true sound of healing.

"Live sound, music made by song or any instrument heard by the
listener directly reaches the ear with all the harmonics and overtones
which are inaudible in fact, not distorted." (Gimbel, 1990:57)

A garden has continuous "live sound" all year long. It can be used as a
healing therapy by creating sound vibrations that permeate our bodies. These
vibrations are produced by energy from objects that move through air molecules and are dispersed into the atmosphere to be picked up as sound. These vibrations have the ability to affect us emotionally by pulsating according to our rhythms. This makes us comfortable and familiar with the environment and may cause healing.

Music has the ability to control our emotions. It awakens within us an innate knowledge of ourselves and the world around us that can be appreciated through sound. Music is an aphrodisiac and and has the capacity to produce meditative states in some people. Hospitals are using music as part of their wellness programs. Stress hormone levels dropped in surgical patients subjected to music (Spingie in Mazer and Smith, 1993), T-cell count increased in cancer patients who used music therapeutically (Achterberg in Mazer and Smith, 1993), and anxiety lessened in ICU patients who were exposed to music (Updike in Mazer and Smith, 1993).

Music can become a healing sound by being available in perfect pitch. According to Gimbel, sound and color are related through harmonies and intervals and are responsible for healing sound. He suggests that vertebrae, must be balanced and aligned as the scales of music and color; if an unbalance in the spine is found, music and color can cause a realignment of the spine.

“These intervals can then be used in conjunction with harmonies and accompanying tones repeatedly so to set off an oscillation that can re-adjust lost balance in the molecular cell structure.” (Gimbel, 1990:64)

According to Cox, we associate some sounds with colors and they are related through terminology. He gives the examples of pitch being derived from hue, and timbre being derived from texture. The diatonic scale arranged by Newton and the color-note system invented by Aleksandr Scriabin, a
Russian composer, relates to color and a color scheme in the garden can be created through their use according to musical notes (Cox, 1993). For examples, See Cox, 1993:44. According to Cox it works. Cox also suggests, that certain flowers such as the Liliium formasanum take on the form of musical instruments and remind us of musical notes. He implies by arranging high tone flowers with low tone flowers a musical composition can be achieved in the garden.

If sound is used creatively and in conjunction with the natural laws of health and harmony it should offer an increase in health and well-being. If the landscape architect uses healing sound in a garden design that adheres to the principles of aesthetic design and health, then healing would surely be enhanced.

Garden sounds can either be natural or implemented. However, they must be sounds that follow the principles of design and health in order to be affective in healing. Mazer and Smith suggest that therapeutic sound relaxes and produces healing in patients. They also suggest that sounds that are of a negative and inappropriate quality may unravel the healing process. Assumming this to be true, every effort should be made by the landscape architect to provide the garden with appropriate healing sounds; sounds that reduce stress by creating feelings of relaxation and harmony.

Recomendations Addressing Healing Sounds in The Garden
1. Use species of vegetation that create pleasant sounds when coming in contact with the wind. Plants that fall into this category are the following: Ornamental grasses, The Pine family, especially Pinus bungeana, Cornus florida, textured ground covers, Ficus carica, Betula papyrifera, masses of flowers with thick foliage, such as Peonies, Rudbeckia fulgida ‘Goldstrum’,
and Chrysanthemums.

2. Use species of vegetation that attract birds and provide coverage and food for them. Plants that fall into this category are the following: Impatiens wallerana, Lobelia cardinalis, Monarda didyma, Fuschia x hybrida, Alcea rosea, Hemerocallis spp., Salvia spp., Nicotiana alata, Gladiolus x hortulanus, Celosia spp., Capsicum annum, Papaver orientale, Lunaria annua, Dianthus spp., Cleome hasslerana, Elaeagnus augustifolia, Ilex aquifolium, Taxus baccata, Aster novi-belgii, Cosmos sulphureus, Lonicera periclymenum. Woody plants that attract birds are: Magnolias, Tuliptree, Forsythias, and the Common Sweetshrub.

3. Use species of vegetation that attract butterflies and bees to the garden. These insects create a pleasant and soothing sound that is harmonious and balanced. Plants that fall into this category are the following: Aromatic herbs, Monarda didyma, Phlox paniculata, Mirablis jalapa, Rudbeckia spp., Sedum spectabile, Rosa pimpinellifolia, Virbinum tinus, Lavandula augustifolia, Calendula officinalis, Chrysanthemum spp., Hyssops officinalis, Gaillardia spp., Iberis sempervirens, Lonicera periclymenum, Saponaria officinalis, Reseda odorata, Verbena bonariensis.

4. Use a pond to attract birds and insects. Use fish, frogs, and plants to create sounds. Plants such as Nelumbo nucifera, Nymphoides peltata, Typha latifolia, Nymphaea species, Pontederia cordata, and Iris Pseudacorus are conducive to sound through movement with the water, fish, and frogs.

5. Use a small waterfall to create a healing sound as the water softly cascades against pebbles and stones. According to Minter, this reminds one of a woodland stream. It is a therapeutic sound that innately heals.

6. Use a fountain that causes water to be soft in appearance and sound. The
sound should be balanced and rhythmical. This can be an element in a meditative enclosure. It will enhance the tranquil experience.

7. Use a small pool as a reflective element in the garden. Add sound by placing a water spout at either or both ends that softly introduces a continuous flow of moving water that imprints its signature in the pool through currents of sound and movement.

8. Place a sound system into the garden that introduces healing music for a relaxing and soothing affect.

9. Place melodic chimes and musical sculptures into the garden so that the wind can produce healing music.

10. Create a sound space in the garden where the user/s can feel free to sing, play musical instruments, and listen to healing sounds.

11. Place the garden in an area that is not bombarded by noise. Both loud intermittent noise and chronic levels of steady low to moderate noise are found to be uncomfortable and stressful. A comfortable level of noise would be at a frequency of 1000 to 12000 Hz. Walls and hedges should be used to absorb and deflect noise from the garden. Plant ceilings also absorb heavy sounds. Vegetation placed in masses absorbs unwanted sounds as well as water, such as pools or ponds.

Touch

Touch is another important sense in activating the healing process. The skin is one of the most sensitive organs involved in communicating with the environment. We literally have the ability to “feel” our world. This is accomplished by the nervous system’s split second interaction and analysis of the stimuli we come into contact with on a daily basis. The sense of touch is the first sense the human embryo is aware of well before its eyes and ears
develop (Montagu, 1971).

Babies will not grow if they do not receive cuddling from their mothers. Province and Lipton (1963) compared the lack of touch among babies and found that institution babies lacked the ability to bond with adults, were unmotivated, and adapted rocking motions (Montagu, 1971). Other studies suggest that massaging babies increases their weight gain at a much faster pace than babies who are not massaged (Ackerman, 1990).

Without tactile arousal digestion and elimination will become weak and maladaptive. The endocrine system will not produce enough hormones so that we can grow properly. Snuggling offers an aesthetic experience to mammals by producing pleasure and ultimately feelings of well-being (Tuan, 1993).

"The pleasures of being alive and our deepest sense of well-being depend on cutaneous rewards that may come anytime, anywhere: the coolness of a stone in the shade, ... the smoothness of a baby’s skin, ... the fat kiss of raindrops, ..." (Tuan, 1993:40)

The act of touching someone or something is activated by nerve receptors in the skin. With this act an energy is released as well as received. This is an electromagnetic energy, what the Chinese refer to as "Chi" (life-force), that is present in all living things. Energy requires heat and since the human body is capable of maintaining and regulating heat it must therefore produce the energy necessary for this function. Also, in order for movement to occur energy must be produced. Movement begins at the cell level and continues to keep the body/mind in motion. Without this motion produced by energy life would cease (Chopra, 1991, Krieger, 1979).

Since touch is electromagnetically driven it interacts with energy fields.
Dr. Doris Krieger describes the human energy field as the "empty" space beyond the boundaries of the skin (Krieger, 1979:24) that carry electromagnetic charges. The human field interacts with all other fields present in an environment. This interaction takes place at a level that is not open to the human body/mind. Dr. Harold Saxon Burr (1973 in Krieger, 1979) conducted a study on nerve cells that suggests energy is exchanged in both internal and external interactions. He labeled these fields L (life)-fields and inferred that illness could be rendered from these fields according to the psycho/physiological state of the individual (Krieger, 1979).

Since our nerve cells seem capable of exchanging energy, both internally and externally, would we not be able to release that energy into the environment and pick up energy that is available from a vital source in the environment? If the available energy were released from a natural substance that contained properties of healing such as a plant would it not be an energy that could be used to aid the healing process?

Dr. Krieger suggests that colors have energy. Several practitioners of color therapy base their treatment on the belief that each color signifies an energy associated with certain parts of the body (Gimbel, 1994). If this were true would spending time in a garden and absorbing the energies emitted by flowers be therapeutic? Would the color, feel, and fragrance of a flower transmit an active energy that has the capability of penetrating the human energy field and act as a therapeutic agent? Hopefully, future research will be able to confirm this. This may be possible since research has confirmed that the energy of the sun (light rays) is able to penetrate our being and cause us to perform innate functions that ensure the survival of our species (Liberman, 1991).
The energy of the earth is evident in earthquakes and other natural movements. It is a powerful source of movement (touch) that surrounds us every day. Unfortunately, we have shunned away from it rather than embraced it. The landscape has the potential of exerting the earth's energy in a natural manner by balancing all of nature's forces into a natural habitat. By feeling the wind on our faces, the dirt and grass in our hands, the warmth of the sun or the coolness of a northwest breeze on our skin we can experience nature as a receptive energy field.

Tactile stimulation is adventurous in nature. Touching an object to explore its meaning is an innate action that requires sensitivity and an absorbing mind. We learn through touch and we feel through touch. Touch can cause pleasure or displeasure. Touching plants can cause pleasurable reactions and help to reduce stress. This has been confirmed by gardeners who feel that plants help relieve tension (Lewis, 1991).

**Texture**

Texture is a surface quality that is defined by an object's appearance and feel. The "feeling" that texture conveys is both visual and tactile. It can be a rough or smooth feeling of a surface. It can be a hard or soft characteristic that a surface portrays. It can make an object appear dull, sharp, interesting as well as mediocre. Texture adds variety and interest to life. Life would be dull and unesthetic without it.

Color can be enhanced or aggravated by texture. According to Hobhouse, texture absorbs and reflects light, and can cause a translucent appearance which gives flowers, more variation in their color range. For example, the waxy texture of tulip petals makes their color seem more intense, while the velvety texture of the rose flower makes its color appear
more subdued. This is due to the illumination or shadows texture adds to an object when it catches the sun’s rays.

Contours, or the outline of an object, such a stone garden wall can block light and create shadows in the vegetation adjacent to it. These shadows change the vegetation into a less textural entity and without light texture is lost. The more light available to a garden, the more rich and diverse the textural qualities will be. The landscape architect should equate texture to light and incorporate this concept into a healing design.

All objects have texture. Every living cell has texture. Nature has made it available in the most exciting and dynamic forms. It is not always easily seen, but can be made available under microscopic conditions. The geology of the earth is a textural resource which is evident in rocks and sand. Our bodies are rich in textural qualities, such as hair, skin, and fingernails. Plants and vegetation have high degrees of texture and are seen as very complex objects. Stems, leaves, roots, and flowers can have different textures. For example, the leaves of the Stachys byzantia are a soft texture, the leaves of the Hosta Plantaginea are a medium texture, and the petals of Hibiscus moscheutos are a fine texture.

Spatial dimension is a result of texture. Texture compels us to feel, reach out and touch something or someone. Texture is present in every aspect of our life. Because texture needs to be touched to be understood it can create behavior that responds to touch (Tuan, 1993). This is very important when designing a garden for the visually impaired.

It is almost impossible to separate touch and sight when analyzing the textural qualities of an object. Increased texture causes retinal cell excitation that is due to absorption and reflection of light (Anderson, 1961). Texture in
with the season and the garden needs enough textural elements to compensate for the loss of deciduous leaves in the winter. If the landscape architect does not plan for this change, the garden may look bleak and dreary during some seasons. This may be depressing and unhealthy for some people.

Tree barks are good tactile stimulators and offer a variety of colors and textures that are especially pleasing during the winter months. They beg us to pet and pick them, which increases our sensual pleasure. The river birch (Betula nigra) is a good example of this. With its various textural qualities, it seduces us to pull away its shedding outer layer and stroke its soft, new layer of skin. This is both exciting and pleasurable for most people. It rewards the senses by providing a satisfying sensation that is translates into feelings of health and well-being.

**Recommendations To Enhance Texture in The Healing Garden**

1. Provide an appropriate amount of light in the garden so that texture will be highlighted and visually stimulated. This also makes it more likely to be touched.

2. Create contrasts of textural variety in vegetation or other garden elements. Do not allow one type of texture to dominate the garden. For example, Cox suggests using a coarse textured plant as an accent, as well as with a variety of fine, and medium textured plants. This alleviates monotony and provides a moderate level of complexity that is important for motivating the healing process. According to Robinson, fine texture is easier for the eye to follow, and causes a soothing reaction. Coarse texture gives the appearance of weight and depth, and energizes the eye to explore more fully, this may cause a degree of tedium and stress. Medium texture adds unity to the differences
between fine and coarse textures and causes a visual adaptation to these changes that is not abrupt, and therefore less stressful.

3. Use texture in the following amount for stress reduction to be an accomplished outcome in a healing garden: fine-40-50%, medium-30-40%, Coarse-20%. According to F. B. Robinson, variety and contrast of textures should be balanced, especially in a small area to avoid discord.

4. Use fine textured plants for a space to recede, coarse textured plants for a space to come forward, and medium textured plants for a space to feel balanced. For example, a meditative space would feel too closed in and uncomfortable with coarse texture; fine texture in an open space would make it seem broad, expansive, and never ending.

5. Place a considerable amount of contours, or outlines of garden features, in the garden for textural affects produced by the interplay of shadows and light. This adds visual interest and mild complexity. According to Robinson, fine textures increase the outline and form of plants and objects, and when placed against medium to coarse textures they visually stand out.

6. Plan for seasonal change by adding enough textural variety to compensate for the loss of leaves, especially in the winter months. Place evergreen trees and shrubs with fine, medium, and course textures adjacent to deciduous trees and shrubs. This will compensate for the open, hollow look that winter can bring to the garden.

7. Use texture to highlight or subdue colors in the garden. Fine textures soften colors, while medium, and coarse textures tend to intensify colors. For example, placing soft textures of a contrasting color next to coarse textures subdues the effect. This will add color harmony and visual interest.

8. Add texture through paths, garden architecture, water features, soil and
ground covers.

9. Provide flowers and other vegetation, with textural qualities that ask to be touched. For example, the bark of Betula nigra with its coarse textured outer layer causes passersby to pull a piece off; the feathery texture of Pennisetum setaceum causes a stroller to run their hands across the grass.

10. Provide medicinal herbs in the garden, such as aloe vera, that can be used through touch. This will cement our connection with the “plant as healer” and help our health.

11. Add some textural plants to an evening garden. The medium to coarser textures work best because they hold light better than the finer textures. According to many gardeners, evening light makes certain plants, such as the hostas, rhododendrons, and azaleias, more noticeable for their textural qualities.

12. Plan a section of the garden for pleasurable tactile stimulation. Call it the “Touching garden”. It will reacquaint the client with their tactile sense and produce pleasure and well-being.

13. Place some grasses in the garden. Grasses come in different textures and add a tactile and visual quality to the garden. They move gracefully in the wind, produce a pleasant sound, and have a quality of gentle stimulation which is conducive to health. They also complement other textures quite well.

14. Provide a textural path and ground cover area that encourages one to meander barefoot in the garden. This is very sensual and awakens childhood memories that produce happy feelings.

15. Place sculpture in the garden that can be touched and explored for its textural qualities.
16. Avoid textures that are sharp, too rough, and jagged. These qualities can cause both physical and psychological harm that is stressful.

17. Use a smooth textured water feature next to medium and coarse textures; use a medium textured water feature next to fine and coarse textures. This helps focus the eye on the water feature making it a focal point in the garden.

18. Create an enclosed "tranquility space" by using mostly fine with medium textured elements. This will avoid claustrophobia and enhance the spiritual experience by providing a soft, relaxing feeling.
CHAPTER IX

A garden is a sensual oasis that refreshes the body and mind and should be created to provide the utmost in pleasures.

SENSUAL GARDEN ELEMENTS

This chapter describes the power the garden has on our senses. It begins with a brief overview of the garden as place and then moves on to the elements in a garden that are found to be potent stimulators which effect us sensually. The descriptions are clear and concise mainly to inform the landscape architect of the importance of choosing garden elements for their sensual appeal rather than their general qualities. The relationship between the garden, its elements, and healing are outlined so that a design concept will be manifested in a lucid and complete manner that positively addresses stress reduction, health and well-being.

The Garden

A special place exists that abounds with pleasure, sensual satisfaction and causes an increased reduction in stress by enhancing emotional and physical well-being. This place is a haven for the weary and a shelter from the daily hassles of modern life. This place can be used in solitude or shared by many to increase feelings of inner strength and emotional security. This
“special place” is a garden, a healing or therapeutic garden, one that facilitates health and well-being through an interaction with nature and the senses.

Gardens are becoming increasingly important as an alternative therapy for stress reduction, especially in an urban setting. A garden that promotes health is well-planned and executed with care. It is created to address the needs of individuals who want to reduce stress and reach an optimum level of health. How can it be experienced so that stress is reduced and health is increased? How might design elements of a garden improve one’s health? How do plants cause positive and healthful reactions in individuals who care for them and watch them grow? How do the senses perceive and react to a natural environment that is meant to facilitate healing? The garden holds the answers to these questions.

The garden is a sensual oasis that harbors all the elements in nature necessary for pleasure, health, and well-being. Gardens are symbolic of life. Life is renewed on a seasonal basis in the garden and this affects human consciousness. Many refer to the garden as a small version of the universe because it flows with life in the form of little ecosystems. It represents harmony through its continual biological relationships that relate to our lives, and it is through the garden that we innately are taught the meaning of life.

“The sun and moonlight, the plants, and the water of gardens have always been used by human beings for psychological orientation and as important sensations to maintain a sense of self.” (Warner, 1992:2)

For thousands of years humans have turned to gardens as special enclaves to release tension, to heighten a sensory experience, to express love and commitment, to bond with nature, to bring back health, and to
contemplate the past before life passes by. Most cultural and personal rituals have taken place in the garden. It is not surprising that anthropologists have found the garden to be part of every population's culture and religion. Since the garden has such implicit meaning it is not surprising to find that Western Society, which has placed such a low value on the natural world, has become an emotionally, physically and spiritually deprived community.

In order to reintroduce wellness to society it is important to reestablish a bond with nature that opens up a means of communication between all living creatures and the universe. A garden has the capacity to do this. All elements in a garden were created to enhance human life. Aesthetic, mental, physical, emotional, as well as, spiritual processes have been effected by the garden. The garden symbolizes restoration and health through a deep and intuitive connection with the human psyche, in terms of a spiritual restoration.

Gardens allow for contemplation and self-actualization to take place in a setting that is conducive to spiritual introspection (Lewis in Francis & Hester, 1991).

"He flows with the life forces that are directing growth. Actions in the garden become a counterpoint to a large theme. I believe that gardening ultimately leads to spiritual realization." (Lewis in Francis & Hester, 1991:247)

According to Cooper Marcus, a landscape architect, the garden represents paradise and is contained in myths such as the Buddhist Shambhala and the familiar Garden of Eden. "They are conceptual bridges or symbols by which the human mind finds a link between so-called reality and something intangibly behind it." (Cooper Marcus in Francis and Hester, Jr., 1991:26) She feels gardening appeals to so many because it causes us to search
for a return to paradise. Maybe, if we go back to paradise we can begin a
rebirth and restore our spirituality which may bring health and well-being
into a realistic perspective.

Healing, like the garden, is a renewal process that happens naturally
when harmony is present. By using the garden as a metaphor for health and
harmony we are attempting to symbolically communicate our need for a
connection and involvement with the natural world to understand our place
in it. The elements that make up the garden are important for their symbolic
message which affects us greatly. This affect can have a significant influence
on how we behave and restore our soul.

The healthful benefits of both an active and passive garden are
numerous and well documented. According to Charles Lewis, a
horticulturist who has researched the people-plant relationship for over
thirty years, gardens affect us intellectually and emotionally and carry certain
meanings for each individual. Lewis suggests in garden design, it is not the
plants and their compositional design that is so important but the implied
meaning they convey to the viewer. This is similar to Lazarus’ suggestion of
perceived stress in which he infers that the stress is not so much from the
stimuli but from our perception of it. The landscape architect needs to be
aware of meanings associated with plants so that they may be perceived as
strong indicators of health.

As proposed by Lewis, gardens can be experienced in what he refers to
as either a “observational” or “participatory” mode. Both modes according to
Lewis enhance well-being. However, he implies that the “participatory”
mode seems to offer a more pronounced and effective experience. “The
gardener gains a sense of accomplishment, self-esteem, and control over his
surroundings." (Lewis in Francis & Hester, 1991:247) These characteristics, according to several medical doctors and psychologists, are indicators of health and well-being.

The Kaplans also mentioned this in their research. They found that participation was a more effective variable than control in describing well-being. This was due to the fact that gardens sometimes need supervision or they will get "out of control". The most important aspect of gardening found by the Kaplans was the tranquility it offered. "...the greatest benefit of gardening was related to the sense of tranquility it afforded." (Kaplan & Kaplan, 1989:169)

It seems that the garden offers a holistic approach to the search for health, happiness and a spiritual identity. It should be a serious consideration for all who seek completeness and peace of mind in their life. Since tranquility seems to be an important factor in the garden experience the landscape architect needs to find or create elements in the garden that offer this quality.

**Plants**

Plants carry so many sensual stimulants that they can define a garden in terms of color, fragrance, sounds, textures, and taste. A heightened sensitivity is added to the world by plants and this is why so many people prefer them in their lives. Plants that flower are significant for us because they help us express our feelings. Janick writes "Flowers still retain extensive ceremonial use in the expression of joy, affection, welcome, gratitude, sympathy, celebration, grief, friendship, marital union, or spiritual contemplation." If plants, especially flowering plants, became obsolete society would become depressed and unmotivated for life.
We are not aware of how much we depend on flora to add beauty and meaning to our lives. Fragrant plants are symbolic of our need to feel beautiful and derive pleasure from a seductive source. In health flowers symbolize a renewal of spiritual life that is promising. Millions of dollars are spent annually in the floral business to bring aesthetics and peace to our lives (Heerwagen & Orians, in Kellert and Wilson, 1992). What is it about plants that makes them so desirable? Why is it that they can change a sad mood into a happy mood? Why do we depend upon them (oxygen, food, medicine, pleasure) to remain in a state of continued health?

Flowers hold many functions for the human species. According to Heerwagen & Orians, trees signify food. The flowering part of the tree evolved to be mostly non-toxic and provide us with pollen and nectar, a natural form of sugar which is important in providing energy. Flowers meant that we would have stamina to continue our quest for survival. Because they were aesthetically pleasing, they were easily noticed for food and eventually pleasure (Heerwagen & Orians, 1992). Ulrich supports this theory by imply that flowers are a prefered object, as well as green vegetation and water for most people because they subconsciously remind us of survival.

"These natural elements should tend to elicit liking and attention because throughout evolution they have directly and indirectly signaled either the certain presence or the likelihood of finding two survival necessities: water and food.” (Ulrich in Kellert and Wilson, 1993:90)

There is a feeling of pleasure that is derived from survival. Plants greatly enhance this feeling by causing the senses to be compensated greatly for their awareness and adaptation to an environment.
Flowers stimulate all the senses with their qualities. Their color is astounding, their fragrance is intoxicating, their texture is titilating, their aroma and taste is sweet, and they have the ability to attract the birds and bees to make beautiful music. All these attributes cause the senses to react in unison and create an atmosphere of pleasure and well-being. Plants also have a spiritual and psychological affect that dwells in our subconscious and causes us to respond to their implied meaning.

Paul Shepard, an ecologist, suggests that plants act as communicators of our psyche. They symbolically represent a part of ourselves that does not consciously emerge. We can express our feelings through them as Shepard describes in terms of “A phyto-resonance-the reciprocation of an an internal aspect of the self and an external plant.” (154) We use plants in myth, poetry, art, music, and love to express our selves. Because plants follow the innate structuring of nature we associate ourselves with them and find comfort in our similarities (Lewis, 1992, Shepard, 1994)

The mystery and challenges of life are seen through plants and the garden. Charles Lewis expressed this analogy when he spoke of the healing process in terms of the garden. “Vegetation, growing in man-made gardens or untended wilderness, has a potential for healing scars on the land and scars imposed on the human psyche.” (Lewis in Francis and Hester, Jr., 1991:244)

James Ottobre (1994), a landscape designer, believes that we have the ability to transfer our energy to plants through imaging. He discusses experiments in which plant’s and human’s electrical energies were measured during meditation. It was found, according to Ottobre, that the plants had the same graphic patterns as the humans and it was concluded that they are capable of accepting and expressing human emotion, especially at the cell
level. This may be a primary criterion in a healing garden. To communicate with the plants in a garden in a meditative space surely is therapeutic especially, if we are able to also absorb their healing energies. Would plants that are known to have healing qualities and substances such as Foxglove (cardiac), Aloe Vera (skin erruptions), and medicinal herbs, be placed in a garden so that their energies may be used physically and symbolically to heal? Would this be an effective alternative to synthetic drugs? Only future research can tell what the implications are. However, the results may be surprising and add a healing component to Wilson’s “Biophilia Hypothesis.”

According to Lewis plants respond to tender loving care. They do not threaten, judge or discriminate against us. Like most pets they give us unconditional love in the form of growth and beauty. They make us feel like we produced something special. This boosts our sense of self and feelings about our place in the world.

Plants are responsible for reducing stress in individuals who interact with them. The need to nurture something and feel useful is believed to be satisfied through interaction with nature. Plants have been proven to be great stress relievers and are used as a source of preventive medicine to relieve stress and fight disease (Lewis, 1988). “Plants take away some of the anxiety and tension of the immediate “now” by showing us that there are long, enduring, patterns in life.” (Lewis, 1988:114) Plants restore us emotionally.

Lewis suggests that a garden is an appropriate setting for healing to take place. He labels this a “healing environment”. “It is a place where ancient linkages between person and plant are reestablished and we find fulfillment.” (Lewis, 1979:338)
Paths

Paths invite one to explore and experience the garden. They symbolically guide us by manipulating our steps in an intended direction, toward paradise. They may create mystery, a quality conducive to mental restoration according to the Kaplans, by leading us into the unknown. The path in a healing garden is primary in directing our emotions to each part of the garden for a sensual effect that produces well-being. Emotion and cognition are influenced by paths since they offer a sense of mystery, legibility, and imagery. If a path is paved it stimulates the senses by adding color, texture, sound, and a feeling of movement.

The garden path can imply harmony by stimulating the senses to perceive it as balanced and non-confrontational. This is usually achieved by circular, winding motions, rather than straight, angular movements. A soft feeling path heightens one’s awareness that pleasure lies ahead in the garden. A hard feeling path may insinuate strength or the contrast between the softness of most flora and hardness of the earth. Placing plants at the perimeter of a path will help soften and smooth a harsh appearance. In order for a path to be an important element in a healing garden it should blend in and harmonize with the setting. It should not cause distraction or conflict since this will produce an unhealthy reaction. It should lead us and direct us to sensual pleasure.

Water

Water is the most important element in sustaining life. It is suggested by Orians (1980,1986) and Ulrich (1992) that an environment preferred by our ancestors contained water that was accessible for survival and basic needs.
Water that sparkled and possessed slight movement was preferred because it signaled the availability of food and purity (Ulrich in Kellert & Wilson, 1992). Health and well-being are associated with water because it brings back collective memories of survival and sustenance (Orians, 1980, 1986).

Water has the ability to reflect natural elements giving the appearance of depth and connectedness. Because of this property it is able to offer a visual experience that brings the world into the garden. The image of the sky, and surrounding flowers and vegetation is mirrored in water and causes us to perceive the garden as an endless picture of the natural world. Sue Minter, a designer of healing gardens, states “Reflective water doubles the visual impact.” (1993:134)

Water is symbolic of life and health. Water has medicinal qualities. It is used as a solution for medicines, and some cultures, such as the American Indian, place it in the sun pray over it and believe it absorbs the sun’s energy to restore vitality (Swan, 1992). The waters at Lourdes are believed to possess healing qualities that have been recorded and witnessed by many, according to Swan. Since the Greeks and Romans mineral springs have symbolized healing, and as stated by Swan ...“the only medicines used for over five centuries.” (159)

Water has been used in Religion as a rite of passage (Baptism), a symbol that cleanses, and a means of reflection. All cultures place water in their traditions and attach a spiritual quality to its importance in life. People pay high prices to live near it, most vacations are to resorts on the ocean, and spas use it to offer a physical and spiritual healing.
Water in the garden symbolizes our connection to life. It should be of a gentle nature with soft sounds and motions that enhance relaxation. The sound of water is extremely therapeutic to most people because it is a balanced and rhythmical sound that reminds us of life and renewal. “When allowed to fall and cascade, the sound of water can become a soothing and therapeutic component of the natural world.” (Strong, 1987:13)

If it sparkles we seem to prefer it and according to Ulrich water preference is an evolutionary component tied to survival.

“Accordingly both modern children and adults evidence strong preferences for scenes with water and are sensitive to certain optical properties of water in landscapes, especially glossiness.” (Ulrich in Kellert and Wilson, 1993:90)

The Chinese garden always has a water feature because it represents fertility and a renewal of life. “A Garden without water would be lifeless.” (Morris, 1983:89)

Pleasure is enhanced by the presence of water in a natural environment.

“Another reliable finding consonant with the earlier conceptual arguments is that natural settings with water features elicit especially high levels of liking or preference.” (Ulrich in Kellert & Wilson, 1993:91).

Without water life would wilt and end within a matter of days. It is an essential element in a healing garden. The landscape architect must be aware of this and incorporate it into a healing design concept either physically or symbolically.
Humphrey Repton, a landscape architect famous for his "Repton Redbooks" of the early 1900s, used water in most of his designs to enhance their sensitivity (Heerwagen and Orians in Kellert & Wilson, 1993). He instinctively used rocks as a feature to add the illusion of a rippling movement. This design feature, according to Heerwagen and Orians (1993), is preferable to a stagnant body of water. This makes sense because stagnation infers an unhealthy environment and therefore would not produce feelings of well-being. While, a rippling effect would create a refreshed, balanced movement implicating a healthy environment that fosters life. Sue Minter implies, that still water sets a contemplative mood in the garden as it was used in China as a contrast with vertical garden elements to produce balance and harmony.

The popularity of water gardens has grown over the last several years. Another feature of having water in the garden is the addition of certain fish and plants into the setting that otherwise would not be a part of the garden. When fish are incorporated into a a water feature, such as a small pond, they add movement and life to the water. When breezes softly move the water-plants they create a balanced movement and sound. This stimulates the senses of vision, hearing and touch. Water movement in a healing garden should be soft and rhythmical so that the sense of sight and sound are not disturbed. If it is too harsh and busy it will cause an unsettling and agitated feeling that is unpleasant and unnatural. This may create rather than ease stress.

Garden Architecture

The use of architecture in a garden emphasizes mystery, complexity, and delight. This is achieved by the contrast between the rougher textures of
the architectural structures and softer foliage which heightens the visual experience, and the shape and openness of the structures. Vertical elements such as pillars, pergolas, and arches add height, structure and enclosure to a space. Without these structures the garden would lack certain plants that climb and cling. By using these plants the vertical space of the garden becomes stimulating, interesting, and affectively pleasing.

An entry can be enhanced by these structures so that it has character and meaning. In order for the garden to be healing, garden architecture must be in harmony with the other elements in the garden. If it is viewed as a supporter for plants that naturally belongs within the garden it continues to add balance and order to the design. If it is viewed as a separate element that does not belong or add to the overall garden composition then pleasure is not created and it detracts from the harmonious theme so necessary for health.

Garden architecture also symbolizes our need to interact with nature. By placing man-made objects in the garden we imply that we want to be part of nature and establish an enduring presence in the garden.

**Garden Enclosures**

Enclosed spaces provide a feeling of security, refuge, and solitude consistent with Appleton's refuge-prospect theory (1975). These feelings may lead to increased health and immunity. According to the Kaplans enclosure increases a sense of mystery and natural elements that offer mystery are conducive to health. Mystery which arouses the mind to seek the unknown stimulates the senses. The stimulation decreases as the space is defined by natural elements (trees, shrubs, hills, and the like) that offer a feeling of familiarity, solitude and calmness. For example, a winding path that leads
around a rolling hill makes one curious to see what is behind the obstructed view. When the view is visually opened and a small space with running water, surrounded by trees that close the sky with a lush canopy, is encountered one instantaneously feels the need to explore and remain silent in that space to receive the restorative effects of nature. The curvilinear forms of the path and hill are soft and offer a low-intensity impact on the eyes. The running water is soft in sound and form and relieves any physical tension. The canopied trees that add definition to the space through form and texture offer feelings of security and repose.

Enclosures offer the garden a space for privacy which is conducive to meditation and contemplation. This is important in a healing garden because it addresses the need for solitude and retrospection which can be a facilitator of health and harmony. Enclosures can be in the form of vegetation, fences, walls, trellises, pergolas and the like. In order for them to be effective in the healing process they should stimulate the senses to produce healthy behavior. If an enclosure creates a soothing environment with textures, colors, sounds, and fragrances that are soft, pure and warm it should promote health. The use of vegetation, flowering plants and other natural elements enhances these qualities.

**Recommendations For Healing Through Sensual Garden Elements**

1. Use flowers and vegetation, water, and other garden elements to stimulate the senses with color, texture, fragrance, sound, and taste. See this chapters and Section 3.

2. Create a sense of mystery by enhancing tranquil views. This can be done by enframement, enclosure, which are discussed in Chapter XII. Make views appear tranquil and serene by enframing them with soft foliage and flowers,
as well as garden architecture covered with vegetation. Create a sense of mystery by enclosing part of a view, through hedges, walls, and the like that offers a glimpse of paradise and a seductive path to it.

3. Balance garden spaces by an ordered placement and rhythmical pattern of vegetation, and other garden elements. A sense of order and balance is found to be sensually soothing. See Chapter XIII.

4. Produce a moderate level of complexity through the use of harmonious relationships of color, form, texture, fragrance, and sounds. This will keep stimulation at a controllable level so that the user is not bored and fatigued by too little stimulation or overwhelmed and confused by too much.

5. Use trees and/or groups of trees that have a canopied affect. This produces a feeling of protection, comfort, and safety that is important to psychological health. The canopy also filters light in an ethereal manner that visually produces a feeling of spiritual unity.

6. Use a water feature that produces soft, mellifluous, sounds and movements, and is visually pleasing. Too much sound, movement or visual disturbance can cause anxiety and lead to stress.

7. Provide a small lawn area, if possible, to give a savanna-like exposure that may be conducive to health. The open space subconsciously reminds us of safety, refuge, and survival that is important for continued health.

8. Enframe this area according to guideline #2 so that tranquility can be enhanced through aesthetic pleasure.

9. Provide small garden areas that address each sense seperately so that an appreciation of that sense and a heightening of a specific
sensual pleasure may take place. For example, the client may feel relaxed through fragrances rather than color and may need a separate space to address and enhance that need.

10. Plant flowers that attract birds and butterflies, as well as providing shelters, feeders, and birdbaths. See this chapter & Chapter X.

11. Plant flowers and shrubs at different heights to add interest, visual stimulation, and a feeling of depth. See chapter...

13. Allow an area, if the client wishes, for an active participation in plant care. This enables the client to sensually bond with and become physically, emotionally and spiritually connected with the garden.

14. Include foliage of different shapes, colors, and texture that offer a moderate complexity and soft sensual stimulation. Variety offers a interest and a subtle stimulation that is conducive to health. Monotony is boring and causes anxiety because the senses do not receive enough stimulation to feel comfortable and become motivated in the pursuit of pleasure.

15. Create paths that are curvilinear in form and express a soft direct movement. This produces a visual perception of a melodic line that is soothing to most people. If paths can only be angular soften their form by adding plants and vegetation along the perimeter.

16. Provide a soft, "natural feel" path surface for gentle strolling. If a surface is found to be too harsh it may make one feel uncomfortable and anxious. For example, ground covers that are soft and crunchy feel good. Masonry, such as brick and stone are not too slick and feel solid underground. This enhances a feeling of being connected to the earth. For handicap accessibility keep path materials smooth and groove free so wheelchairs, canes, walkers, and other
ambulatory accessories do not have trouble maneuvering in the garden.

17. Produce a path system that is harmonious to the garden not contrasting. A path that blends well with a moderate degree of contrast in the garden can be interpreted as relaxing and safe. This effect can be achieved through balanced color, texture, form, and pattern.

18. Place pools of water, in areas of the garden that are lush and colorful, so that their reflection will be large and sensual. Add fish and water plants that add color, and soft movement and sounds to the water.

19. Create a soft and rhythmical sound with water. This can be in the form of cascades, ripples, and fountains. They should stimulate the senses in a moderate, balanced manner so that their effect is therapeutic.

20. Place garden architecture close to buildings to carry the garden theme forward and add a sense of connection to the area. By connecting the building to the garden sensual stimulation is constant and progressive. Also this enhances the design principle of unity. See chapter.

21. Provide vertical garden architecture to produce height, structure, and enclosure. Enhance the garden architecture with vegetation that stimulates the senses with color, fragrance, form, and texture. Use soft foliage and climbing flowers to outline the architecture and produce a contrast that appears visually stimulating. The naturalness of the flowers softens the contrast and add an aesthetic element that is soothing. Use fragrant climbers so that the fragrance will fall upon and around one as the space is experienced. According to Appleton, verticality emphasizes spirituality. The sensual essences of the space causes the senses to unite and experience this spiritual haven and produce holistic health.
22. Emphasis the entry to a healing garden by using garden architecture to outline and strengthen it, as well as add character and a sense of place. Use guideline #21 to create a sensual element in the entry space.

23. Create a private sensual enclave that enhances relaxation by using the above guidelines.

**Summary**

Preference plays a primary role in why we prefer one environment to another. Perception is the process of perceiving the environment through the senses with cognitive input. It involves environmental stimuli, sensations, cognition, and memory. Along with cognition, our emotions affect the way we perceive the environment. We also rely on our memory of past experiences so that the similarity of events can be analyzed and put into perspective. Once perception takes place, sensations and appraisals begin to categorize what we perceive into distinct selections of preference. Researchers suggest, that we prefer nature to the urban environment. Nature causes us to be less stressful and mentally fatigued. It activates our senses to produce feelings of pleasure that are important to psychological health.

Several studies (Honeyman, 1987, Kaplan & Kaplan, 1983, 1989, R. Kaplan, 1983, Ulrich, 1979, 1981, 1983) indicate the need for nature in the urban setting for continued well-being and future empirical research looks promising. The Kaplans’ and Ulrich’s theories provide interesting information on how “experiencing” the landscape can affect our health and well-being. These are important studies for landscape architects to be familiar with. Ulrich measures the physical as well as psychological impact the
designed environment has on health. The Kaplans quantify the affect of nature on mental restoration. See the bibliography for a list of their studies.

Certain features of the landscape, such as water, enclosures, and vegetation, especially flowering plants, are found to be restorative to our senses. We seem to prefer them because they activate both emotional and cognitive responses that reduce unnecessary stimulation and mental fatigue.

In order to heal the senses must be stimulated to activate hormones that keep the immune system in balance. The key to health is balance. Balance can be achieved through a harmonious relationship between the senses and the environment. The senses have the first contact with the environment and are responsible for feedback to the body-mind through sensation. So it is through the senses that our body-mind decides how our perception will be.

The garden offers the senses a myriad of delights. It gently stimulates each sense into a unified experience that causes the body to naturally relax and remain open to continual health. A garden can contribute greatly to the need to feel whole and in touch with oneself (Kaplans' theory of restoration). It can facilitate one's journey for inner peace by providing a sensual sanctuary that is conducive to the enhancement of health, harmony and inner happiness.

A healing garden that is focused on the sensual interpretation and reaction to a natural environment activates the senses by design that encourages a reduction in stress through nature. It enhances the healing process by creating a balance of physical, emotional, and spiritual behaviors.

This will allow a harmonious relationship to exist within the garden.
SECTION 3

"The path of the just is as the shining light, that shineth more and more unto the perfect day."

-Proverbs 4:18-

LIGHT AND COLOR
Introduction To Section 3

The third section of this study explores and evaluates the design elements of light and color and their relationship to nature and health. The importance of light and color (a form of light) are crucial to the continued functioning of nature. Theories linking light and color to health are explored and compared for their relevance to a natural setting. Results from this evaluation are related to garden design and a set of guidelines addressing light and color in the healing garden follows each chapter.

The landscape architect needs to be aware of the importance of light and color as a holistic element that causes the garden to exude a healing atmosphere that can have an immediate therapeutic effect on the psyche. If the landscape architect is able to capture this effect and incorporate it into garden elements (through the use of light and color) surely health can be enhanced.
CHAPTER X

A garden absorbs the light and warmth of the sun to bathe us in its healing glow that penetrates our being with a spiritual illumination.

LIGHT

According to Genesis light created the first day and then God created life. Light is so important to life that it is represented as a life force by many cultures. Light is energy emitted from the sun and reaches the earth in the form of rays. The sun’s energy was believed to be a potent healer by many ancient societies. The Greeks and Romans worshiped the sun and built healing temples to take advantage of the light rays of the spectrum. This light was used to heal several ailments, anemia, asthma, and rheumatism associated with each color of the spectrum (Anderson, 1986, Gimbel, 1991). Sunlight and the ocean’s breezes were prescribed by Aesclepius, the Greek God of medicine, as a therapy for healing. Light has always been associated with health and spirituality. Illumination reminds us of the heavens and life in the hereafter.

Healing light is light that is naturally available on a daily and seasonal basis. It is light that contains the full-spectrum white light (color) beginning with ultraviolet and ending with infra-red. Full spectrum light is present

Light, like water is a primary component in the process of life. Like water, it is a nutrient that is necessary to life. Photosynthesis can not take place without proper amounts of sun light. Plants and animals sustain life through a constant interaction and dependence on each other and Photosynthesis is part of that dependence. Plants grow in the direction of the sun and if humans, like plants, are not exposed to enough natural light they succumb to disease and vitamin deficiencies. If you spend several hours a day out of doors with moderate exposure to sunlight you will notice a feeling of energy and exhilaration. This is due to the absorption of the suns rays into the body which, like plants, are used to perform functions such as metabolism, growth, and hormone production (Ott, 1963, Liberman, 1991, Hyman, 1990).

"If Human skin is not exposed to solar radiation (direct or scattered) for long periods of time, disturbances will occur in the equilibrium of the human system. The result will be functional disorders of the nervous system and a vitamin-D deficiency, a weakening of the bodies defenses, and an aggravation of chronic diseases." (Ott, 1976:107)

Without daylight's presence animals would not produce appropriate hormones. They would become infertile and emotional stability would decrease since light activates hormones which control several body processes. Light affects the nervous system and without proper amounts of natural light mental illness can occur. Natural rhythms are controlled by light. The life cycles of most living things are affected by light through both a daily and a seasonal cycle. In fall and winter most plants become dormant when there is
less daylight and warmth, and in spring and summer most blooming takes place (Ott, 1963, Liberman, 1991, Hyman, 1993). The importance of light cannot be underestimated and landscape design should address this as a high priority in creating an outdoor space. Appropriate lighting will not only enhance and illuminate a space but assure that health will be increased.

Natural light needs to be available for hormonal function which receives its light through the retina. A recent study (Czeisler and Others, 1995) implies that certain forms of blindness do not inhibit light from entering the eyes and reaching the hypothalamus. According to this study some blind patients are able to continue functioning according to circadian rhythms (natural rhythms controlled by the sun) and suppress melatonin when exposed to light. Melatonin, a hormone secreted by the pineal gland, is responsible for keeping the body asleep at night (high levels) and awake during the day (low levels).

When the retina receives light it transfers that message to the hypothalamus via the optic nerve. The hypothalamus (controls certain behaviors associated with basic biological drives and mechanisms such as sex, hunger, temperature regulation, emotional manifestations, and endocrine production) maintains the body's natural rhythms by sending neural messages to the pineal gland to release melatonin into the blood stream. Nocturnal melatonin (high level) is blocked in individuals exposed to artificial light at night and causes a variance in the sleep-wake cycle.

According to this study, the patients whose retinohypothalamic tract (nerve pathway between the retina and hypothalamus) had been damaged by blindness, had already changed their waking and sleeping patterns in accordance with social patterning. However, their circadian rhythms were left
in tact and they responded to hormonal conditioning. If the patients decide to sleep when their melatonin is at its height they drift peacefully into sleep. If they decide to sleep when melatonin levels are low, their sleep is disturbed. When melatonin levels are not balanced according to the natural day-night cycle sleep and behavior disorders can occur. In other blind subjects, whose retinohypothalamic tract was preserved, nocturnal melatonin was induced by the introduction of bright artificial light (Moore, 1995).

"When the melatonin rhythm is out of synchrony with their sleep-wake cycle, the subjects are maladjusted and have serious sleep disturbances and other symptoms. This condition...highlights the critical role of visual information in circadian timing.” (Moore, 1995)

This study clearly indicates that light permeates our bodies and is instrumental in causing internal functioning to take place. It seems to be the eye, that is the window to the hypothalamus, which controls most hormonal activity. Eighty-five percent of sunlight permeates the retina which carries this message to the brain in the form of energy (Ceder, 1992).

If this is so, then our eyes should be visually stimulated by natural light (full-spectrum) in order to ensure a balanced functioning system. It appears to be extremely important for us to have a daily amount of natural light in our lives in order for homeostasis to occur. Natural light is the preferable choice since it contains full spectrum light and is usually available free of charge. As a society we need to spend more time out of doors receiving natural light which is so important to our health. Spending time in a garden is one way to accomplish this. The garden has the ability to have light reflect off vegetation, water, and other natural elements naturally, so that we receive this energy without being in constant direct sunlight.
Another problem associated with the lack of natural light is seasonal affective disorder (SAD). SAD is known to cause depression in some people and is due to the inadequate amount of light received in the winter months in certain areas of the world. The use of a light box that contains full spectrum light capacity usually alleviates this disorder (Ott, 1973, Liberman, 1991)

"Without this experience of daylight many people who are borderline depressive cases quickly experience a worsening of their conditions...Exclusion from this natural light can lead to a weakening or worsening of health patterns." (Gimbel, 1987:158)

Recent studies suggest that full-spectrum light directed at the eyes rather than the skin is responsible for recovery from SAD. However, more studies need to be carried out to strengthen this point (Brainard, 1992). It seems to be evident that exposure to natural daylight in the form of ocular contact is crucial to both psychological and physiological health.

Again, the eyes which control the sense of sight, seem to be an important factor in maintaining mental health. If a garden were designed to reflect natural light, would it not be effective in fighting depression? If reflective light could be enhanced in the winter by having the garden designed to take advantage of this healing source would it not be advantageous for depressed people to spend more time in a garden? I think so, and the garden designer should be aware of this. The garden should be designed so that light is constantly available to the eye. This can be done by filtering the light for a subtle effect or by reflecting light off vegetation, water and other garden objects that carry reflective properties.

Our bodies also absorb light through the skin. Light refracts off our bodies just as it does through a prism. Research suggests that these light
waves pass through our bodies and reach the cell level where it is absorbed into energy (Torrice, 1989) Apparently this research is in the early stages and falls under the category of color therapy. This study does not cover this topic. However, the following authors are suggested for an indepth review: Faber, Birren, Theo Gimbel, Mary Anderson, and Dr. Morton Walker.

Florence Nightingale, an early advocate for light and health, stressed three important criteria in her fight against disease during the mid-eighteen hundreds. They were fresh air, light, and cleanliness. In order for fresh air and cleanliness to be available, light plays a primary role. If the air is dark or appears dirty it cannot be clean. In order for Florence Nightingale’s criteria to be addressed it becomes apparent that fresh air and cleanliness cannot exist without appropriate and adequate amounts of light.

Ms. Nightingale was certainly ahead of her time when she suggested that “light is essential to both health and recovery” (Nightingale: 47) and advocated the use of direct sunlight in healing. She stressed the importance of having lots of windows in hospitals, having patient’s beds face the sun’s direction, and the need for several hours of sunlight per day. She also believed that people, like plants, were drawn to the sun and innately faced its direction. “Aspect, view and sunlight are matters of first importance to the sick...Without sunlight we degenerate body and mind.” (Nightingale: 48)

Taking Florence Nightingale’s advice by placing seating and activity areas in the direction of the sun (so that its healing properties are accessible most of the day) is an important design consideration for landscape architects to consider.

Dr. John Ott, a photobiologist, researcher, and consultant on the effect of light on health, has published several papers and books pertaining to this
subject. He was one of the first to use time-lapse photography in his experiments on plants and their reaction to light waves.

While experimenting with photosynthesis and elodea grass cells, Ott found that photosynthesis only took place in cells exposed to full spectrum light. He also noticed that behavior changes occurred as various filters were used to change the color of the light. He concluded that photosynthesis needs full spectrum light to take place and that colored light can effect behavior (Ott, 1976, Walker, 1989). Photosynthesis in plants is similar to metabolism in mammals. If full spectrum light is essential for this process, then it is surely important to have sufficient exposure to natural light on a daily basis.

Ott decided to test this theory. He experimented with pumpkin seeds and found that the fluorescent lights did not induce full growth. When he placed them under full-spectrum lighting the seeds grew into healthy pumpkins. In 1973, Ott did a study funded by the Environmental Health and Light Research Institute which involved the effect of light on first-graders in a windowless school. Standard cool white fluorescent lighting was used as the light source for the children in two classrooms while full-spectrum fluorescent lighting that mimics natural light was placed in the other two first grade classrooms. The children and teachers were monitored by hidden time-lapse cameras as they went about their daily school routine. The results were astonishing. Ott found that the children exposed to the standard fluorescent lighting showed symptoms of nervous fatigue, irritability, lapses of attention, and hyperactive behavior (Ott:203). Behavior returned to optimum functioning after a few weeks of the new lighting (full-spectrum fluorescent) and was found to be consistently better with the alleviation of nervous behavior after four months. The results of Ott’s study suggest that unnatural
light may contribute to learning disabilities and hyperactivity in school-aged children and that natural light may alleviate these conditions. (Ott, Liberman)

This study inadvertently discovered the importance of natural light in the reduction of dental caries. The children exposed to the full-spectrum lighting reported 1/3 less cavities than the children who received the cool-white fluorescent lighting (Liberman, 1991, Ott, 1973). Studies from the 1930s suggest that the number of cavities in school-aged children rises during school months as opposed to non-school months. The number of cavities rose as well in children who lived in areas where sun exposure was limited (Liberman, 1991, Ott, 1973). This seems to identify the importance of natural light in maintaining health and healthful practices. If children had adequate amounts of natural light on a daily basis it seems that several positive behaviors could be induced by this contact. A school garden could be a way to have children bring the classroom into an outdoor setting and benefit from natural light most of the year. It could be called "garden time."

Another study in 1980 done by Dr. Fritz Hollwich determined the effects of light on stress hormones. He placed some subjects under intense cool-white fluorescent lights and others under full-spectrum lighting (which mimics natural light) and recorded their hormonal responses. The subjects exposed to the intense cool-white fluorescent lights showed high levels of the stress hormones ACTH and cortisol. The other subjects showed no increase in these hormones (Liberman, 1991).

"He concluded that the degree of biological disturbance and the resulting behavioral maladaptions were directly related to the difference between the spectral composition of the artificial source and that of natural light." (Liberman, 1991:60)
Again, this clearly indicates the need for natural light in controlling stress and improving health. Daily exposure to natural light by spending time in a small garden can be a way to achieve this. Most people spend their day cooped up in an office with artificial lighting and very few exposures to natural light. No wonder we feel stressed and out of synch with ourselves and nature.

Overexposure to light can also be harmful and cause unwanted hormonal changes. Increased levels of street lighting at night have been shown to activate premature menses in girls who live in proximity to these lights. Aging is also accelerated when contact with the sun and artificial light is excessive (Gimbel, 1994). The landscape architect should try to achieve a balance in the amount and intensity of light in a garden. This balance is dependent on the designer’s knowledge of the changes in light, according to the natural rhythm of the day and the seasons. The landscape architect should place design elements and vegetation appropriately so that this balance is evident and controlled. It would also be helpful for the landscape architect to be familiar with the physical properties of light so that reflection and absorption can be properly utilized in the garden design.

**Summary**

The amount of exposure to natural light (full-spectrum) is one of the most important design elements in a healing garden. Light is synonymous with health and formats the internal functioning of the body/mind. Light establishes the natural rhythms and seasonal changes that influence the behavior of all living things. Without proper amounts of light on a daily and seasonal basis, health becomes compromised. When designing a garden
chronobiology should be emphasized so that natural healing can take place. This can be done by taking advantage of both daily and seasonal changes that occur in the outside setting.

A garden is a natural environment that can capture light and use it as a beneficial element to promote healing. Winter depression, caused from a lack of full-spectrum light, may be treated through exposure to a garden that has reflective properties. The retina absorbs 85% of the light needed to produce health. Design should be focused so that both retinal stimulation and absorption take place. This can be accomplished by adding reflective vegetation and materials that softly deflect the sun’s energy into the retina.

Facing the sun as plants naturally do is important for healing. A garden should be designed so that moderate exposure to sunlight is consistent, controlled and absorbed. If the light is too strong or too weak it will not be balanced which is an important component of health. The retina will malfunction, and cause physiological changes that are detrimental to health, if it perceives an unbalanced amount of light. Light must be filtered and shade created as necessary to achieve a harmonious relationship between light and health.

Healing light is natural light that causes the body to function in harmony. If it is available, on a daily and seasonal basis, health will be increased. A garden must be designed so that light is a primary design element and captured in a gentle way. Light can be used to control the microclimate of a space. A balanced microclimate is important to health. A warm and diffuse light should create a glowing entry that draws one in to be bathed in the healing rays of the sun. An entry that is dark and cold will not portray a healing environment. Vegetation should be placed in a
balanced, orderly manner so that light is absorbed and reflected. This causes a pattern of light, that repeats the theme, of balance and order.

The amount and direction of natural light is very important in producing a comfortable atmosphere and temperature conditions. The garden should not be too extreme in any one aspect. There must be an appropriate amount of light during the day that is conducive to healing.

**Recommendations Addressing Light and its Effects on Health**

1. Filter the light by use of deciduous trees throughout the garden as needed. This is especially important for a southern and southwesren exposure where the sun is very strong in the afternoon. This will allow proper amounts of light and shade to enter the garden during all seasons. Trees that contain dense foliage, such as maples, oaks, and lindens, would be a good choice for these exposures.

2. Use trees, shrubs, and groundcovers that absorb and reflect the sun’s rays. This encourages warmth to stay in the garden. For example, rhododendrons, vinca, and magnolias are a good choice.

3. Provide shade, and allow breezes to flow through trees that are open on the bottom, for a garden that offers a southwest exposure. In the winter, sun will be allowed to radiate and filter through the trees and add warmth.

4. Use reflective elements such as metal sculptures to project light and warmth. These reflective objects should not be extra smooth or slick because this may promote glare.

5. Use light paved surfaces to absorb warmth and reflect light. The lighter the surface the more heat is retained and reflected from the sun.

6. Filter reflective objects with vegetation to control glare. Place plants above and around these objects so that the glare is dispersed.
7. Create plant ceilings to reflect outgoing radiation at night. This also offers a feeling of security for some.

8. Place mirrors in garden structures, such as gazebos, to catch and reflect the sun. Avoid glare by using vegetation adjacent to, and in the structure. This also connects the structure to the garden.

8. Use a water feature to reflect light. Place it in a southern exposure to absorb as much light as possible. Use vegetation to control glare and heat.

9. Create a meditative space, surrounded by deciduous trees, to allow the sunlight to filter in an ethereal manner. A tree, such as the honey locust, with filigree leaves gives the impression of heavenly light.

10. Place vegetation in a meditative space so that it absorbs the sun and produces a feeling of warmth and reflection.

11. Allow an area in the garden to be open to full sun, for those who can tolerate, and wish, to take advantage of its healing rays.

12. Use flowers that have reflective properties (white is a very reflective color) in a section of the garden that offers more shade. They will absorb the light from other sources and in the evening have a considerable glow. Also smooth textured flowers absorb more light than matte textures.

13. Provide areas for shade that are easily accessible and not too confining. For example, an area a few feet away from a sunny path that is shielded by a tree's canopy is helpful.

14. Provide seating materials, such as wood, canvas, and stone that are not overly reflective. Seats must be comfortable and within a normal temperature range.

15. Do not use metal seating materials in a sunny, open space. Metal is highly reflective, and greatly retains heat. It may cause discomfort if it is used
without a protective barrier, such as a canvas cushion. In a shaded setting, it may remain cooler and be used for seating.

16. Place a hammock in a sunny spot of the garden to provide a warm relaxed atmosphere that is conducive to relaxation. Chose a shady spot with deciduous trees for those who prefer less sun. This will provide the user with a restful alternative to a stroll in the garden.

17. Place large trees, such as oaks, maples, and elms along the northwest, west, and southwest sides of buildings that border the garden. This provides shade during periods of heavy sun exposure. A balance of sun and shade creates a harmonious setting that produces well-being.

18. Use vegetation and garden architecture as a secondary light source in the garden. Plants and garden architecture with smooth, shiny surfaces reflect and absorb light easier than rough, dull surfaces.

19. Place the garden in proximity to secondary light that is bounced off of buildings to ensure that appropriate amounts of sun and shade are available to the garden. For example, light may bounce off a brick or wood building for a distance of five to ten feet. This is due to the building’s poor absorption qualities. Keep this in mind so that light absorbing vegetation can be placed at this distance. Also, a building that contains a lot of glass and metal reflects light over a larger distance. Plantings should be placed at a farther distance to catch this secondary light.
CHAPTER XI

A garden expresses its feelings with color and should be created to visually astonish us with emotion and pleasure.

COLOR

Color is such a broad topic that a major study could be devoted to the psychological affects it produces. Color as it relates to healing and the landscape is the primary focus of this chapter. The important aspects of color that affect the healing process in a garden setting will be discussed and defined. The available literature relating to color and health is very contradictory. Theories on this subject differ and few are backed by solid scientific evidence that would lend support to their credibility. Most theories are related to the psychological effects of color pertaining to objects or interior settings. This chapter begins by reviewing the historical perspective associated with color theory. It then moves on to more contemporary thoughts.

Color is light in the form of rays that we visualize in the electromagnetic spectrum. Color has been associated with healing since ancient times as it was believed that the sun was a sacred energy that greatly influenced life on earth. Early healers prescribed certain colored concoctions
(mostly herbal) as alternative treatments for illness. They believed that
disease could be diagnosed from, and associated with color (Birren, 1963

**Early Theories on Color and Health**

Sir Issac Newton (1662) is responsible for the contemporary
classification of the colors of the spectrum. He simply shone light through a
prism and classified the result as red (the longest wavelength), orange, yellow,
green, blue, indigo and violet (the shortest wavelength). Dr. S. Pancoast, a
19th Century physician, was responsible for a book *Blue and Red Light* (1877)
that explained his theory on light and healing. He believed that sunlight
could cause changes in behavior if it passed through either red or blue glass.
Red and blue were described by Dr. Pancoast as the “important therapeutic”
colors. His theory states that red stimulates the nervous system and should
be used for motivation and action results. Blue calms the nervous system
and should be used to foster tranquility (Birren, 1963, Liberman, 1991).

In 1878 Edwin Babbit, another 19th Century physician and scientist,
wrote the book *The Principles of Light and Color* in which he theorized
about the importance of color and used it as a healing therapy (color therapy).
This theory was felt to be a credible source of healing techniques using color
with both natural and artificial light for the medical profession. He used
water (a symbol for health) and the “Chromo Lens” (Liberman:69) (colored
filters) as a healing elixir. By filtering sunlight through his “Chromo Lens”
into the water he felt he was able to capture the potency of certain colors so
that the water would be a source of healing powers. Dr. Babbit described red as
a source of energy, yellow as the luminous color, and blue and violet as
soothing colors. He believed colors to be potent energy sources (blue-

Other experiments used colored lights as a source of energy for plants. H. W. Popp (1926) experimented with greenhouses that contained special glass allowing a balanced amount of colored light into each structure. When short wavelengths such as red light were blocked, growth patterns were changed. He concluded that plant growth was exceptional when long wavelengths, such as blue and violet were introduced to the greenhouses. Other experiments in the 1940s showed that red light helped long-day plants grow and that blue light helped short-day plants grow. Plants grew tallest under orange-red light and grew profuse foliage, did not flower and remained short under yellow, green and blue light. Of course all plants showed a normal, healthy growth pattern when grown under full-spectrum lights (Birren, 1950, 1963).

These early theories were carried out with little scientific testing and done mostly on plants. Colored lights, usually red and blue, were used on the surface of plants and skin as therapeutic agents. At the turn of the Century, ultraviolet light gained attention as an antibacterial instrument in fighting disease (Liberman, 1991, Walker, 1991). However, it is very unlikely that natural light would unbundle into separate light rays so that certain colors could be used therapeutically. So what is found to be remarkable for healing is simply the need for daylight.

Although different colored lights have effects on growth patterns it seems there is no substitute for the natural environment when a normal pattern of growth and development is sought. If full spectrum light is a natural remedy for plants would it not be for people as well? All these
studies confirm the need for exposure to sunlight. These theories do not indicate that significant colors are important in the healing process.

**Recent Theories on Color and Health**

Drs. R. van der Veen and G. Meijer (1959) found that plants showed the most receptivity to red and blue light for growth and remained neutral to yellow and yellow-green light. They suggest this to be the opposite reaction of the human retina to colored light since it is more sensitive to yellow and yellow-green light (Birren, 1978). By checking the wavelengths of these colors it was found that yellow and yellow-green wavelengths lie between the blue/violet (longest) and red (shortest) wavelengths. Could this implicate that their placement on the spectrum has to do with an internal balance? Are they the balancing colors of light for the human eye? If so could they play a part in balancing health and well-being? Should they be the balancing colors in a garden? Future research needs to address the effects of light rays on vision in a natural setting.

According to Gimbel (1990) red light causes focusing behind the retina and makes an object advance. Blue light causes focusing in front of the retina and makes an object recede. Green light causes a balanced focusing on the retina and equalizes the excesses of the other two colors. It makes sense then to include green in a color scheme when a balance is necessary. The greenness of vegetation seems to be a natural equalizer since it is so abundant in nature. Maybe vegetation evolved for this purpose or our eyes evolved to perceive green vegetation as a balancing element in nature?

As suggested by Dr. John Ott, color is a form of light and also causes cellular changes. These changes can affect behavior and be controlled by manipulating variables such as color. Another experiment conducted by Ott
in 1963 showed the affect of colored light filters at the cellular level. Time-
elapsed photos of elodea grass displayed the affects of colored light on their
chloroplasts (cells). When the chloroplasts were exposed to a full spectrum
(ultraviolet) light source they behaved in a programmed, orderly manner
which consisted of circular movements from one end of the cell to the other.
If this light source were interrupted their behavior would become chaotic and
they would lose their ability to move as programmed. Ott introduced
different colored light filters into their environment. When a red filter was
placed over the light source movement was out of control. When a green
filter was substituted some of their previous patterns of movement were
regained. However, the degree of movement never reached its prior level.
The greatest improvement was attributed to a blue filter. Most cells recovered
as though full-spectrum light were available. All the cells returned to normal
when ultra-violet light was reintroduced (Ott, 1986, Liberman, 1991).

"With reference to the various shortcut patterns caused by the
different colored filters, ...the red, or longest wavelengths,
caused the greatest shortcut or variation from the
pattern...Blue wavelengths made the chloroplasts go almost all the
way around the far end." (Ott:79)

Blue light seems to be responsible for maintaining appropriate
behavior at the cell level of plants. This level translates behavior to higher
levels of the organism. Blue, may be regarded as a color that has the ability to
reduce abnormal behavior in plants. It seems unlikely that a comparison of
this outcome on humans, would be similar.

Plants and humans, although they consist of similar molecules, have
different molecular structures which may cause different reactions to similar
stimuli and situations. Humans also possess cognition, which places them in
a completely different category in regard to stimuli response. Cognition gives humans the ability to be influenced by memory and experience. Culture and personality are by-products of cognition and emerge from memory and experience. Culture and personality have heavy influences on aesthetic preference. Color is an aesthetic choice. It was an evolutionary adaptation that was needed to survive and remain healthy in the world (Orians and Heerweegan, 1991). Colors may have a completely different affect on humans due to both these factors.

Several researchers feel that colors have an emotional affect on humans and can produce both physical and psychological changes in behavior. In 1937 Dr. Felix Deutsch studied the emotional reaction that color had on his patients. In order to understand their reactions to color, Dr. Deutsch placed each patient in a room that viewed a garden. Distinct hues were able to penetrate the windows by the arrangement of the panes. The interior of the room was illuminated by artificial light. The colors Dr. Deutsch used in this study were a warm (quality) red and a cool (quality) green. He had the subjects (one at a time) view the garden for up to one-half hour. Questions regarding their feelings about their exposure to light were recorded and analyzed. He concluded that color is capable of producing emotional impulses that affect the vascular system. However, according to Dr. Deutsch, this response is not specific to the color hue. Reaction to color is personal and differs from patient to patient. Color associations activate memory which brings back feelings that remind us of certain colors.

"Green may recall nature mountains, lakes. Red may recall the sunset...These superficial associations lead to deeper lying memories, which explain the affective emphasis of the attitudes toward the colors." (Deutsch in Birren, 1978:46)
Kurt Goldstein (1942), an early color researcher, suggested that color could elicit an organic response. He experimented with the affects of color on muscle tension. By directing colored light on the eye, while the subjects' arms were horizontal to the body, an increase in muscle activity would be apparent on the side where the eye was affected by light. The arms would diverge with red, and converge with green. Increased restlessness was observed in the movements effected by red light (Birren, 1963, 1978).

Goldstein feels green light alleviates erratic muscle tension and suggests that green glasses be worn to remedy this condition (Goldstein in Birren, 1978:49). Dr. Ott, is against this theory and does not support wearing sunglasses of any color. According to Ott, sunglasses block the flow of natural light to the retina and over a period of time can produce illnesses associated with light deficiency. Dr. Leiberman (1991) confirms this assumption. This is a contradictory view held by many and is typical of several views on color.

Dr. Henry Wohlfarth (1958) tested the effects of colored lights on the nervous system and found that respirations, blood pressure, and pulse were increased substantially when exposed to yellow, orange, and red, in that order. When exposed to black there was a large decrease, blue an average decrease, and green a small decrease (Leiberman, 1991).

In an experiment conducted at UCLA in 1958, for his doctoral dissertation in clinical psychology, Robert Gerard placed red, blue, and white lights onto a diffusing screen that was stabilized for brightness and spectral purity (this was considered a very inclusive and expiremental study on the subject matter at that time). Blood pressure, respirations, heartbeats, palmar sweat, muscular activity, eye blinks, and brain waves were calculated. The subjects were also questioned on their personal experience, judgment, and
feeling of color. This was a measure to control personality choice (Birren, 1963, Liberman, 1991, Walker, 1991).

Dr. Gerard’s findings showed the following:
1) The color red was found to cause agitation in anxiety prone subjects. The higher the anxiety the more severe the reaction. Blood pressure showed an elevated reading. The color blue was found to be soothing and released tension in anxiety prone subjects as blood pressure showed a diminished reading to blue.

2) The palmar sweat was instantaneous to both colors. However, it was found over time to be more prevalent to red when arousal was introduced. Brain wave activity was excited by all three colors. However, after a ten minute period the activity was more profound when the red light was displayed (both these variables usually have an activated response when introduced to most stimuli).

3) The respiratory rate was higher with the color red, and lower with the color blue. Heart rate remained the same with both colors. Eye blinking was more frequent with exposure to the red light and less frequent with exposure to the blue light (Birren, 1963, Liberman, 1991, Walker, 1991).

“In short, Dr. Gerard’s research implies that blue produces an increased sense of well-being, calmness, and pleasant thoughts for anxious people, while red causes excitement, arousal, and tension.” (Walker, 1991:49)

“Because blue lowers blood pressure it may have possibilities in treating high blood pressure. General relaxation and relief from tension experienced by the subjects suggests that blue may help to alleviate muscle spasms and, perhaps nervous twitches and tremors as well...It might further contribute to subjective relief of pain through its reported sedative action.” (Birren, 963:178)
A recent experiment conducted at The University of Texas, Galveston by Dr. Scott Hasson (1988) suggests that the colors we perceive have an affect on our energy levels. He asked fourteen subjects to view four types of stimuli for approximately ten seconds and then tightly grasp a hand for three seconds while still viewing the stimuli. This was carried out under unfiltered light, red light, blue light, and then a recovery period of six minutes in darkness. The red light showed a 13.5% gain in muscle strength. Muscle activity (electrical) was amplified by 5.8% after viewing the red light. Dr. Hasson concluded that the color red causes excitation and increased energy. However, he feels that his results are preliminary since the increase in muscle strength results was rather small. He suggests, more research needs to be done to understand the full effects of color and energy (Legwold, 1988).

If the color blue is found to illicit feelings of peacefulness and composure, would it not be the color of choice to use in a garden that is designed to reduce stress and foster well-being? If it is suggested that blue reduces high blood pressure, (a common physical reaction to stress) and has qualities of sedation (usually treated by anti-anxiety medication) in some people, might it not be used in a garden setting as a natural prescription for health and well-being? Of course it is a possible color choice for a healing garden. However, to elevate blue to a level of certainty in regard to healing criteria would be preliminary.

First of all, these experiments were done under controlled conditions in an interior environment. Not one experiment was carried out in an outdoor setting which has a mixture of colors (not just one). Interior reactions to stimuli may differ from exterior reactions. This is due to the varied and changing environmental variables present in a natural setting.
Does the color red suggest tension because it is being experienced in a closed environment which can be tension forming for some people to begin with, or because the interior environment with artificial lighting increases its intensity?

In a natural environment variables such as natural light, atmosphere, microclimate, and the like, would cause consistent variations in reactions from moment to moment. Natural light could diffuse the intensity of color so that color appears softer and less harsh. Most laboratory lighting is completely different from natural daylight. In the natural environment light and color cannot be controlled in the same manner as in a laboratory. Until further research regarding the psycho/physiological reaction to color in the natural setting is evaluated advocacy that a few colors should be preferred over others for an external healing environment cannot be concluded.

The quality of each color should be analyzed as it appears in a natural setting. This determines which of its qualities are found to be conducive to healing. The qualities of color that are found to be important determinants of health should be used in accordance with the principles of well-being in order for healing to take place. Would a harmonious rather than a contrasting color scheme reduce stress? Would the use of similar colors over and over cause boredom and monotony and eventually stress? Can contrast become balanced?

According to Gimbel (1956), when more than three colors were used in an arrangement shown to subjects it caused stimulation and anxiousness in 73% of the viewers. However, when arrangements of three colors, with one of the colors always blue, were shown it seemed to alleviate the subjects former feelings of stimulation and anxiousness. Maybe the color blue has
soothing effects on people that transfer over to other colors or becomes dominant when in a group of three colors, or neutralizes the effects of the other colors? Gimbel (1990) also suggests the use of eight colors for healing because of their rhythmical associations within the spectrum. They are: red, orange, yellow, green, turquoise, blue, violet, and magenta. I found an arrangement of flowers in a garden I was visiting to be very soothing and tranquil. Much to my surprise it contained these eight colors.

Much research suggests the reason why a color is found to be appealing has to do with culture, experience, memory and the emotional impact we associate with that color (Tuan, 1993). Color choice is personal, and usually reveals aspects of personality related to experience and cultural conditioning.

There is a universal approach to color preference that seems to be more commonly held by researchers. “Studies have shown that optical discords and harmonies tend to affect people the same way all around the world.” (Cox, 1993:34) So maybe it is these discords and harmonies that create tension and balance, not the actual color itself?

Florence Bell Robinson, a garden designer, suggests that harmony of colors is responsible for health and a thorough understanding of their relationships is critical in garden design.

“Discord of any sort disturbs the nervous system. Harmony tends to promote sanity and health...If this were more thoroughly understood, color harmonies, gardens, landscapes might serve mental and physical health as well as aesthetic and emotional feeling.” (Robinson, F.B., 1940).

It has been suggested that color may affect moods and certain colors are referred to when describing moods (green with envy, case of the blues, red with anger), (Birren, 1963, Robinson, F.B., 1940, Walker, 1991). It is a known
fact that dark colors make environments seem smaller, while light colors
make them appear larger. Pale, cool colors cause objects and settings to recede,
while vibrant, warm colors have the opposite affect. Colors that resemble
each other in character are said to be in harmony (Birren, 1978, Hobhouse,
harmony is an important element in maintaining health, and color harmony
can enhance health by being a consistent design element in the garden.

Harmony is apparent in both contrast and similarity. There are several
books on color theory and art that will explain this. According to N. H.
Robinson, color can be described according to three qualities in landscape
design, hue, value, and saturation. The hue, or color, changes according to
gradations of shade. The value or tone of a color depends on the amount of
light it carries. The saturation or chroma, a.k.a. the brightness of a color, gives
it variation. Colors can create illusions when combined. Dissimilar hue or
contrast tends to move colors away from each other while value tends to
lighten or darken distinct colors when in proximity. Because color is so
complex in nature it cannot be labeled as an absolute in landscape design

Dr. Morton Walker, a color theorist, in his book *The Power of Color*
describes color harmony in terms of four principles. They are: order,
He feels that color harmony is also an important aspect in the size and form
of an area. It can alter our perception of a site by its use in defining what the
site is meant to convey. If a garden is to convey tranquility the colors must be
harmonized so that a tranquil feeling is elicited from the design.
Penelope Hobhouse, An English Horticulturist and garden designer, describes color harmony as colors that share pigment. She suggests that colors be mixed either by contrast or harmony. According to Hobhouse, contrast can move toward harmony as pigments become shared. Hobhouse implies, if colors are only chosen for similarity they will exhibit the quality of likeness and by definition be harmonious. She states that spectral (pure) hue (color quality) used in a monochromatic scheme, may elicit an emotional response that is lasting. However, it can complicate matters by causing the eye to view this as upsetting. Monochromes lack balance and a degree of complexity. This complexity, as Berlyne (1960) suggested in his book *Curiosity and Arousal*, is tantamount to achieving balance and harmony. This is important to health.

Hobhouse also believes in the design principle of order in relation to harmony. She describes it as keeping color value within a hierarchical scheme. Color is, and needs to be, proportioned in the natural environment. Hobhouse feels this can be achieved in a garden by balancing hue and tone. F. B. Robinson suggests, that color harmonies be of one hue with graduated shades, two hues that are complementary, or three hues that allow one hue to dominate. However, she implies that the more colors used the harder it is to achieve harmony.

Electromagnetic energy released by the sun filters to the earth in the form of wavelengths (which are color) at a speed of 186,000 miles per hour (Liberman, 1991). Each color that we are capable of perceiving is unique and possesses specific qualities. The eye is capable of distinguishing the three primary colors of red, yellow, and blue and relates all other colors back to these primaries (Cox, 1993, Hobhouse, 1991:40). From these colors we get all
the colors in the landscape. For example, the sky and water are blue, the sun is yellow, vegetation is green (yellow and blue), and the earth is brown (red and green). Because of these associations we seem to gain comfort from nature.

Color changes with the light of day, which changes with the time of day. With each hour of daylight, the colors in nature take on a different palette. Morning light is soft and translucent, and usually associated with a pink and purple pastel shade. Afternoon light is vibrant and warm, and reduces glare as it highlights foliage. Evening light is crimson and glowing, as it dims the vibrant colors of day, and allows the soft blues and violets to take notice (Cox, 1993, Hobhouse, 1991). Because of this diversity in daylight it is important for the landscape architect, to work with color in the garden, as it relates to the changes in daylight. This will allow for a variety of color and enhancement of health.

Hospital environments are becoming increasingly aware of the importance of color and light in their design. Colors are being used to define how a space will function. In doing so color manipulates the users to fulfill that function. For example, nurses stations are being colored with cool colors or very reflective colors. This is to produce an interior setting that reduces tension, shadow and glare. This increases productivity as stimulation and aggression are reduced (Trent, 1994). “Those that reduce stress and tension-cool colors-can provide a comfortable, non-distracting environment.” (Trent, 1994:48)

Color has acts as a “wayfinding” tool for many Alzheimer’s patients at nursing homes. It can also be incorporated into a garden setting to help Alzheimer’s patients find their way to and from a garden during the day.
harmoniously. However, research into the effects of reds and blues in a natural setting needs to be conducted to see if the results would be similar to laboratory studies. If the results suggest a similarity then blue may be a good choice in a healing garden when release of tension from stress is a goal of the landscape architect.

Does the intensity of red, as suggested by some researchers, cause feelings of tension and anxiety as well as bring about agitation in a natural environment? When a red rosebush is viewed in the garden most people would not experience feelings of aggression or tension. On the contrary, they may express feelings of pleasure and serenity. Is it because the red roses are symbolic of love, their color is muted by the sun, or their texture is soft, or the green vegetation softens the red hue by absorbing the intensity of its light rays? Is it because other elements in the garden blend in the background to ease the tension in the eye? All these reasons are suggestions of why red in a natural setting may not be viewed as aggressive. Again, research needs to be conducted to fully understand, and answer these questions.

The following is a brief review of the most common colors found in a garden and suggestions for their use in reducing stress and promoting well-being:

**White**

White seems to create a mood of purity and innocence, and represents the wholeness of earthly and spiritual life. It is the color of illumination and is used culturally to renew life and mourn its departure. White is considered a neutral color in garden design. It is perceived by the brain as the absence of color (color is perceived as specific light rays bounce off objects into the retina). It possesses reflective properties and gives the illusion of added space
and depth. As other colors are placed beside white they seem to increase in richness and intensity, due to white’s luminescence.

Harmony, a quality that seems to help reduce stress, may be achieved by placing lighter colors next to white. Darker colors may cause a high contrast. This contrast may cause increased stimulation and if it is not balanced by the lightness of white anxiety may result. Dark colors may not be a good choice in a stress reducing color scheme. White has the ability to play down an unattractive response. When the sun sets and darkness enters the garden white adds illumination. This is because the loss of light causes the eye to rely on the rods to determine form, light and shadow. Blue and violet may be good colors to use during the evening with white. They become more luminescent and intense due to their shorter wavelengths that are conducive to setting light. Colors that show intensity during the daylight, such as reds and oranges with longer wavelengths, tend to fade in the early evening. According to Minter (1993), white holds its luminescence during twilight and appears heavenly and serene. This further sets a mood for contemplation and relaxation. If a garden is to be used for the purpose of reducing stress for a person who works during the day, white may be considered as a primary color scheme. Other luminescent colors such as blues and violets may be added. However, a suggestion for a truly inspiring experience that captures the spirituality and illumination of full spectrum light is a totally white garden.

Gray

Secondary to white, gray is a color that often accentuates the pure hues of a color. It is able to reflect all light rays in a less intense pattern than white. Because of this, it may be useful to use gray (which is primarily a color of foliage in the garden) with more intense and deep colors such as red and
yellow to soften and harmonize their affect in the garden. Remember white has the capability of intensifying colors that are placed next to it. Gray foliage may be a good choice to soften the intensity of other colors.

Also gray foliage, which appears as a gray-green, is a balancing color in the garden due to the large amount of green found in its pigment (Hobhouse, 1991). Gray foliage seems to absorb the characteristics of adjacent colors. It may darken or lighten according to the color it is nearest. It may also intensify the pure and brilliant qualities of deep colors, as well as illuminate soft colors (Hobhouse, 1991. This can create a feeling of harmony and balance if used in the garden.

**Green**

Green is the most important unifying element and color in the garden. It adds order and balance to a color scheme. Without unity, balance, and harmony cannot exist. It is the most abundant color in the garden. Most foliage, which outlines every plant and tree, contains a shade of green. According to Hobhouse, the intensity of foliage influences the harmony in the garden. If the foliage is harsh, it may take away from the softness and brilliance of most flowers and vegetation. If the foliage is harmonious, it may increase the ability of the flowers and vegetation to portray characteristics of balance and harmony that are conducive to health.

Hobhouse (1991) suggests the use of silver, white and blue-green foliage to ease the dominance of green and softens the intense affect and monotony that too much green of the same value and intensity can condone.

**Yellow**

Yellow, according to Minter (1993) used in its palest shade, offers a feeling of softness, peacefulness, and reflection. Because yellow is easily
perceived by the retina it does not create a perception of recession or advancement. It offers the eye a direct, balanced perception that holds its attention, especially when sunlight is indirect. It needs, and becomes harmonious with softer, pure foliage that it enhances with its reflective properties. Because yellow and blue innately personify the meaning of spring, which is soothing as well as invigorating to most people, it can help create a feeling of intense tranquility and closeness to nature (Hobhouse, 1991, Minter, 1993). Yellow in a soft, pure shade may be a good choice to use with blues, violets, and mauves of pure shades in a healing garden. According to Hobhouse, this builds a harmony through a subtle contrast that relies on hues and purity of each color. Harmony is a goal in the design of a healing garden and color harmony may very well bring about feelings of health.

**Blue**

Blue (consists of blue, violet, lavender, and purple) may illicit ambiguous feelings in those who perceive it in a natural setting. This, Minter implies, is due to its abundance in nature in the form of the sky and the oceans. Both the sky and ocean may be calming and stimulating for some people. The use of blue to promote healing may be best if it is used in its purest form and in several variations. Penelope Hobhouse suggests following the spectrum in a descending order so that blues carry the pigment from red to violet in their hues. This softens the impact of several blues and causes them to be harmonious with most colors. Sue Minton suggests using blue with complementary colors to ease its sedating qualities during the day. Too much blue without the contrasts of other colors may appear depressing and monotonous to some individuals (Hobhouse, 1991, Jekyll,).
According to Hobhouse, blue flowers have the capacity to extend the garden, since the coolness of blue is a receding quality, and need to be defined in a space. Otherwise they may cause the eye to continue searching a space without rest. This may cause anxiety. Blues seem to glow at dusk when filtered light enhances their luminosity. They also become luminous next to low intensity colors such as gray during the day (Hobhouse, 1991, Minter, 1993). Another option for an evening garden that may reduces stress is a predominant color scheme of soft blues and violets enhanced by white.

**Pink**

Pink, in a soft shade, is found to be a restful color that harmonizes with most colors. Many hospitals use pink as a color that refreshes and rests the mind. Prisons use pink to release agitation from prisoners. In the garden it becomes a neutral, non-threatening color that can be used as a color to greet and draw one in (Hobhouse, 1991, Minter, 1993). As a healing color it retains the warmth of red while remaining pleasant and subdued. Hobhouse implies that pinks appear luminous against gray, richer with a white or silver backdrop, and ruddy if situated among too much green. They seem to remain soft and translucent during daylight and become brighter with the approach of evening. Pink is also a good choice in a healing garden because it seems to retain its color quality both during the day and the evening.

**Red**

Red has the ability to appear as a warm, orange-red shade, and a cool, blue-red shade. This is due to the amount of yellow or blue in its pigment (Hobhouse, 1991). In order for red to appear, as well as remain vibrant, Hobhouse suggests it must be balanced by foliage that is a true green (balanced hue). Intense sunlight can cause red to appear warm, and rich which some
people find stabilizing and fulfilling. For this reason it may be a good choice for a sunny spot in the garden. Because it tends to create excitement and energy due to its vibrancy it must be used sparingly and with a large amount of green to reduce its potency (Hobhouse, 1991). This may be important in a stress reducing garden where the goal is to reduce excitement. However, it may be used more dramatically to activate the immune system to increase its healing energies. Red will appear soft and muted if a blue-red is placed with blue-green foliage and an orange-red orange is placed with deep green foliage according to Hobhouse, Jekyll and Minter.

**Orange**

Like red, orange is considered by many to be a strong color. It needs to be used harmoniously to achieve a relaxing affect. Placed next to silver or gray foliage as suggested by Gertrude Jekyll can have an immense impact on the intensity of orange by bringing about its luminesence. Turquoise-green foliage tends to soften and complement orange as well. White helps soften the glow of orange as does low light. Both orange and red loose their luster in the evening when the intensity of the sun is less (Hobhouse, 1991, Minter, 1993). They are best for day use in a healing garden where one prefers more intense colors and a more energetic feeling.

**Summary**

Harmonious color relationships seem to be the key to well-being. Certain colors such as blues, pinks, and violets have a soothing effect on some people. While red, yellow and orange may be stimulating for others. Color choice seems to be personal, and based on prior memories and experiences, as well as affectual reactions.
Color is one of the most important components of garden design. It makes the garden come alive and take on a personality of its own. Color that is conducive to healing is of primary importance in reducing stress and producing homeostasis. Most colors in a pure hue and intensity can be beneficial to healing. Harmony is an important element in maintaining health and color harmony can enhance health by being a consistent design element in the garden. Some research suggests that some colors are more therapeutic than others. Other research suggests that personality and culture direct some color choices. Most of this research has been based on psychological and quantitative analysis on subjects in interior (mostly laboratory) settings. Some of these results are considered controversial, while some seem to have merit. Confusion seems to abound in color theory. Empirical research needs to continue to validate or dispel these concepts.

Healthcare facilities have experimented with color and found certain colors to be appropriate for needs and functions in different areas. These theories do not seem to be relevant to the effects of color on health in a natural environment. Nature creates too many variables that cause changes to occur from moment to moment. The yellow of a tulip either glows, or becomes dull according to the way natural light falls upon it during the day; or other flowers or shrubs contrast or harmonize with it. The beauty and excitement of nature is that things never remain the same. Change can be pleasurable, and that is good for health. If a color is preferred by an individual or group and seems to alleviate stress than it is a color that should be pursued, by the landscape architect, in the search for health.

In designing a garden to reduce stress and promote healing the landscape architect should refer to the "Holistic Interview" for color
preferences. It does not seem to be the choice of color that produces health but the qualities of color and the harmonious relationship it produces with the other elements in the garden. Contrast should appear soft, balanced and exciting not harsh, erratic and intense.

Intensity of color should be enhanced by natural light and other pure colors. If harmony, which is a factor in maintaining health, is enhanced through color quality, then health will surely be enhanced through color in a garden. Empirical research needs to be conducted on garden color and feelings of well-being associated with color in a natural setting to verify these assumptions. Very few studies have addressed the affects of specific colors on health in a natural setting.

**Recommendations For Color Harmony In The Healing Garden**

1. All color should be used in an harmonious relationship that produces pleasure, balance, gentle stimulation and satisfaction. This can be achieved by concentrating on the color intensity and hue.

2. Use color in a gradational manner so that variations (hues) flow together rather than apart.

3. Keep subtle contrasts within pigment levels so that they appear soft, rather than sharp. This softens the impact of contrasting colors by building a harmony that relies on hues and purity of each color to form a relationship.

4. Place colors beside white when a balance is needed. White has the ability to play down an unattractive response. White increases the richness and intensity of other colors due to its luminescence.

5. Create harmonious relationships within the green family. Green is so abundant in foliage that it must be used in appropriate hues to complement the other colors rather than take away from them. The use of silver, white
and blue-green foliage, that accommodates the hues of neighboring colors, can ease the dominance of green and soften its overall affect. This helps create color harmony. An over abundance of green of the same value and intensity can create monotony and cause the eye to drag. A mix of green’s intensity assures the eye that the foliage in a garden will have depth and character. Foliage should be carefully planned in the beginning stage of a healing design and not as an afterthought. It should be used to give structure, order, and cohesiveness to the planting scheme. Otherwise, the garden appears flat and disheveled. According to Cox, If foliage harmony is planned first, and color harmony is based on the foliage, the garden will remain colorful throughout the year.

6. Yellow is a good choice for indirect sun because its hue can be perceived in low light. It enhances soft-colored foliage with its reflective properties. It uplifts moody blues and keeps a glow after dusk. An evening garden may be complemented by pure yellow, especially if it contains blues and purples. Yellow shows best if it is balanced by foliage.

7. Pinks will appear luminous against gray, richer with a white or silver backdrop, and ruddy if situated among too much green. Pink is a good choice in a healing garden because it retains its color quality both during the day and the evening. It remains a neutral garden color except when placed next to orange. This can be remedied by using white as a blender to turn the orange’s intensity into a muted shade.

8. Blue may appear relaxing if it is not limited to one shade or hue. Colors that fall within the blue family are good choices to use with yellow and white in shaded areas and evening gardens because they pick up the reflections of the translucent colors.
9. Create an evening garden for the client who is in need of stress reduction in the early evening. When the sun sets and darkness enters the garden white, will add illumination. This is because the loss of light causes the eye to rely on the rods to determine form, light and shadow. Blue and violet are good colors to use because during the evening they become more luminescent and intense due to their shorter wavelengths that are conducive to setting light. Pinks, enhanced by white and spectral yellow may also be used if a variety of color is wanted. Colors that show intensity during the daylight, such as reds and oranges with longer wavelengths, tend to fade in the early evening. Both White and lavender flowers are very fragrant in the evening and this will add to the effect.

10. Use foliage that offers a seasonal change so that green is not the dominant color in autumn. Plan to have a variety of warm oranges, reds, and yellows that harmonize during the fall. This adds warmth to the garden. As daylight shortens the healing garden(in the fall) must feel warm and cozy so that well-being is offered to its users.

11. Plan for winter color by using evergreens to fill in and contrast with the wood of deciduous trees. Choose some evergreens with berries for extra color. Choose some evergreens that carry the snow well for a full and white appearance. These trees and shrubs also reflect the light from the snow and give a bright appearance to the garden.

12. Plant vegetation that flowers in the late fall and winter for added color. For example, Sedum and Chrysanthemums carry their color into the fall.

13. Plant vegetation that flowers in winter for added color. For example, Sarcococca flowers in winter and releases its vanilla scent, Viburnum farreri has both a white flower and sweet fragrance in winter, and Prunus
‘Autumnalis’ has soft pink flowers through the winter into spring.

14. Use a varieties of colored bark so that interest is evident in the fall and winter season. Barks that have strong textures and variations in color are preferred because they contrast with the leaves of trees and shrubs, and the open skys of winter. This contrast adds a moderate to high complexity which is important in the cooler months otherwise boredom sets in and causes stress. Barks that fall into this category are the following:

Acer griseum, Betula pendula, Betula papyrifera, Prunus serrula, Acer grosseri, Arbutus andrachnoides (evening light intensifies color, good for evening garden), Myrtus luma, Cornus alba, Betula albo-sinensis septentrionalis.

15. Place the garden in proximity to the house, office, and the like so that a colorful view can be available on a seasonal basis when circumstances keep one from enjoying the setting. A view to the garden is very important, especially in the colder months when it tends not to be used as much. Winter color adds interest and makes the view inviting. On a cold and dreary day a look at evergreens, colorful barks, winter berries and flowers, all enhanced by a backdrop of snow can be stimulating, refreshing, and healthful.

16. Use vegetation that requires some care and upkeep. This requires the user to interact and come into the garden in the colder months. Mild activities such as pruning and cutting back shrubbery can get rid of the winter blahs especially if the garden is designed to be colorful in winter.
SECTION 4

"While with an eye made quiet by the power
Of harmony, and the deep power of joy,
We see into the life of things"

- William Wordsworth-

Universal Principles of Health and Design
Introduction To Section 4

The fourth of this study defines and analyzes the design principles relating to form and space that are found to be consistent natural laws for health and harmony. The results are placed into a context that addresses health in the 21st Century, through garden design. Guidelines, deduced and specifically directed to a healing garden, end each chapter.

The importance of design and its relationship to health cannot be overlooked, since it is the impetus behind a successful aesthetic solution that contributes to well-being. In reviewing these design principles it becomes very apparent that they are one and the same as the natural laws of health and harmony. They exist within each level of the universe, from the cell to the limits of outer space. They are what creates us and connects us to the wholeness of life. In the landscape they are evident through composition and they visually attract us to view the garden as a whole that creates health and harmony through a universal equilibrium.
Chapter XII

A garden is a space created by forms that are familiar, comfortable, and soothing. It helps us relate to the natural world in terms of ourselves.

Space and Form

The Concepts of Space and Form

Architecture is described by Ching (1979) as the arrangement of space through the elements of form. The Landscape is the arrangement of space through the elements of natural form. Landscape architecture is a combination of both. Space is both a two and three dimensional phenomenon that is structured by form according to characteristics of spatial organization.

Perception of Space

Perception of space is an emotional and cognitive process that causes us to experience spatial phenomena through the effect it has on the senses. According to Tuan, space represents an emotional and creative analysis of life that contains aspects of nature based on aesthetics.

"Space becomes symbolic when it intimately conjoins human and social factors with those of nature. Symbolic space is a mental artifact, necessary to the ordering of life, and so in this sense a practical venture; and yet it is also infused throughout with the aesthetic values of balance rhythm, and affect." (Tuan, 1993:172)
According to R. H. Robinson, an English landscape architect, spatial perception is a sensual experience that is detected by the tangible qualities of a space, i.e. pattern, texture, and color. These qualities give form to space as it is experienced on both a conscious and unconscious level. The concept of space is deep and complex and involves several processes. For the purpose of this study it will be related to tangible aspects of space that are found in landscape composition.

Appleton, a geographer who studies landscape preference, introduced a theory related to prospect and refuge in an environment. He suggests that our subconscious perceives the landscape in terms of survival needs and our reaction to an environment is based upon our need for safety, comfort, and pleasure. R.H. Robinson relates Appleton's theory to an innate understanding of spatial organization that causes us to accept or reject a space. He implies that Appleton's theory is extremely useful for the landscape architects because it treats design in terms of an experience rather than a space.

"We can consider, then, our perception of space as an integrated whole, a gestalt built up from a variety of received sensory information which is interpreted in the context of our biological and cultural heritage. This helps us to understand why space is not simply the gap between objects, the absence that allows us to perceive the presence, but something with an impact and meaning in its own right." (R.H. Robinson, 1992:44)

Space can be perceived as a personal part of our life experience. It imprints a universal message of experience on our psyche. Something that is unique to us yet part of a distant past that may control our present and future experiences in life. It always appears in our feelings of "deja vous" when we
express "I feel like I have been here before."

Space has the ability to illicit emotional reactions according to its functional design or purpose (Simonds in R.H. Robinson, 1992). For example, a space that is lush and sensual produces pleasure and relaxation; a space that is dreary and bleak produces nervousness and depression. R.K. Robinson argues that emotional reactions to space are multifaceted and the landscape architect needs to be aware of this in order for a design to be relevant to a space. If a garden is designed to heal, then the landscape architect should address all the emotions related to the healing process, not just relaxation. Examples would be to address pleasure, stimulation, satisfaction, inner security, fascination, and the like. As color and texture need to be varied for healthful responses so do the feelings of health and well-being.

We first perceive the world in the third dimension by innately reaching out for it through the sense of touch (Garrett, 1967). At a later period in life, Garrett, an artist, implies that we draw upon a greater knowledge to understand how space is expressed as a second dimension; a process beyond sensation is necessary to fully grasp the concept of space. According to Hubbard, an early landscape architect, the third dimension cannot be fully comprehended or appreciated until this process outlines the second dimension.

Cognitive perception of a space involves what Jackle refers to as the memory developing a "cognitive map". This map according to Jackle is the result of perceptual stages of development that address our intellectual attachment to space. He bases this assumption on the psychologist Jean Piaget's theory of spatial perception. In *The Visual Elements of Landscape* Jackle outlines Piaget's theory as the following:
Stage 1-birth to two years-perceived objects are related to space through sight and coordinated movements.

Stage 2-two to seven years-a simple understanding of the environment is grasped; concepts of objects and space are not fully understood.

Stage 3-seven to eleven years-conceptualization and transformation of spatial experiences is understood.

Stage 4- eleven plus years-abstract conceptualization of space in relation to environment is grasped.

Jackle suggests that our experiences with cognitive spatial organization is placed into a personal category that persuades our feelings of space as we experience it. We continue to rely on this method and Jackle implies that landscape perception is ruled by this interpretation of space. Hubbard, had a similar assumption years ago (1917) when he implied that spatial interpretation is based on past experiences that influence present and future perceptions. He believed that all our sensations, experiences and memories related to space resurface with each new perception of space, which continue to influence the immediate perception.

We also perceive a space according to the relationship it has with other, adjacent spaces (Booth & Zink, 1994). The form and meaning a space conveys is directly connected to its placement within a hierarchical organization of subspaces.

"Therefore, an environment comprised of several distinct interconnected spaces is not only more complex, but more interesting, more engaging, more enduring and more memorable." (Booth & Zink, 1994:3)
Spatial Organization

Spaces create well-being when they are balanced in their arrangement with other spaces and their structures are endowed with the aesthetic characteristics that produce pleasure. If there is a perception of disharmony or undue tension within a spatial pattern of organization or form it negatively affects the user.

The Chinese have a way of intentionally using space to create and convey feelings of harmony and wholeness that affect both the conscious and unconscious mind. They view space, according to Tuan, as an organization of forms that physically and symbolically relate to the five cardinal points and "the round processes of nature" which are consistent with the Chinese concept of 'yin' and 'yang'. (Tuan, 1993:174) In China the goal of garden design is to imitate landscape paintings and offer an aesthetic sanctuary that empowers the senses with pleasure and the intellect with virtue. The senses and intellect are inundated with the harmonic principles of nature and moral goodness, which Tuan writes "indicate the nature of the bond." (1993, 216)

According to Morris, an authority on Chinese horticulture, Space in the Chinese garden is treated as a series of sequential events with symbolic overtones. These spaces are usually separated by walls implicating boundaries. Due to the lack of available land in China gardens used spatial illusion to create spaciousness. Adjacent views were borrowed and incorporated into a garden scheme through the use of openings and grille work in walls. This added the illusion of mystery and open space, a concept from closed to open, dark to light, high to low, architectural to natural, watery to mountainous, the garden owner forgot that his space was small." (Morris, 1983:77)
The comparisons suggested by this quote express how the alteration of space can affect our emotions and behavior. If space is designed to sequentially alter our moods and bring us out of the darkness into the light of paradise then surely it must have a positive effect on our health.

These concepts of Chinese spatial organization are important not only for their influence on design but for their symbolism that affects the human psyche. If a garden is to produce health in its users, the landscape architect needs to analyze space for the intended emotion it is meant to convey.

The composition of a landscape can be equated to a composition in a painting. It carries the same design principles as art which are also inherent in nature (Hubbard, 1917, F. B. Robinson, 1940). A pleasing composition of both art and nature can be healthful. Hubbard implies that enclosure or enframenent give the landscape composition. It also makes it easier for the viewer to concentrate and benefit from the picture within the frame (visual perception is focused). Jackle states “For the painter the very act of representing reality inside a frame brings a degree of compositional unity.” (1987:126)

The Kaplans’ research suggests that a broad or open expanse, with a feeling of endlessness, that offers an unobstructed view allowing the element of depth to appear, is a mostly preferred space that aids in restoration. This is similar to park designs and may be one of the reasons why parks are highly preferred. According to the Kaplans, open spaces make it easier to observe the environment and are preferred for reasons of security and survival. They offer information about the environment and if it is legible and understandable a mental relaxation occurs (Kaplan & Kaplan, 1989) This reduces stress.
"Characteristically, these have relatively smooth ground texture and trees that help define the depth of the scene." (Kaplan & Kaplan, 1989:48) A space that is legible with natural elements that define its accessibility is important to well-being. The concept of "way finding" (Lynch, 1960) reduces stress by setting up mental pictures of natural elements that define our use and movement through a space. This helps ensure a feeling of comfort and security which is essential to health.

Form

Spatial organization or composition is the arrangement of forms in space. Form is the outline of an object in space; it defines the characteristics of a space. Form has the ability to open or enclose a space, create boundaries, movement, and direction in a space, as well as dominate a space. The form, or shape, of an object effects the form of other objects around it. For example, the form of a building effects the landscape around it. If its form does not relate or take on qualities of the landscape it will appear out of place and create discord. If its form melds with the landscape it produces harmony.

Forms create mass, according to F. B. Robinson, a horticulturist and landscape designer, and line is the chief determiner of form. The joining of line, mass, and form creates a composition for the landscape architect that allows third-dimensional space to exist (F. B. Robinson, 1940). Line can exist as straight, curvilinear, rectilinear, and as a combinaton of these qualities. In order for form to be aesthetically pleasing, non-threatening, and relaxing it should follow a flow that is harmonious. This is easy for the eye to perceive and follow. Stress is controlled by stable, legible, predictable movement. If the movement or flow is unpredictable, erratic, and illegible, anxiety may emerge and cause unhealthy feelings. If the edges or boundaries of a form are
too harsh or angular they may need to be softened by elements of form, such as line, texture, color, shadow, and light.

**Natural Forms**

Forms found in nature are usually very pleasing and familiar to us. For example, the sun, moon, and earth are round. Most trees have a round trunk and canopies. The form of the body is both angular and curvilinear, rocks and mountains are angular and curvilinear. However, the angularness of nature is accented by curves to round out the few sharp edges. Because we are innately comfortable with most forms of nature we seek it out for pleasure and survival (Kellert, 1993).

People seem to find natural forms such as mountains, lakes, rolling hills, groupings of vegetation, and the like to be both aesthetically pleasing and relaxing. Landscape elements such as trees, vegetation, flowers, paths, shelters, and the like, that appear natural, soft and approachable in form may offer a positive reaction to the viewer or user of a space. It is easier and less stressful for the eye to follow a smooth, flowing form, rather than an interrupted, jagged form (Carlson, 1991, Garrett, 1967).

The concept of mystery (Hubbard and Kimball in Kaplan & Kaplan, 1989) is provided by natural forms such as mountains, and groupings of trees that obscure a view. The Kaplans used this concept to enhance the cognitive process to seek out and enjoy a restorative environment.

Softness seems to illicit pleasurable memories and experiences that can be translated to similar elements in the landscape. A contrast between soft and rough forms is appreciated and visually stimulating (Tuan, 1993). This is because softness is more obvious and appears more natural when it is highlighted against a rougher surface. However, the contrast cannot be too
extreme or it may cause conflict to emerge. A sense of calmness and tranquility comes about when the complexity and intensity of textures and patterns is at a lower level (Berlyne, 1971). If forms are balanced in complexity and intensity they should appear to be less harsh and softer in quality. This appearance may illicit feelings of well-being.

A. J. Downing describes forms in nature in terms of the “Beautiful” and the “Picturesque”. The “Beautiful” is nature expressed with fluid, curvilinear lines and the “Picturesque” by discontinuous, interrupted lines. “The Beautiful is an idea of beauty calmly and harmoniously expressed; the Picturesque an idea of beauty or power strongly or irregularly expressed.” (Downing, 1921:34) A healing garden would tend to lean toward the concept of the “Beautiful” because of the connection it has with harmony. However, beauty expressed irregularly in the form of power, as Downing states, would give a sense of strength and achievement in the struggle to maintain good health. This sense could strengthen the immune system to react in an exhilarated manner that enhances immunity and creates well-being.

Downing suggests that both qualities may exist together in a landscape. A combination of the two qualities may very well cause a healing garden to be strong, interesting, and aesthetically pleasing, all characteristics of health. “This is often seen in nature; and indeed there are few landscapes of large extent where they are not harmoniously combined.” (Downing, 1921:35)

Downings’ description of form in terms of the “Beautiful” and the “Picturesque” can be compared to the Chinese concept of ‘yin’ and ‘yang’, “...the two causative principles of Chinese cosmology...” (Morris, 1983:163), which are apparent in all forms of nature. The ‘yin’ embodies the feminine aspects of life and form and the yang the opposite or masculine. The ‘yin’
expresses nature in terms of the "Beautiful" by using forms, such as ponds, and mounds, expressed in round curving shapes. The ‘yang’ uses forms such as rocks, and walls in strong, dynamic, geometric shapes to illustrate the "Picturesque".

Chinese gardens depict the connection between heaven (yang, masculine, and "Picturesque") and earth (yin, feminine, "Beautiful") as a metaphor that describes our relationship with the universe. Space is organized according to this concept. All forms in the space are treated as symbols connecting heaven and earth. For example, vertical forms such as vegetation, rocks, and garden architecture are arranged to mimic a mountainside, and forest which could be interpreted as getting closer to heaven. While ponds, and horizontal vegetative forms are placed in lower, more enclosed areas to represent a bond with the earth. According to Tuan, the placement of form in the Chinese garden is to represent a landscape painting in three dimensional form.

The symbol of the Mandala, which means circle in Sanskrit, is an ancient religious and spiritual image used by Eastern societies to express a deep relationship with the cosmos. It is commonly seen in the form of a circle in a square or as a division of four spaces within a circle. It is frequently used as a meditative device to bring the inner self in touch with the universe, the very essence of our being (Cornell, 1994, Ellis1978).

This symbol is used to reawaken psychic energies for healing and spiritual conversions that put us in touch with our souls.

“When a practitioner willfully illuminates and embodies a sacred image from within the psyche while in a meditative state, spiritual transformation, physical healing, and the integration of personality fragments can result.” (Cornell, 1994:3)
The use of this symbol in the healing garden can create a space that is used for meditation and spiritual reaffirmation. It can help us experience a space that draws upon the subconscious for a healing ritual that is personal, effective and integrative of body, mind, and spirit. It turns form into a powerful agent of health and design.

Trees limbs and shrubs can impact the landscape with dominant forms. According to Cox, limbs with strong degrees of line can add beauty, art, and structure to the garden. Shrubs with alternating forms can add interest and stability to a space. Garden architecture and water features can impact the form of a garden by adding strength, unity, and balance. These forms can exist in either the second or third dimension.

Vertical and horizontal forms bring a two-dimensional space into the third dimension. These forms can outline, separate, unify, strengthen, open, close, as well as personalize a space. They can add symbolic overtones, distinction, and emotion to a space. This is an important concept for healing. Garden enclosures that are strong vertically can transfer the feeling of strength and security to the user of the space.

Form is a very important element in a healing garden. It not only defines the space of the garden but controls the perception and behavior that is associated with the design of the garden. The Landscape architect needs to create form in a space that is conducive to the motivation of healing.

**Spatial Character**

Landscape space can be organized according to function. Form organizes the space into different structures. One of the most important organizers of a space is the form of its boundaries and edges, according to Newton, a landscape architect. “A space thus clearly bounded is felt to have
integrity, to be something in and of itself; its form and size are unambiguous.” (Newton, 1971:xxiv) Once a sense of what Newton refers to as “positive spatial character” has been maintained, the structure, according to Newton, is developed from the relationship of the parts to the landscape composition. If a garden is not designed as ordered parts of the whole that read well it may not function properly. This can create disorientation which is stressful. This relates to Appleton’s prospect-refuge theory (1975) of the innate understanding of a space which R. H. Robinson relates to our feeling about a space. Boundaries and edges need to be addressed by the landscape architect in the beginning of a design so that the form and organization of a space can function smoothly and please aesthetically.

Circulation in a space can be designed once the form and function has been defined. Like the organization of a space circulation must flow well or it becomes confusing to the viewer. Lynch (1960) implies that legibility in paths gives us the ability to find our way in a space which relieves the stress of getting lost or being disoriented.

According to Ching, an architect who has written several books on the principles of architectural design, there are two kinds of form: regular and irregular (fig. 15). Regular forms are geometric and uniform in their relationship with similar forms and they are symmetrical in relation to one or more axes. Irregular forms are variable in their relationship with other forms and provide a relationship that is asymmetrical and usually energetic. A regular form can become an irregular form by the use of subtraction or placement within an irregular structure. Both forms (fig. 15) are found in nature and both can be enclosed within the other (Ching, 1979).
Regular form is usually referred to as formal, symmetrical, or classical while irregular is usually referred to as informal, asymmetrical, or organic. They can be used to create spaces through dependent or independent associations with Ching's description of spatial organization (fig. 16). He describes them as the following:

1-**Linear**- a simple series of progressive spaces that direct movement, and implied growth. These spaces can have similar or different qualities that relate to form.

2-**Centralized**- an arrangement of sub-spaces around a key space that denotes the function and form of the whole space. These spaces can have similar or different qualities that relate to form.

3-**Clustered**- a grouping or clustering of spaces that form a relationship based on a characteristic of form that is carried throughout the space.

4-**Grid**- a structure that organizes space around a three-dimensional pattern that uses repetition as an organizing theme.

5-**Radial**- a central space that projects a linear organization through a pattern of line that suggests a circular energy.
Figure 16  Spatial Organization
These are all characteristics of spatial arrangements that can be used in landscape architecture by incorporating them into regular and irregular forms where appropriate. A hierarchy of space can also be apparent in spatial organization and is usually related to function. R.H. Robinson implies that hierarchy is an expression of form and may be 'vertical' or 'horizontal'. “The number of levels in the hierarchy will depend on the purpose and character of the spatial organization.” (R.H. Robinson, 1992:74)

A healing garden should be divided into hierarchical spaces according to function. Each space should be organized according to the spatial characteristic of its purpose. For example, the entry, personal, public, and meditative spaces should follow this order to be effective and standout as unique. The landscape architect needs to design with this concept in mind so that healing is approached from a functional as well as aesthetic viewpoint.

The transition from one space to another is a part of spatial relationships that define space through symbolism, form, dimension, and function. It is usually apparent by the use of boundaries and edges. A boundary or edge can identify the beginning and end of a space.

The entry of a space is an important design consideration for the landscape architect. It is usually the first encounter one has with the garden. If it is not strong, well organized or inviting it will not seduce an individual to experience what the garden has to offer. Russell and Ward, environmental psychologists, address this in their circumflex of emotion (1978) when they suggest that the amount of arousal a space facilitates determines whether or not to enter or avoid a space. The first and most important step in the design of a healing garden is for the landscape architect to design an entry that functions as a space that is inviting and exhibits the pleasures and healing
powers of the garden within.

Recommendations Addressing Space and Form In The Healing Garden

1. Create a spatial organization of the garden space and enhance it by the use of form. This form can be regular, irregular or a combination of the two. For example, a classical structuring of space may use regular form throughout or an irregular form within a regular form. Soften the classical forms with light, pale shades of colors and fine to medium textures in vegetation and other garden elements that can be placed within or adjacent to the regular forms. Organic forms are soft and free-flowing, of a curvilinear nature. Use these forms for a more natural design. To make them appear more dynamic place them within or next to regular forms. This is an example of using both forms to compliment each other. The goal of a healthful design is not so much the forms used in spatial organization but the appearance of and the balancing of the forms with characteristics of aesthetic design.

2. Arrange the garden spaces according to Ching’s five categories of spatial organization to help structure and define the function of space. Decide which category is relevant to a healing space in the garden. For example, a radial organization of space may be appropriate to define the energy of healing through specific plants or symbolic forms. Remember these categories of spatial organization can be used with regular or irregular forms.

3. Create interesting forms with line in the garden through the use of vegetation and garden architecture. For example, let vegetation cover parts of a brick wall so that it softens its rectilinear form (regular form) and creates an interesting line outlined by the vegetation’s irregularity (irregular form).

4. Define the function of the space by its form. A relaxing and stress reducing space appears to be legible, stable, and movement is predictable. These
qualities are caused by the relationships of form to spatial organization and relate emotionally to R.H. Robinson’s interpretation of Appleton’s theory.

5. Strengthen the form of the garden spaces through hierarchy. An organization based on hierarchical function adds strength and stability to a design. According to Ching this can be achieved by adding a degree of distinction to a form or space through size, shape, and location.

6. Use a minimum of simple forms to arrange a space and create a familiar and relaxing mood. According to Cox, two to three different forms are all that is needed to keep a garden aesthetically pleasing and relaxing. Many different shapes may cause confusion and increased complexity.

7. Place vertical and horizontal forms in the garden. This brings a third dimensional quality to the space. It helps strengthen and unify a space. It can also personalize a space for healing. For example, vertical elements can add a feeling of spirituality to a space, and horizontal elements can make one feel grounded. These are feelings necessary to health.

8. Use color, texture, and light to give the garden a three dimensional feeling. See Chapters IX, X, & XI. Form is controlled by these variables and the more they are defined the more alive the space will become.

9. Relate the garden to the building(s) around it. Use form to define the space according to how the building will interact with it. For example, if the building is older, or classical in its style, a formal or symmetrical space may be more appropriate for the garden.

10. Create boundaries and edges that are strong indicators of functional and transitional spaces. Use walls, hedges, fences, vegetation, color, light, texture, buildings and garden architecture to define both vertical and horizontal boundaries and edges. For example, walls and hedges can denote vertical
boundaries while color and texture in a ground cover can characterize a horizontal edge. This gives the spaces an identity as well as purpose. Edges and boundaries also create a spatial organization that adds pleasure and harmony to a landscape composition. One gains comfort from the structure and stability they offer.

11. Design an entry that is sensually inviting and based upon the function of the garden. As a healing space it should activate both emotional and cognitive perception of what healing qualities the space will offer. It should be a preview of the paradise that lies ahead.

12. Create circulation patterns that function with the space and define a legible pattern of movement. According to Lynch, this causes a relaxing feeling.

13. Enframe a space through vertical elements such as, hedges, walls, arches, pillars, and the like. Enframement imposes order (see Chapter XIII) and a visual focus on the garden composition. This strengthens the visual perception by placing the space within boundaries.

14. Create a spiritual space for intercession using the mandala as a healing symbol. This activates the psyche to integrate positive thought and behavior into a state of well-being. For example, use vegetation, especially colorful and fragrant flowers to form a mandala. See Judith Cornell's book *Mandala: Luminous Symbols for Healing*, for examples.
Chapter XIII

A garden should be created to place harmony in our lives through a natural ordering of the universe.

Order

Landscape Composition

In a landscape the ordered, balanced arrangement of parts create harmony. According to F. B. Robinson "Always the aim of design is harmony." (1940:77) This statement is very similar to the goal of achieving good health; to create an inner harmony. According to Hubbard the purpose of landscape architecture is to give pleasure and beauty. This can be interpreted that the landscape architect's purpose in design is to create health which comes about through aesthetic pleasure. Andrew Jackson Downing expresses his opinion on the "Beautiful" when he states "...there are certain universal and inherent beauties common to all styles, and indeed, to every composition in the fine arts. Of these, we shall especially point out those growing out of the principles of unity, harmony, and variety." (Downing, 1921:44)

Apparently these early landscape designers knew the importance of equating art with the landscape. They expressed their views about nature
very simply, in terms of art. They felt, and intuitively knew that the landscape was art and landscape design needed to adhere to the universal principles of art and design to create pleasure and beauty that translated into well-being.

"Landscape architecture is primarily a fine art,...but it is also concerned with promoting the comfort, convenience, and health of urban populations, which have scanty access to rural scenery, and urgently need to have their hurrying, workaday lives refreshed and calmed by the beautiful and reposeful sights and sounds which nature, aided by the landscape art can abundantly provide." (Elliot in Hubbard, 1917:1)

Isn't landscape composition what the Kaplans' theory of restoration is about? Aren't they equating peace of mind, or as they state restoration of "mental fatigue" with the power of pleasure derived from a landscape composition? Doesn't the "restorative experience" contain the same aspects of landscape composition except in cognitive rather than design terms? Is Roger Ulrich telling us that well-being derived from the presence of a landscape is due to its composition (various parts that create the whole) which, if arranged successfully, produces perceptual harmony? Are the Kaplans and Ulrich discussing the importance and power of nature for health and well-being, (especially in an urban setting) through compositional design terms? Is it nature itself, or the arrangement of the parts of nature into a harmonic whole that produces these outcomes? Is it the landscape or the landscape composition, created by the universal principles of art and design, that is responsible for holistic restoration? These principles seem to be one and the same as the universal laws of health and harmony.
Order

Order is the arrangement of forms that brings equilibrium to the organization of a composition. It consists of relationships among the forms, colors, and textures that form a space.

"The success of the landscape designer in producing the most beautiful landscape compositions...will depend on his skill in combining the shapes, and textures, and colors at his disposal in a pleasant and orderly fashion." (Hubbard, 1917:93)

According to Georgy Earle, a professor of landscape architecture, order is the "big organization" of spatial design which tends to govern the overall design scheme (1966:4). The structure of a space is defined by its organizing patterns that control its function, its progression, and its aesthetic appearance. Both Ching and Earle define order in terms of five principles. Some are similar some are not. Since Earle is a landscape architect it is more appropriate to discuss his principles and refer to Ching's architectural principles as it is relevant. Earle describes the five principles (fig. 17) as follows:

1. **Gross Collections**- a primitive form of order that is simple and related to organizing disorder.
2. **Classified Categories**- organizing the disorder into groupings according to characteristics that define the elements.
3. **Symmetry**- arranging elements according to a relationship that expresses a connection with the whole. This is achieved through the use of a line or axis that places elements into a bilateral (mirror image) or central division.
4. **Asymmetry**- an irregular ordering of elements into a relationship that relies on a spatial relationship that is subtlety intended and not obvious.
5. **Occult**—an unbalanced arrangement of forms that becomes ordered through a visual perception of its absurd relationship that fits within the spatial composition.

Ching implies that order is also characterized by (fig. 18):

1. **Hierarchy**—labeling a space as important and special by means of size, form, or location in relation to the other spaces around it.
2. **Rhythm/Repetition**—the recurring qualities of a spatial relationship in the form of pattern.
3. **Datum**—a continuous arrangement of forms and spaces along a horizontal element that adheres to ordered appearance.
4. **Transformation**—the changing and transforming of a spatial relationship into a strong structural organization by dispersing and retaining forms.

These principles of order can be used to make a garden design function in a harmonic fashion. Since order is a principle of spatial organization, balance, unity, and rhythm may be seen as aspects of order when used within this context. When used out of this context they can be considered as separate principles of spatial composition that define the terms of a quality or characteristic of design.

**Balance**

Balance is a state of ordered relativity that exists when a feeling or quality of equilibrium is present. In health, this unchanging dynamic of

![Balance Diagram]

Balance
Fig. 17 Earle’s Five Principles of Order
Figure 18  Ching’s Additional Principle’s of Order
neutralizing opposing energies, is responsible for the prevention of illness. In art and design, it is responsible for the visual harmony that exist within a composition. In landscape composition it relates to visual harmony, according to Hubbard, by focusing on a vertical axis. Balance elicits a perception of wholeness or completeness. If an emotional (health) or visual (design) perception of an environment is unbalanced or incomplete our health becomes effected.

"The most important psychological as well as physical influence on human perception, Dondis notes, is our need for balance. Equilibrium is our firmest and strongest visual reference, both the conscious and unconscious basis for making judgments." (Jakle, 1987:128)

A space may be balanced through an ordered display of symmetry or asymmetry. The former creates a composition of balance through the placement of equal parts; the latter creates balance through the placement of unequal parts. Most forms of nature are composed of symmetrical arrangements that may appear asymmetrical. This is evident in microscopic slides of tissue samples. "In general symmetry occurs in the internal structure of nature rather than in her large arrangements". (Earl, 1966:35) The human body has bilateral symmetry, some plants have radial and axial symmetry, and natural landscapes have asymmetry. "In nature, axial symmetry is exemplified by such images as near perfect water reflection and by many plant materials whose leaflets and fibers grow opposite each other on their stems." (Earl, 1966:35)

Equilibrium is achieved in asymmetry through a balance of weight and position. "Asymmetrical balance may be likened to the placing of unequal weights at different distances from a fulcrum, thus achieving balance."
Occult balance, is expressed through invisibility. The balance is innately perceived as the part that organizes and balances the whole. Hubbard feels this balance makes up for the variations between symmetrical and asymmetrical design. "In occult balance we feel with satisfaction the stability of the composition, but only after contemplating or consciously analyzing it do we perceive the balanced relation in which the stability consists." (Hubbard, 1917:97) This is a good form of balance to use in symbolic design.

Movement, weight, velocity, light, color, shadow, and form influence the state of balance in a composition by their intensity and placement. They can either strengthen or weaken a design. According to R. H. Robinson balanced landscapes offer a visual energy that is related to mass and height. Smaller masses of vegetation can balance larger masses according to their placement in the landscape. "Such a stable composition may include dynamic elements and exciting contrasts, but its parts are held together in a unified whole." (R. H. Robinson, 1992:106) When a rational of completeness has been attained, balance becomes evident and change ends. This is true of both health and design. A healthy body seeks out and accepts balance, a healthy garden design includes and offers balance.

The landscape architect needs to be aware of the importance of balance in a garden because it effects health at subliminal levels. Its effects begin at the level of perception. If balance is present the design will flow and "feel right".

The concept of order is an important considerations in a healing garden. The landscape architect needs to be aware of its discrete purpose which is to strengthen and integrate the elements of color, form, texture, and
scale into a healing design. If the spatial organization is weak the design will lack stability, balance and purpose. Health may be compromised due to stress produced by a visual and emotional perception of an unbalanced, monotonous, boring setting that lacks stability and order. An ordered and balanced lifestyle produces a healthy body just as an ordered and balanced garden design produces a healthy garden.

**Recommendations For Achieving Order In The Healing Garden**

1. Provide a clear, and strong edge to the design. See Chapter XII. Repeat this edge throughout the garden spaces. This gives the garden organization, legibility, and aesthetic order.

2. Provide an orderly, and strong placement of spaces. Define their place and value through hierarchy, repetition, pattern, and rhythm. If the space is small, organize and strengthen it through the use of form, color, and texture.

3. Outline and strengthen a space by using rhythm, repetition, and unity as supporters of order through vegetation and garden architecture. Use similar form, color, and texture to achieve this.

4. Use symmetry to organize a space. A classical or symmetrical order would divide the space along an axis or center point and arrange the garden forms in a mirror image relationship. This offers the user a very ordered, structured, and balanced appearance that denotes a universal harmony that is important to health. It makes one feel as though a higher power has ordered their life into a balanced existence. This is soothing for those who feel they need structure, balance and order in their lives to feel whole. However, if the order appears too rigid and defined for some, soften or reduce its "controlling feeling" by using informal arrangements of vegetation and other garden elements. Soft shades of color and fine to medium textures can compliment
the forms and help reduce the rigidity that sometimes accompanies a highly ordered space. An organic or asymmetrical order is arranged more subteley and the order, which is there, is not as apparent or obvious to the user. It is a subliminal order that produces harmony through spatial relationships that are more creatively rather than mathematically ordered. For example, asymmetry does not rely on an axis or number sequence for the placement of forms in a space; it relies on a balance created by the perceived weight and distribution of elements in a space to achieve an equilibrium.

5. Keep garden elements within a familiar framework. This cuts down on elements competing for the strength of the design, eliminates clutter, and disharmony.

6. Place vegetation in ordered masses and groups rather than alone, unless used as a focal point or sculptural element. Have it relate to other garden objects to maintain a "natural flow" and balance.

7. Use a balance of dense and diffuse plantings. This adds interest and low complexity.

8. Use a balance of contrasts in colors. This can be within the same color range by using shades of the same hue. Our eyes have adapted to be more sensitive to light and dark rather than intensity of color for survival needs. It is more important to vary the shades of color than chroma or hue to achieve a balanced effect.

9. Provide an ordered arrangement of forms in the garden that are related through color, shape, texture, and the like. For example colors may be related through value, hue or chroma, textures through degree of stimulation, and shape through weight and geometry. Vegetation and garden architecture may relate by means of the qualities attributed to color, shape, and texture. This
helps add order, balance and harmony.

10. Strengthen this relationship through number, color, shape, weight, mass, direction, size, and placement. For example a unity of three trees, that has the same qualities listed above, placed at different intervals throughout the garden adds stability, visual strength, and a sense of balance.

11. Balance the vertical and horizontal elements in the garden by following guideline 8. This gives a sense of stability and purpose.

12. Create a focal point that addresses healing, such as the “focus of tranquility”, and center it by balancing other, less forceful elements around it. Cause a convergence of these elements to the center. This adds a feeling of spiritual strength, balance and wholeness to the garden.
CHAPTER XIV

A garden that is designed for healing embodies the natural rhythms of life into a unity of the body, mind, and spirit for a full and complete restoration.

Unity

Without the concept of unity order would not be a strong or apparent element in a space. Order relies on unity to increase its potential and accomplish its mission. The concept of unity works within an ordered framework to connect the parts to the whole. It is dependent upon the formation of relationships among the parts that give strength and connection to the whole. Without these relationships unity disappears and order looses its strength and ability to hold a design together. Unity can be produced through an orderly arrangement of form, color, and texture in the garden. "The success of the landscape designer in producing the most beautiful landscape compositions ...will depend on his skill in combining the shapes and textures and colors at his disposal in a pleasant and orderly fashion." (Hubbard, 1917:93) Without this unity the landscape will not appear as a balanced and harmonious composition. It should be one of the first design consideration of the landscape architect.

"Unity or the production of a whole, is a leading principle of the highest importance, in every art of taste or design, without which no satisfactory result can be realized." (Downing, 1921:44)
Various unities may exist throughout the composition. This adds a pattern or network that strengthens the composition (Hubbard, 1917).

According to R. H. Robinson, we need unity to feel whole. It is innately understood as a motivating principle that carries us forward in our perception of the environment. It links us to the landscape composition through a sense of harmony or wholeness that is part of ourselves. Unity expresses equilibrium, a quality related to both health and design.

Unity in health expresses the bodies ability to function as a cohesive system. If a system of the body is not in accord with the other systems the body suffers. For example, if the circulatory system, which includes the heart, becomes impaired the pulmonary system (lungs) usually suffers as well. This is due to, the increase or decrease, of blood being pumped by the heart through the circulatory system. When the blood reaches the lungs, the gases it contains are at an inappropriate level for balanced functioning.

Without unity, according to Hubbard, a landscape design will not be successful nor offer pleasure to the viewer. A space must be viewed as a whole unit not as different and distinct parts that make up that unit. Jackle states “For the best composition, the parts should be organized so that the whole is seen before the parts.” (1987:125) Order places the parts within the whole, while unity forms the relationship among them.

Earle describes unity as the “spirit of the design”. It is the creative energy that keeps a design flowing and functioning at the same time. It is an abstract quality of design that emerges within and supports the principle of order.

“Without this internal unity, the design structure would lack the force of singleness of purpose of unanimity, of concensus, however well ordered
externally it might be.” (Earle, 1966:10)

According to Earle, there are seven aspects of unification (fig. 19) which he refers to as “unification processes”, that cause the visual perception of unity. They are the following:

1. **Dominance**—causes the various parts of a composition to become subservient to a single, powerful element that controls the action, meaning, and placement of all other parts. An example would be a focal point.

2. **Repetition**—similarity in appearance, function, and intent. A simple means of conforming to an unchanging standard. An example would be a Boxwood hedge.

3. **Major Contrast**—the establishment of a contrast that is overpowering in its affect on the elements in the composition. It divides the elements into two distinct entities that contrast and conflict with each other according to variables such as color, form, and texture. An example would be a row of bright red tulips behind a row of pale yellow Globeflowers. According to Earle, the contrast makes the elements seem harmonious because they are related to each other through the difference the conflict produces.

4. **Compartmentalization**—subdivides different elements into units that function as a whole. It unifies through enframing. Elements can differ in size, number, form, color, texture, and the like. An example would be a grouping of three trees, such as a Pine, a Dogwood, and a Birch that enframe a view. Although they may be dissimilar they fit into the category of tree which adds a unity to their grouping.

5. **Interconnection**—assembling a dissimilar group of elements into a relationship that functions according to proximity and physical contact that
creates a bond of unity. An example would be three different trees whose
canopies weave with one another.

6. **Spatial Tension and Balance**-causes a unity of visual perception based
pattern, sequence, and repetition. These principles create opposite feelings.
Balance is felt when there is an even distribution of elements in a space.
Spatial Tension is felt when the distribution or more specifically a pattern is is
uneven or incomplete. However, there is an expected balance that is
perceived by the viewer and this adds unity to the design.

7. **Unity of Three**-produces a psychological balancing of elements that seems
to achieve a visual unity. By placing design elements in groupings of three
throughout a space a sense of unification is achieved. Elements may be
similar, dissimilar, or have a combination of different qualities. The unity is
in the number of design elements not in their qualities.

In a landscape design unity is created by these processes to strengthen a
common theme. Unity is the placing of design elements into a cohesive
whole that reads as one integrated structure that expresses a dynamic energy.
The landscape architect needs to use unity as a consistent design principle that
creatively adds life and meaning to a healing garden by fortifying the
organization, appearance and function of its parts. This may cause a
psychological unity to exist within the garden that translates into health and
well-being for those who experience it.

Color, texture, size, number, and form may be used repetitiously to give
order and unify a space. When repetition organizes a space through interval
and recurrence it is related to the concepts of rhythm and unity. Without
repetition, and a sense of unity, as Hubbard implies, harmony is lost in a
composition. Repetition creates a physical and visual motion that continues
Figure 19 Earle's Seven Aspects of Unification
throughout a design. This motion and arrangement of design elements unifies a theme into a single entity or wholeness through a recognizable pattern.

A pattern creates unity by arranging or placing design elements to produce a legible design. The design becomes unified when organized according to the size, shape, and quality of design elements. According to F. B. Robinson, Landscape patterns may be formal or informal as found in nature. Patterns are usually linear, may be repetitious, need not be identical, may be based on mathematical formulas, may contain rhythm, and are abundant in nature. Most patterns in nature relate to a universal whole. For example, the patterns of the bronchioles in the lungs resemble the patterns of the branches of trees. Patterns that we see in nature are comfortable and soothing if they mimic the patterns we see in ourselves. Music and the natural sounds of nature can be connected to rhythmical patterns much like those of our respirations, heartbeats and brainwaves. When these patterns do not flow naturally health may suffer. Rhythm creates a a natural flow that strengthens and unifies the life force.

Rhythm

"Rhythm refers to the regular or harmonious recurrence of lines, shapes, forms, or colors." (Ching, 1979:368) It is a quality of life, and design that is necessary for the healthy functioning of every living thing. The natural rhythm’s of the earth, moon, and sun control our daily, monthly and yearly existence. Our body is in tune with the rhythms that control its processes. Our pulse, respirations, sleep and growth patterns are dictated by rhythms. When they are off-balance, illness results. If rhythm is not incorporated into a daily routine our health suffers.
“From ancestral times man has been accustomed only to organic or cosmic rhythms. More and more, mechanical rhythms are being superimposed on our living patterns, affecting our nervous system and interior rhythms, our consciousness, and our emotions. Such inflexible and monotonous rhythms can be endured only for a limited time; we need intervals of discontinuity or rest between them.” (Garrett, 1967:113)

Rhythm connects elements into a wholeness, or unity (Ching, 1979, Earl, 1966). It adds a sense of stability and strength to a composition, to our lives and to the environment. It becomes obvious through variations in quality and form. There are seven rhythmic principles (Fig. 20) that Earle describes as representative of rhythm’s intrinsic qualities. He lists them as the following:

1. **Repetition**- a sequential pattern of rhythm that unifies according to similarity.
2. **Alternation**- repeating a pattern through interruption; alternating the repeats.
3. **Inversion**- repeating a pattern in reverse to create change.
4. **Gradation**- an even continuity of combining one quality into another; from an intense quality to a muted quality or vice versa.
5. **Radiation**- radial symmetry; carries energy forward in a circular expansion.
6. **Echo**- similar to gradation. However, the gradation goes from strong to weak. It is the repeat of an image in a weaker form.
7. **Extension**- progressive repetitions that characterize movement. All other qualities of rhythm are subdued except the intense energy of movement which reads very clearly.

These properties of rhythm can help the landscape architect creatively unify a design through the energy that rhythm produces in every design
Figure 20  Earle’s Seven Principles of Rhythm
element in the garden. It may not be obvious, but there is an underlying current of rhythm in all created objects that is enhanced by aesthetic design and healthful living. It is increased by similarities and variations of shape, color, texture, and the like. "From man's smallest activities to his largest movements he sees life as one intimately complex system of rhythms." (Earle, 1966:45)

According to Earle, the need for rhythm in our lives can be explained by the benefit the body gets from a sequential harmony that places the mechanics of energy into an even paced action bringing about a natural competency. "As in the more physical muscular activities of chopping, rowing, or running the more "rhythmical" the more efficient and the less fatiguing." (1966:19) The neuromuscular system responds extremely well to rhythms. Most activities are controlled by rhythms, even thought patterns are being studied for the affect of rhythm on cognition. A preliminary university study exposed students to classical music before an exam. The students were relaxed more and their cognitive powers were sharpened. Could this be due to the rhythmic patterns that classical music is noted for?

Visual perception needs to be enhanced by rhythm in order to be pleasing. The visual stimulation of an aesthetic experience must be of a moderate intensity so that the eye does not drag and tire easily or jump and get overly excited. (Berlyne, 1960, Earle, 1966) Because repetitions cause an onward movement the eye continues to follow along and expect a harmonious continuation of what it has perceived. The eye begins to anticipate a degree of stimulation that is necessary for relaxation and continues to do so even if an interruption takes place. As long as the interruption is mellifluous relaxation continues (Earle, 1966)
Rhythm invokes vitality into all living things and causes the garden to come alive with sensations and symbols that affect one's life. By active participation one becomes energized and lured by what Earle refers to as "the seductive appeal of rhythm."

Rhythm in the garden is apparent through nature and design. Natural rhythms make us aware of the beginning and end of the day, the natural cycles of the year. "...nature's rhythms are infinitely varied in detail while, at the same time, primarily controlled by non-random patterns of a higher order." (Earl, 1966:46)

The design principle of rhythm places a physical and visual movement that is unified into the garden. It causes vegetation and other garden elements to repeat a pattern that offers unity and balance to a design. It adds a feeling of familiarity and cohesiveness to the senses that reduces stress and contributes to well-being. Rhythm in the garden helps establish a sense of purpose and gives meaning to a theme. This is what the Kaplans and Lewis refer to as the benefits of gardening. "Plants communicate universal life qualities to those who tend them, displaying rhythms different from those of the man built environment." (Lewis in Francis & Hester, 1991:248)

In a healing garden it is important to maintain a rhythmical flow so that stress does not result due to chaos in the design. The landscape architect should be aware that the garden is an important place to make rhythm an appropriate tool for lowering stress. The use of rhythm helps the landscape architect consistently place unity as an important factor in the design of a healing garden. Unification of a space and its elements is necessary for health to become a viable aspect in a design concept that reduces stress through an unconscious association with the natural laws of health and harmony.
Recommendations For Unity in the Healing Garden

1. Use dominance to suppress other garden elements and create a unity through its powerful appearance. For example, a water feature may be used as a focal point to express relaxation. All the other elements such as vegetation, and garden architecture that are in the space may carry relaxing qualities such as colors or forms that are less intense yet related to the focal point. Be careful not to let the focal point have too much control over the other garden elements or the dominance may be too intense and cause anxiousness which causes stress.

2. Repeat similar colors, forms, and textures in the garden so that a relationship exist among the design elements. This can be psychologically comforting and cause a physical relaxation in some people.

3. Use contrast to create harmony by the use of color, form, and texture. For example, use a strong color in a portion (1/3) of the design that contrasts with less intense colors the remaining 2/3 of the design. According to Earle, this ratio creates a balanced contrast.

4. Use vegetation, garden architecture, and other garden elements to enframe spaces. This adds unity by separation into a whole. Elements can differ in size, number, form, color, texture, and the like.

5. Overlap trees, garden architecture, and the like for an interconnected affect. Unity is accomplished by a visual and physical connection among the elements in a garden.

6. Create a visual perception of balance by using design elements such as vegetation in patterns that repeat in number and arrangement. By leaving intervals and alternations in a pattern of vegetation balance is anticipated and spatial tension emerges. As long as a consistent tension is perceived stress
remains low.

7. Place design elements in clusters of three. This unifies the garden, according to Earle, by psychologically conditioning the mind to find unity in concepts such as the beginning, middle, and end. There is a sense of closure to this issue which causes relaxation and avoids fixation on objects. Three trees, colors, shrubs, flowers, and the like can fit this concept. Provide at that relates to nature and design for continued heath and well-being.

8. Provide adequate light in the garden to take advantage of daily and seasonal rhythms. See chapter on light.

9. Use patterns and repetitions of similar vegetation, garden elements, color, form, and texture that flow in a sequence that is legible and consistent. The sequence must also be interesting to offer a moderate amount of complexity so that we get excited about following it. This form of rhythm is found to be harmonious by most individuals. Gradation, radiation, and inversion may be used to achieve this effect.

10. Use a sequence with alternation, consistent interruption, in vegetation, garden architecture, and the like to produce harmony in the garden. Because alternation unifies the movements of design elements through a sequence of time it provides the user(s) with an actual rhythm that can be felt as a harmonious melody.

11. Use extension in rhythm to create unity in the garden through number sequences that create change through movement. This adds a sense of security to the design elements in the garden because their sequence is expected and controllable.
12. Use Rhythm to encourage the following:

* a walk about the garden in a slow, restful movement
* a suggestion of continual visual interest and relaxation
* a sense of unity and wholeness throughout the garden
Chapter XV

A garden that is within the scale of humanness relates to our basic needs and offers us pleasures we are capable of sharing with nature.

Scale and Proportion

Humans view their world in terms of how it relates to them. This concept is termed human scale. Proportion is viewed in terms of mathematical relationships. Although proportion, tends to fall within the parameters of scale it is considered a measurable entity. Since scale is a non-absolute concept this precludes it from being the same concept as proportion. They are related yet different.

Scale

The perception of the physical environment in terms of human functioning is called anthropomorphic proportion or human scale. Early measurements such as the foot, cubit, and fathom were based on human measurements and used to build environments where humans would function in an easy and related manner. It is based on measurements that are not always accurate because human error (everyone is proportionately different) occurs due to variables such as sex and age (Ching, 1979). According to Hubbard scale relates to objects that are measured against a standard and
relative scale is measuring the size of forms in a landscape composition against the human body. For example, we relate the size of trees and shrubs in the garden to our relative size within it. According to Ching, the amount of space needed in a building depends on the bodies requirements for active and passive movement. The garden would also adhere to these same requirements since it can be considered an outdoor room.

Hubbard feels that a man’s height is the relative scale for landscape composition and design elements should be related to this scale for harmony. This is similar to Corbusier’s module, a simple frame of reference for architects to measure buildings, that possesses both humanistic and mathematical qualities (Ellis, 1978). "...he found them all about 2.20 metres high, roughly equivalent to the height of a man with upraised arms." (Ellis, 1978:165)

R. H. Robinson states that landscape scale is a ‘generic’ scale that differs from human scale because it relates objects to the space not the person(s) experiencing the space. Human scale relates to one experiencing the space.

According to R. H. Robinson landscape architects need to relate design to both human and landscape scale so that the effects of visual perception adapt to the person(s) experiencing the space.
The importance of human scale must not be overlooked by the landscape architect because it is an important factor that relates to the size and shape of the garden. The garden’s size will influence the design concept. For example, the size and arrangement of garden elements, spaces, as well as activities must be in scale. Otherwise a sense of equilibrium within the space will be disturbed. This may cause stressful reactions. When one feels out of scale with their environment confusion and anxiety result. Color, form, and texture of objects in the garden can impact scale through depth perception due to surface changes. For example, texture can change by the amount of light on its surface and this may cause a change in its form. Hubbard implies that texture and scale share a mutual relationship.

Viewing distance also effects scale. Hubbard implies that a small decrease in far objects’ size makes the objects appear farther away than they actually are; and objects can be perceived as farther away by bisecting the foreground which also increases its size. ‘Viewing scale’, as R. H. Robinson suggests, is dependent upon the distance and movement of the viewer and therefore planting scale should represent this relationship. Landscape composition must include different scales in order to fully appreciate an aesthetic perception of space (R. H. Robinson, 1992).

**Proportion**

Proportion implies that a relationship exists between the whole and its parts. This relationship is a comparative process that involves mathematics and innate visual acuity (Garrett, 1967). Ellis, a mathematical theorist, states “Ruskin too came out against finite rules of proportion. It was he said a ‘matter of feeling and experience.’” (1978:162) However, according to Ellis most architects needed to rely on a set of standards otherwise building
structure would prove to be problematic and even disastrous. This standard became the Golden Section (fig. 21), an ancient principal of aesthetic harmony (Vajda, 1989). In landscape design proportion need not be as strictly adhered to as in architecture, simply because the landscape architect is working with, for the most part, animate elements that already have an innate structure that is strengthened by the natural laws of proportion. Since Ruskin was deeply in touch with nature in the philosophy of his Arts and Crafts movement his statement makes sense in regard to proportion.

The right proportion gives a "feeling" of wholeness and harmony that is innately felt by most individuals. Nature is a master at proportion. For example, the nautilus is a dynamic structure that possesses symmetry in the form of a spiral. Its chambers exhibit a consistent change in size that is proportional. This change is a mathematical ratio known as the logarithmic spiral (fig. 21). The interior rectangle that forms the beginning of the spiral is the same proportion as the Golden Section (1:1.618 ), (Vajda, 1989). "The Golden Section is a way of dividing a segment so that the smaller part is to the greater as the greater is to the whole." (Ellis, 1978:162) It can be found in nature, architecture, music, and art. According to Rachel Fletcher, a geometer and a designer, its ratio and harmonic properties can be perceived in such ancient structures as the Great Pyramid, and the Pantheon, as well as, the natural structures of the triton shell, sunflowers, apple blossoms, and pine cones. The geometric structure of the pentagon (fig. 21) form is controlled by the Golden Section and apparent in the relationship of petal and sepal in some plants (Rachel Fletcher, 1994).

In art it is referred to as 'the divine proportion' and is apparent in artwork created by artist such as Albrecht Durer, Mondrian, and Seurat (Ellis,
Jackle implies that landscape composition was influenced by eighteenth century artists, especially Nicolas Pouissin, who based his paintings on establishing an equilibrium between vertical and horizontal landscape elements that related to the golden section. Leonardo Da Vinci studied the structures of nature to bring meaning to his art (Scheerer in Relf, 1992) Schear implies Da Vinci deduced that forms, such as the spiral were abundant in nature and he related this geometric principle to all parts of life.

According to Ellis numbers are the impetus for harmony in the world. They are apparent in nature from the simplest to the most complex forms. "We have, therefore, a direct link between a daisy and a seemingly arbitrary pattern of numbers worked out millions of years after daisies first evolved and hundreds of years before anyone studied their structure." (Ellis, 1978:145) He is referring to the Fibonacci principle in this quote.

The Fibonacci principle (fig. 21), a modern mathematical theory based on a sequential arrangement of numbers formed from previous numbers was discovered by Leonardo of Pisa (Fibonacci) in 1202 and proves that number series are not coincidental (Ellis, 1978, Vajda, 1989). The sequence is as follows: 0 1 1 2 3 5 ... (Vajda, 1989). It seems to be found predominately in nature. Most plants grow according to this sequence. The pine cone and pineapple skin is made up of spirals that rotate according to Fibonacci numbers (Ellis, 1978, Fletcher, 1994). The human body as well as several animal species, consist of these proportions. For example, the human finger joint consist of three parts. The first joint is one measurement. The second joint is the first measurement added twice, and the third joint is the sum of first and second measurement. The proportion of the human body exists according to this simple formula that defines complexity. According to Ellis nature presents us
The Golden Section

Fibonacci Numbers

Logarithmic Spiral

Pentagon

Figure 21 Proportional Structures
with formulas that produce life through relationships that mathematicians thought were purely theoretical. For example, cell division takes place according to multiplication and division, and the inner structure of body tissues relies on mathematics to emerge and constantly renew itself.

These proportional ratios follow a mathematics of harmony that is ruled by a natural law. They are responsible for the continued flow of health and harmony in all living things. A healing garden needs to be designed with this in mind. Landscape architects should follow this natural law of ratios when placing elements in a healing garden. If these mathematical sequences form our bodies, and we subconsciously relate to the world in these terms (the same proportional ratios found in our bodies), they ought to be part of a healing scheme. Gardens need to be designed for "human proportions" so that both a conscious and unconscious feeling of wholeness, and harmony exists when one experiences a healing space.

These ratios give us the feeling that we are part of the "whole" since every aspect of the universe is related to them. This sense of wholeness, or what the Kaplans describe as extent in their theory of "Restorative Environment," embodies an innate desire to be in touch with our world. As stated by the Kaplans ..."because it matches some sort of intuition of the way things ought to be, of the way things are beneath the surface layers of culture and civilization." (Kaplan & Kaplan, 1989:191)

It seems that these ratios or laws of natural proportion are responsible for the feeling of extent that is more complex than understood. Shearer, a sculptor, suggests that fractal geometry, a new form of geometry based on form not measurements, is intricately apparent in nature. She implies that we are not visually aware of it because it is present within a form and only
becomes obvious after several gross duplications.

“...The fractal content of these structures are not obvious because the object takes on a familiar form only after a large number of iterations (repetitions) of the basic fractal “building block shapes.” In order to make a fractal simulation of a mountain, depending on the level of detail, over ten million iterations may be necessary.” (Shearer in Relf, 1992:218)

This may be what “extent” is all about. Surely we are innately connected to and familiar with nature because of this concept. The reason why nature “feels right” for so many of us may be simpler than previously thought. “Contrary to the thinking earlier in this century, we can now have confidence that although nature appears random, it is in fact ordered and universal.” (Shearer in Relf, 1992:218)

Propotion is constantly changing as variables are added to an environment. This is true in both health and design. If change of any kind is not proportional it effects our health. An unproportioned design causes stress by distorting equilibrium through visual perception. Our senses perceive this as unpleasurable and our nervous system reacts in an unpleasant manner. The landscape architect should keep this in mind if health and harmony are goals in the design concept for a garden.

**Recommendations Regarding Scale and Proportion in The Healing Garden**


2. Create a series of garden spaces that flow according to the natural law of proportion using the Golden Section and the Fibonacci Number Theory ratios. For example, spaces in the garden should follow a system of ratios.
This may be as 1:2:4:8: or 3:6:9:12 or any ratio that exhibits a harmonious relationship among its parts. An example of a harmonious ratio would be found in early Greek temples where a system of proportion would be set up through ratios that connected each part to the whole. This works well in a formal (symmetrical) design. In an informal (a symmetrical) design the proportional relationships may be apparent through the use of vegetation, garden architecture, paths and other design elements that exhibit these ratios at a complex level that may only be apparent to our subconscious. The first example relates to space, the second to form.

3. Use plants, such as the apple blossom, sunflower, and daisy that symbolically show these proportional ratios. This helps strengthen the concept of health through a subconscious connection with nature.

4. Keep the feeling of "extent" alive by using the ratio formulas in guideline #3. This helps our subconscious understand our relationship to nature which produces health.

5. Keep the vertical garden elements in proportion with the horizontal garden elements for visual harmony. This gives a feeling of balanced scale to a space.

6. Maintain vegetation so that its size does not get out of scale. This will cause visual and physical disharmony.

7. Plant dwarf species of vegetation in a smaller garden if the mature forms will be out of scale with the design concept.

8. Keep plantings within a sufficient scale related to the human body. For example, do not chose vegetation that gets very large and overpowering because it is overwhelming in a small space, such as a garden. This is appropriate for office complexes and other large facilities which need a larger
dimension of landscape scale to compliment their facade. According to R.H. Robinson a smaller scale in the garden keeps pleasure constant and causes a sojourn to lengthen. This increases health because one is able to relax longer and reap the psychological benefits of landscape composition.

10. Decide on the size of certain objects by the viewing distance in the garden. Size perception relies on an objects distance from the eye. Objects appear larger if they are viewed up close and may need to be larger or smaller according to where their viewing point is in the garden. For example, if a mass of plantings will only be viewed from a distance it must be made larger so it appears within scale of the closer plantings. In a healing garden most plantings should be within walking distance so size should be a consistent issue and proportioned according to human scale.

**Summary**

The very essence of life is connected to health and design. From the cells in our body to the outer banks of the universe; design has evolved as the driving force behind the continuation of the health and survival of the world. The design principles that control the affects of aesthetic design are the same principles/laws that are responsible for the presence of health and harmony in our lives. It is amazing to think how simple this concept is, yet it has been overlooked by many in the pursuit of the perfect solution to achieving happiness.

Without adhering to these familiar and innate principles, health can not be achieved in a manner possible for emotional and spiritual growth. It is exciting to become aware of the limitless possibilities of health through design. These principles, of health and design, have been taught by the great
sages of antiquity. They have been followed by the religious and the philosophical. They have been with us since life began, they created life as it is today. By returning to these laws of nature, we as a “whole” can create a better and more balanced world. They must not only be followed for continued health and harmony, or to create designs that are healing, but as a philosophy or way of life. Then, design will be naturally healing and create a dimension for life that is all encompassing of health, harmony, and the pursuit of happiness.
SECTION 5

"It is a test of true theories not only to account for but to predict phenomena."

- William Whewell-

DESIGN RECOMMENDATIONS
CHAPTER XVI

A garden should be created to heal body, mind, and spirit through an innate relationship between the natural world and artistic design that restores harmony and well-being to the senses.

THE HEALING GARDEN

This chapter synthesizes the previous data into a set of recommendations that addresses the need for garden design that produces well-being through a harmonious relationship with the natural elements in a garden.

Reducing The Response To Stress Through Garden Design

Both Selye and Lazarus came to the conclusion that stress may have a negative impact on our health. From their theories, a conclusion may be drawn that alludes to the fact that stress needs to be reduced in order for one to become and remain healthy. A way of reducing stress, according to Dr. Benson and others, is to provide a relaxing experience which may prompt the "relaxation response" to provide a "natural high" that causes a release of tension and feelings of well-being. This can be achieved through a number of stress reduction therapies which include moderate exercise and meditation.
Gardening provides moderate exercise and a bond with nature that may cause an introspection to take place that is both personal and spiritual. The Kaplans and Lewis have discussed the many virtues of gardening and being close to nature as affective remedies to reduce psychological stress. The Kaplans, Lewis, Ulrich, Wilson and others espouse the need to be close to nature for continued well-being.

The garden is therefore recommended as one means of stress reduction. A "Healing Garden" should increase and stabilize health through the use of aesthetic design principles and the universal laws of health and harmony that form a relationship between the senses and the natural world. These precepts if followed correctly should create a garden that is truly healing. Recommendations based on the accumulated data representative of this study follow.

Recommendations For A Restorative Garden

1-Pleasurable Stimulation of The Senses

A pleasurable stimulation of the senses (fig. 22) through a balanced design of garden elements that produce interest may reduce stress and produce health. Stimulation should be in such a manner that the senses perceive the garden as:

a. providing visual interest through diversity

b. causing a balanced arousal of the senses that initiates exploratory behavior

c. creating an atmosphere of pleasure that induces relaxation

The data that has been reviewed points to a need for the senses to perceive an environment as offering pleasure for psychological and physical
health to occur. When pleasure is felt, it stimulates the body/mind into a state of arousal that is conducive to positive behaviors that produce health. According to Berlyne (1960), a certain degree of complexity is needed to stimulate exploratory behavior. A moderate complexity was found by Berlyne to reduce arousal; and if complexity increases to an intolerable level conflict emerges.

Some researchers, such as Mehrabian and Russell, the Kaplans, and Ulrich imply complexity must be interesting or pleasure may not be perceived. If a high degree of complexity is offered it should not produce stress as long as it is perceived as interesting. The Kaplans (1989), Mehrabian and Russell (1974), and Ulrich (1983) imply a rich, diverse, ordered environment has the ability to offer pleasure because of its visual interest and multiple sensory stimulation. These three aspects of interest are primary characteristics that should be consistently represented in the design elements of light, color, texture, space and form for a garden to be a healing place.

Pleasure is felt to be appropriate when a sense of balance is felt in the environment and in our lives. A balanced arousal is achieved through sensual interest which motivates our behavior to explore an environment for pleasure. Wilson determined that we innately seek pleasure from nature because it ensures our survival. Both affect and cognition, as suggested by Ulrich (1983) and the Kaplan (1989), complete a pleasurable experience. This strengthens our ability to understand why we are perceiving pleasure from the environment and adds the aspect of relaxation. This notion of interest seems to be important for many because it seems to be a faithful predictor of pleasure according to the Kaplans and Ulrich. Relaxation causes pleasure and pleasure causes healthy behavior.
2. Spatial Organization That is Ordered and Balanced

A spatial organization (fig. 22) that provides interest, order, and balance through the use of aesthetic design principles may reduce stress and produce health. Space should be organized in such a manner that the senses perceive the garden as:

a. **providing visual interest through a sense of natural order and balance**

b. **appearing legible and coherent so that a space can be understood**

c. **creating a sense of relaxation through a positive affective and cognitive evaluation of space**

The Kaplans, Berlyne, Mehrabian and Russell, as well as others, evidenced the importance and desirability of order and interest in the physical environment. Interest emerges when a space is organized according to the design principle of order. If the garden is well organized it should appear as a unified space that is legible, interesting and pleasant to the senses. If an environment is legible, as Lynch (1960) implies, it causes an emotional and cognitive understanding that produces relaxation. According to the Kaplans (1989), landscapes that are understandable allow functioning to be possible. To be able to function in a space seems to reduce psychological stress because movement and use are predictable. Legibility and predictability stimulate the cognitive process to feel restored and refreshed, according to the Kaplans, which produces a pleasurable garden experience. These two aspects were also found to be important indicators of survival by Appleton (1975) and Orians (1984).

Spatial arrangements that are ordered through unity, balance, and rhythm are usually perceived as interesting, pleasurable, and relaxing.
Interest through a rich, diverse, organization of garden elements and spaces provides pleasure. When interest stimulates the senses to perceive a setting as harmonious pleasure begins. When pleasure reaches an enhanced state that is consistent stress is reduced and health emerges.

3. Visual Evaluation Of The Environment Through Openness

An open area, defined through the balanced and ordered arrangement of garden elements, allowing a visual evaluation of the environment (fig. 22) may reduce stress and produce health. Openness should appear in such a manner that a visual perception of a space may be judged and determined as:

a. sensually stimulating, interesting, and approachable
b. legible and coherent
c. providing information to analyze the function of a space

A degree of openness seems to be a preferred quality of spatial configuration that the Kaplans found to be consistent in their studies. This openness should be within a bordered and defined area (defines and identifies the space of the garden and separates it from the rest of the landscape; if there is no definition of a space it may be visually confusing as well as psychologically uncomfortable) that allows an evaluation of the setting. By evaluating an environment we are able to understand it and make decisions regarding our functioning in it. This, as the Kaplans imply, reduces mental fatigue and psychological stress. This is an important assessment that seems to be an evolutionary component that directs preference. Both Appleton (1975) and Orians (1984) address this in their theories.

4. Enclosure That Enhances A Sense Of Mystery

An element of enclosure, that produces interest through the ordered and balanced arrangement of garden elements, creates a sense of mystery (fig.
22) that may reduce stress and produce health. Enclosure should appear in such a manner that the perception of mystery creates:

a. curiosity, interest, and anticipation of pleasure.

b. exploratory behavior

c. prediction of what lies ahead

An open view that provides information is interesting and pleasurable. If that view is enhanced by the quality of enclosure, that is abundant with sensual elements, interest and pleasure may be increased through mystery. The element of mystery is needed, according to the Kaplans, to pique interest and excite exploratory behavior that further enhances pleasure. The Kaplans discovered the sense of mystery to be highly preferred in most natural environments. This was determined by the Kaplans (1989) as an innate need to acquire more information about a space. The element of anticipated surprise seems to be the motivating factor in this analysis, according to the Kaplans. If the surprise is pleasurable it may increase the senses to have a positive response which may create well-being.

5. Enclosure That Creates A Spiritual Haven For The Senses

A garden enclosure that creates a spiritual haven for the senses (fig. 22), through the use of aesthetic design principles and garden elements, may reduce stress and produce health. Enclosures should be perceived by the senses as:

a. providing sensual interest through the use of natural garden elements

b. appearing as a special and personal space

c. creating a sense of relaxation through a gentle organization of garden elements
Gardens that offer enclosure soothe the senses by allowing for a personal haven that encourages retrospection and self-renewal. They may be considered spiritual spaces that cause healing to take place through a natural assessment of our place in the word. Vegetation and garden architecture that appear soothing through color, texture, and form offer enclosures a sense of pleasure through interest and a gentle stimulation of the senses. Mystery is also enhanced by personal enclosures. It offers a peak at what is available within the space or behind it. This according to the Kaplans encourages further exploration through curiosity, interest, and anticipation of pleasure.

6. Garden Elements That Contain Affective and Symbolic Properties

A diversity of garden elements that contain affective and symbolic properties (fig. 22) may reduce stress and produce health. Garden elements should contain characteristics that cause the senses to perceive them as interesting, pleasurable, and relaxing. Garden elements should be perceived as:

a. forms that appear familiar, comfortable and non-threatening
b. light, colors, and textures that are balanced and interesting.
c. symbolic features that innately impress our psyche as nurturing, comforting, and healing
d. restorative fragrances, light, colors, textures, fragrances, tastes, and sounds

Familiar forms that remind us of our connection with nature are found to offer comfort and security because they are an innate part of our psyche. Shearer (in Relf, 1993) alluded to this in her reference to fractal geometry; geometric forms make up the structures of most objects in the
universe. For example, the circle holds symbolic meaning for most cultures and is a form used consistently in referring to health and nature. The sun, moon, and earth are circles and are responsible for the equilibrium in life. The earth is a sacred symbol of life that is a single organism that maintains homeostasis, according to Lovelock's (1974) "Gaia Hypothesis." This maintenance of homeostasis between every organism on the earth is what produces health, according to this concept. So the Earth, being circular, has a special significance in our lives.

These forms touch us emotionally and spiritually because, as Wilson infers in his biophilia hypothesis, there may be a part of us that is genetically programmed to prefer natural elements and environments. Vegetation, according to Berlyne (1971) has a low arousal threshold because its patterns are less acute and do not initiate perceptual conflict. Wohlwill (1976) finds environments that contain large amounts of vegetation to be soothing due to a decreased complexity in their form and arrangement. Mountains, lakes, trees and other natural forms seem to have fluid curves in their outlines and often appear as soft and melodic when viewed from a distance. We visually perceive these forms as familiar, comforting and non-threatening since they seem so natural. These forms were found to be preferred by the Kaplans (1989) in their studies.

Light that is available on a seasonal basis and creates interest with light and shadow arrangements that effect color and texture seems to be preferred by the senses. Natural light stimulates the senses to feel pleasure and comfort and is healing in this form. If natural light is available through reflection in a garden it offers a physical, as well as symbolic, feeling of health. Colors that stimulate the senses through a moderate contrast of hue, shade, and intensity
create a psychological restoration. Color combinations that are harmonious and do not cause conflict are considered therapeutic. Textures that are interesting seem to stimulate the senses through variation and contrast.

The use of fragrance, sounds, and tastes that are sensually stimulating and soothing create an atmosphere of relaxation that may reduce stress by activating the nervous system to produce the "relaxation response." A restorative garden should stimulate more than one sense at a time, it should be a multi-sensual experience that causes a uniform response of well-being. Light, color, form, and texture are the most important elements in the garden that create this response.

Symbolic features that innately touch our psyche as nurturing, comforting, and healing objects are important in the restorative garden. Vegetation, especially flowering plants, water, and light (includes color, which is a form of light) may be the three most important symbolic elements in a healing garden. Without these three elements life would not exist. They innately remind us of our dependence on them for sustenance and survival in this world. When they appear balanced and available we intuitively perceive a state of health.

If these six recommendations are followed a sense of harmony may be achieved throughout the garden. Harmony is the quality responsible for holistic health and balanced aesthetic design. A "Restorative Garden" follows the universal law of harmony in both design and purpose. All relationships in the garden should be perceived as harmonious. When light, color, texture, and form are created in a garden design careful consideration should be given to the effect they may have on garden elements. When used in a harmonious relationship they enhance garden features such as vegetation,
water, and garden architecture to produce well-being through a positive sensual stimulation. These elements consistently appear in environments that are found to be interesting, relaxing, and pleasurable. When these design elements occur in a garden it becomes a restorative environment.
Figure 22 A Healing Garden
CONCLUSION

A “Healing Garden” is a place where an enhancement of health and harmony can be experienced through a physical, emotional, and spiritual bond with nature. This premise is supported by the various authors and studies cited in this study as well as the available literature related to stress, health, nature, and design.

The findings of this study seem to be consistent with several views implying that an experience with nature provides psychological well-being. However, this study has attempted to go beyond the psychological response to nature and connect it to the physical and spiritual components that make restoration a holistic experience. The landscape architect has been provided with explanations that examine the psychological and physiological aspects involved in stress, relaxation and the sensory experience. This has resulted in a set of recommendations that guides the landscape architect in producing a restorative garden design.

This study supports the available research in agreeing with the fact that pleasure should be consistent and available for well-being to emerge. A diverse amount of interesting stimuli that motivates a sensual response seems to continue to offer a pleasurable experience. Complexity itself is not enough to stimulate an organism to seek pleasure. A rich, diverse, ordered degree of complexity seems to initiate, keep, and extend a pleasurable response.
This study concludes that harmony is the most important quality that makes a garden restorative. If harmony is not present, a garden may not be capable of producing a sense of well-being. The pleasure perceived from interest may lose its ability to be effective without harmony. Harmony is a universal law of health and design; if disturbed equilibrium, suffers. The need for harmony in our lives is reflected in our search for happiness.

This determination is not profound, it is a very simple assessment of how the use of appropriate aesthetic design principles creates a balanced composition that brings about interest, pleasure, and health. Any garden that is designed according to these principles can bring health and satisfaction to those who experience it. This study has not discovered a new formula or model for a healing design. Rather, it emphasizes the need for all garden designs to follow the aesthetic design principles (which produce interest through sensual stimulation).

Design elements that positively attract and motivate the senses to seek pleasure were found by this study to be the most important features in a restorative garden. Light, color, texture, and form when used in a harmonious relationship enhance garden features such as vegetation, water, and garden architecture to produce well-being through a positive sensual stimulation. These elements consistently appear in environments that are found to be interesting, relaxing, and pleasurable. When these design elements are properly and sensitively integrated into a garden, it becomes a restorative environment.

This study concludes the following design recommendations are the most important concepts in restorative garden design:
1-A pleasurable stimulation of the senses through a balanced design of "interesting" garden elements.
2-A spatial organization that provides interest, order and balance.
3-An open area, that is defined through the arrangement of garden elements, that allows an evaluation of the environment.
4-An element of enclosure that produces interest by creating a sense of mystery.
5-A garden enclosure that uses design elements to create a spiritual haven for the senses.
6-A diversity of garden elements that contain affective and symbolic properties that become enhanced through sensual garden design to create interest, pleasure, and relaxation.
7-A harmonious relationship among light, color, texture, and form that enhances the garden elements and spaces.

If these design recommendations are followed they may produce a sense of harmony that enhances the state of well-being for those who experience the garden.

These insights verify the need for continued research on the holistic affects of restorative gardens. Empirical studies conducted in natural settings that quantify and record the physical as well as psychological responses to garden elements need to continue and become more sophisticated so that the garden becomes a highly recommended and necessary prescription for the continuation of health and well-being.

Future research directions need to address: 1) the personal aspects of health, nature and recovery 2) the emotional and innate need to be restored
by nature and how it can enhance health 3) the use of therapeutic garden
design for specific purposes, and 4) the continued assessment of natural
elements for their health-giving properties.

Associations between the garden and healing are in the beginning
stages of design study. Eventually, all created interior and exterior
environments should incorporate specific design guidelines that address the
healing process and produce wellness in their projects.

Gardens that facilitate the healing process by reducing stress through
therapeutic design should be available for everyone. This study contributes to
this notion by producing a substantial set of design guidelines that can be used
as a reference for landscape architects who want their designs to produce the
gift of health for their clients.

True healing cannot take place if it is not an innate yearning of an
individual. No one can be healed without believing in the healing process or
opening one’s heart and mind to it. If there are blocked channels of
communication between the body and mind recovery may be superficial and
healing may never be complete. A garden can never be the sole variable
responsible for holistic healing to take place. However, this study has found
that it can contribute greatly to the need to feel whole and in touch with
oneself. It can facilitate one’s journey for inner peace by providing a sensual
sanctuary that is conducive to the enhancement of health, harmony and
inner happiness.
BIBLIOGRAPHY


Booth, N. & G. Zink. "Rediscovering the Invisible Landscape: Abstract Spatial Lessons Within Historically Significant Landscapes." Faculty of The Ohio State University, Columbus, Ohio.


Zube, E.H. "Landscape Perception: Research, application and theory". 