THERAPEUTIC BENEFITS OF NATURE IMAGES ON HEALTH: Results from the Sorting Task

Ellen A. Vincent

INTRODUCTION Ph.D. CommIttee

Dina Battisto, chair, Architecture + Health

Dan Nadenicek, Planning & Landscape Architecture

Jim McCubbin, Psychology

Stephen Verderber, Architecture + Health

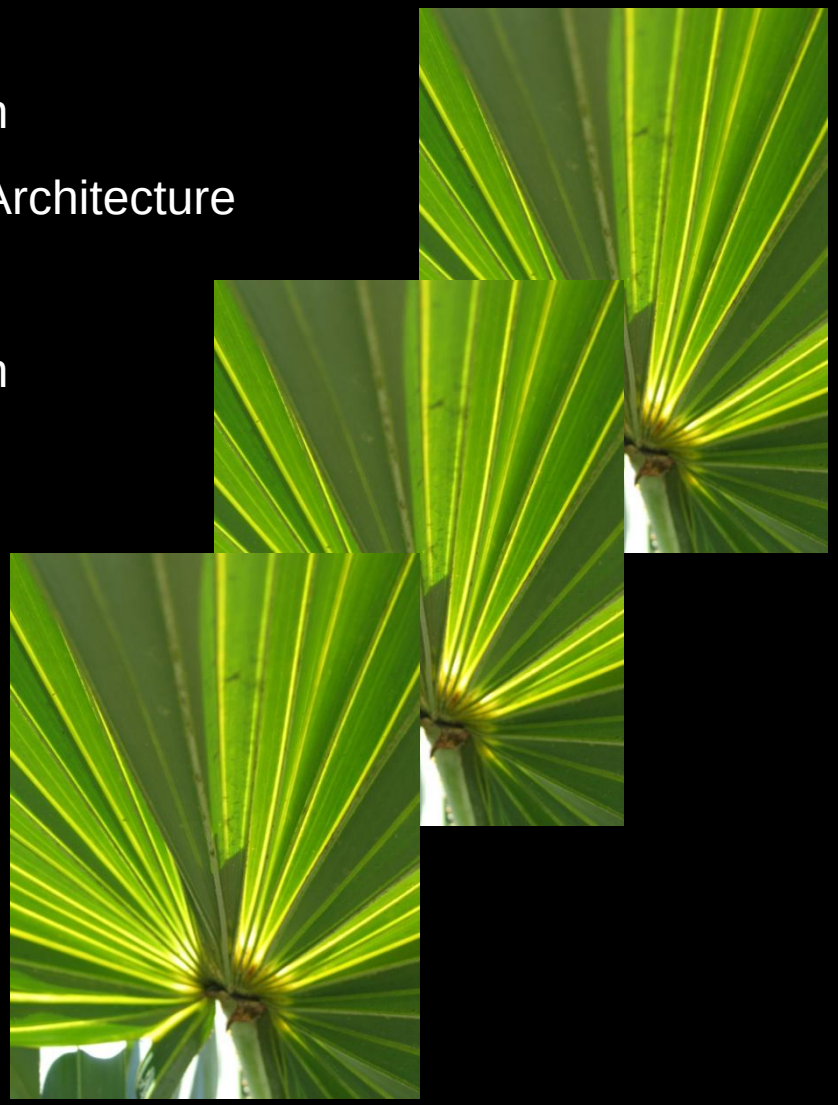
Advisors:

Larry Grimes, Experimental Statistics

Deborah Willoughby, Nursing

Sam Ingram, Graphics Communications

Portia Botchway, Nursing



INTRODUCTION: PURPOSE

Which images are most therapeutic?

While we know (intuitive and research) that nature images have therapeutic or restorative effects upon many people; we do not know which images are more therapeutic than others.

National Trust Photolibrary, England

INTRODUCTION: PURPOSE

How can we study the impact of nature images?

Establish a methodology to select images and then study how they impact physiological and psychological indicators

INTRODUCTION: PURPOSE

Nature has been shown to reduce stress and pain – thus ideal for healthcare settings.

Procedures and instruments are pre-trialed on campus using a healthy population prior to conducting the study in a hospital using a vulnerable "sick" population.

Getty images

INTRODUCTION

The Historical Healing Power of Nature

Time	People	Use	Source
300s BCE	Asclepius	Healing temples near pure water or mineral springs, pure air, and woods	http://dodd.cmcvellore.ac.in/hom/05%20-%20Temples%20Cult.html
5th century	Buddha	Obtained enlightenment sitting under a tree	Palmer 2001
13th century	Rumi	Poetry uses nature metaphors	Barks, 1997
16th century	Monks	Protected healing plants in cloistered monastery gardens	Peplow 1988, p. 26; Vincent 2008

INTRODUCTION

The Historical Healing Power of Nature

Time	People	Use	Source
19th century	British insane asylums	Located in rural areas	Gesler and Kearns 2002, p. 122
Mid 20th century	Transcendentalists Emerson, Thoreau, etc	Nature essential for health	Thoreau 1947, Bode, ed., p. 33
Mid 20th century	Olmsted	Parks were "tranquilizing and restorative"	Beveridge 1997, p. 86
21st century	Modern spas	Near water and mountains; use natural materials for interior architecture	

Photo: http://www.groveparkinn.com/Leisure/TheSpa/Massage_1/

INTRODUCTION: PROBLEM

Stress is a powerful contributor to illness

- Stress is America's primary health problem (American Institute of Stress).
- Stress is a workplace hazard (OSHA).
- Stress related ailments account for 75-90% of all physician office visits.
- Stress is linked to 6 leading causes of death-cancer, heart disease, lung ailments, accidents, cirrhosis of the liver, and suicide (Straub, 2000).
- Stress causes a chemical reaction of hormone secretions which may suppress the immune system (Rice, 1998).
- Immune suppression impairs the body's resistance to disease and infections (Rice, 1998).

… cont.

INTRODUCTION: PROBLEM

Hospitals are stressful environments

- "Hospitals today are unnecessarily stressful and dangerous places" (Craig Zimring, Robert Wood Johnson Foundation, 2004).
- Nursing has one of the highest rates of suicide (Straub, 2000).
- Hospitals face severe workforce shortages that affect patient care. Nursing shortage by 2020 is expected to reach 800,000 (*Cracks in the Foundation*, AHA, 2002).
- Norman Cousins (*Anatomy of an illness*, 1979) checked himself out of the hospital and into a hotel to improve his chances of recovery.

… cont.

INTRODUCTION: PROBLEM

Nature is often absent in the hospital setting

- Multi story hospitals may not be able to provide views to people on higher floors.
- Modernist block hospitals often are void of nature within the center where many diagnostic and treatment centers are housed (Verderber and Fine, 2000).
- Some hospitals occupy buildings with small or high windows that do not allow for views.
- Some hospitals are built in high density areas that do not provide space for landscape plantings or the view may be of another building or parking lot.
- New trends are to build hospitals that resemble the retail mall & commercial hotel and do not feature nature as a design element (Gerlach-Spriggs, 1998).

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INTRODUCTION: NATURE VIEWS

Views of nature can reduce stress and pain

- Research of nature within healthcare settings shows therapeutic benefits within acute and long term settings (Cooper-Marcus 1995, 1999; Ulrich 2004).
- Questionnaires find patients and staff prefer windows and views (Verderber, 1987).
- Physiological findings show that recovery from stress can happen in as little as 4-6 minutes with nature (Ulrich 1992).
- Views of nature helped post operative surgery patients recover faster from surgery and require less pain medication during recovery (Ulrich, 1994).
- Prisoners with access to nature views had less complaints than those who did not (Moore, 1982; West, 1985).

… cont.

INTRODUCTION: VIRTUAL NATURE

Virtual and surrogate views may be an alternative for hospitals whose design does not allow for a view of nature from the patient's room

- Nature art in a dentist's waiting room reduced anxiety among patients (Heerwagen, 1990).
- Psychiatric patients showed clear preference for nature art as opposed to abstract art in studies in Sweden (Ulrich, 1991).
- Blood donors showed lower stress levels when exposed to nature scenes on the television monitor (Ulrich, 2003).

… cont.

INTRODUCTION: PROBLEM

What theory to use in research?

Interdisciplinary research (environmental psychology, health and architecture, environmental design and planning, virtual environments, etc.) is often weak in theory (Dilani, 2006; IJsselstein, 2004).

Evolutionary theory and Appleton's Prospect Refuge Theory have a 30 year history of research use and have informed recent research (Kaplan, Ulrich, Cooper Marcus, Hartig, Kellert, IJsselstein).

THEORY INFORMING RESEARCH

The functional evolutionary view toward human/nature relationships

Prospect refuge theory of landscape preference

Jay Appleton; Judith Heerwagen & Gordon Orians

Biophilia hypothesis

E.O. Wilson; Roger Ulrich; Judith Heerwagen & Gordon Orians

Savannah gestalt

E.O. Wilson; Judith Heerwagen & Gordon Orians

Healing environments using nature

Restorative environments

Kaplan & Kaplan

Positive distractions

Roger Ulrich

Presence

W.A. Ijsselstein; Y.A.W. de Kort

… cont.

THEORY

Prospect refuge theory of landscape preference

"To see without being seen."

Jay Appleton, 1996

- Present day landscape preferences stem from our hereditary hunter-gatherer roles in the African savannah.
- Human's selection of habitats had serious life and death consequences.
- Appleton developed a descriptive functional classification for landscapes.
- Categories include "prospect"; "refuge"; and "hazard".
- "Prospect" in landscapes allows for perception of visual information.
- "Refuge" is associated with hiding, shelter, and safety.
- "Hazard" includes all the sources of danger which should be avoided (Appleton, 1990).

Getty images

… cont.

H Y P O T H E S E S

(1) Nature views are variable in their impact on specific psychological and physiological health status indicators.

(2) Prospect and refuge nature scenes are more therapeutic than hazard nature scenes.

Getty Images

RESEARCH QUESTIONS

Phase I	1. Which nature views do people prefer?
Phase II	2. Are therapeutic benefits higher for participants with surrogate nature images than for participants without nature views?
Phase II	3. Which nature image category, refuge, prospect, or prospect and refuge mixed, has the greatest overall therapeutic effects?
Phase II	4. Where is the viewer's visual attention? a. Which images have 'presence'? b. What is the participant actually looking at during treatment?

RESEARCH DESIGN & METHODS

Phase I: Select Image

Employ a “sorting task” technique to sort images into categories defined by the Appleton’s Prospect Refuge Theory.

Phase II: Test effect of image on health

Conduct a true experiment to determine if nature images effect physiological and psychological responses differently when a person is stressed

Employ mixed methods (both qualitative and quantitative) and use a sequential approach

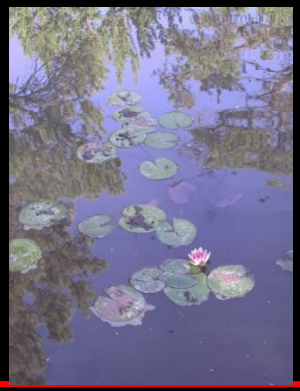
RESEARCH DESIGN

Construct	**Therapeutic benefits**
Dimensions	**Visual nature images** Kinesthetic laughter Auditory sounds of music or water Kinesthetic exposure to companion animals
Operational indicators	**Three therapeutic aspects:** (1) Relief from physical symptoms (2) Stress reduction (3) Improvement in overall sense of well-being; hopefulness *Clare Cooper Marcus and Marni Barnes (1999)*

RESEARCH DESIGN VARIABLES

Independent variables	Nature images
Dependent variables	Psychological + physiological responses






RESEARCH DESIGN PHASE I
Sequential Model for Image Selection

	A **Investigator select**	**B** **Focus groups**	**C** **Sorting task**	**D** **Content validity**
Who	Investigator	55 experts & students	100 students	Subject experts
	informal	informal	controlled	informal
What	Identify images based on theory	Identify preferred category images	Identify preferred category images	Compare findings with category definitions and characteristics
Where	Computer	Classroom	Classroom	Conference room
How	Subjective selection based on Appleton's definitions	Sorting task using "most" to "least" scale	Sorting task using "most" to "least" scale	Content validity rating "most" to "least" scale
Results	300 to 72 images	72 to 20 images (5 per category)	20 to 4 images (1 per category)	20 to 4 images (1 per category) for use in experiment

RESEARCH DESIGN PHASE II
Sequential Model for Image Effect on Health

	Phase II Experiment
Who	100 students
	controlled
What	Test effect of nature image on health
Where	Simulated in-patient hospital room
How	Psychological & physiological health data correlations with nature images
Results	Most therapeutic image(s) category

RESEARCH DESIGN CONTROL PHASE I

Issue	Control
Familiarity: an alternative explanation	Self report questions: “Where have you lived and traveled?” Analysis of co-variance
Participant reactivity	Sorting task instructions taped and hard copied
Photo reproduction	Analyze photo using grid system Calibrate projection equipment and record data Publish photo data results



RESEARCH DESIGN PHASE I (A)
Sequential Model for Image Selection

	A Investigator select	B Focus groups	C Sorting task	D Content validity
Who	Investigator	55 experts & students	100 students	Subject experts
	informal	informal	controlled	informal
What	Identify images based on theory	Identify preferred category images	Identify preferred category images	Compare findings with category definitions and characteristics
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RESEARCH DESIGN PHASE I(A)

Research shows photographs are good surrogates for real views

Use of photographic images of nature "were surprisingly similar to what to what they are in the real setting itself" (Kaplan & Kaplan, 1989).

No difference in participants' response to using black & white or color images (Ibid).

Ample evidence exists to suggest that photos represent environments well enough to elicit evaluations and judgments (Stamps, 1990; Hartig and Staats 2006).

Realistic images: experiential (deKort,2006, p. 6) and visual (Ulrich, 2003) most therapeutic.

RESEARCH DESIGN PHASE I(A)

Image selection criteria

Horizontal orientation
Color
Limited reference to animals, structures, equipment
Dominant nature over built features
No distinguishable people
No national, international landmark places
Limited number of variables
Clear category operational definitions (Appleton's words)
Use royalty free Getty Images and own images (for replication)

Photos by Ellen Vincent

Investigator top selections

Prospect # 59

Refuge # 20

Getty Images photos

RESEARCH DESIGN PHASE I (B)
Sequential Model for Image Selection

	A Investigator select	B Focus groups	C Sorting task	D Content validity
Who	Investigator	55 experts & students	100 students	Subject experts
	informal	informal	controlled	informal
What	Identify images based on theory	Identify preferred category images	Identify preferred category images	Compare findings with category definitions and characteristics
Where	Computer	Classroom	Classroom	Conference room
How	Subjective selection based on Appleton's definitions	Sorting task using "most" to "least" scale	Sorting task using "most" to "least" scale	Content validity rating "most" to "least" scale
Results	300 to 72 images	72 to 20 images (5 per category)	20 to 4 images (1 per category)	20 to 4 images (1 per category)

RESEARCH DESIGN PHASE I(B)
Focus group detail

Research question #1	**Which nature views do people prefer?**
Who	Experts (23) & students (32) = (55)
What	Sort photos into four categories; Rank from “most to least” fit for each category Record selection on score sheet
Materials	72 images Instruction sheet Image category operational definition chart Score sheet
Data analysis	Frequency table for each photo to establish “most fit” for each category
Results	5 highest rated photographs for each category retained for next stage 20 images total (5 per category)

RESEARCH DESIGN PHASE I(B)
PROSPECT Focus group results

	All Faculty Grad+ Under	Faculty	Grad + Under	Under
Image #	51	01	51	51
	69	72	69	52
	52	69	52	69
	72	52	37	37
	37	51	72	72

Similar selections among groups

R E S E A R C H D E S I G N P H A S E I (B)

R E F U G E Focus group results

	All Faculty Grad+ Under	Faculty	Grad + Under	Under
Image #	25	34	25	25
	45	45	45	45
	56	66	56	56
	34	56	6	34
	6	25	34	49

Similar selections among groups

RESEARCH DESIGN PHASE I(B)

HAZARD Focus group results

	All Faculty Grad+ Under	Faculty	Grad + Under	Under
Image #	38	38	38	38
	35	58	33	33
	28	35	35	35
	33	28	28	28
	58	08	58	46

Similar selections among groups

RESEARCH DESIGN PHASE I(B)

Sequential Model for Image Selection

Grad + Undergrad selections chosen for next stage (C) because that group most closely resembles the intended experimental population.

Mixed	All Faculty Grad+ Under	Faculty	Grad + Under	Under
Image #	16	16	16	63
	63	41	41	16
	41	63	63	41
	15	15	15	47
	40	40	40	18

RESEARCH DESIGN PHASE 1 (C)
Sequential Model for Image Selection

	A Investigator select	B Focus groups	C Sorting task	D Content validity
Who	Investigator	55 experts & students	100 students	Subject experts
	informal	informal	controlled	informal
What	Identify images based on theory	Identify preferred category images	Identify preferred category images	Compare findings with category definitions and characteristics
Where	Computer	Classroom	Classroom	Conference room
How	Subjective selection based on Appleton's definitions	Sorting task using "most" to "least" scale	Sorting task using "most" to "least" scale	Content validity rating "most" to "least" scale
Results	300 to 72 images	72 to 20 images (5 per category)	20 to 4 images (1 per category)	20 to 4 images (1 per category)

RESEARCH DESIGN PHASE I(C)
Category sorting task detail

Sorting Task Participant Procedures	Time (minutes)
Read and sign consent form	2
Complete pencil and paper pre-test survey	5
Receive taped orientation describing four image categories (prospect, refuge, hazard, and prospect and refuge equally mixed)	10
Sort 20 photographic images into the four specified categories	5-15
Sort images within each category from “most” to “least”	5-15
Record image selections on the score sheet	3
Receive thank you and $10.00 remuneration	2
Total	32-52

RESEARCH DESIGN PHASE 1 (C)
Category sorting task detail

Research question #1	**Which nature views do people prefer?**	
Who	Students (100)	
Materials	20 images Consent form Pre-sort surveys Taped audio instructions Instruction sheet Image category operational definition chart Score sheet	
What	Complete consent form & surveys Listen to taped instructions; review category definitions Sort photos into four categories; Rank from “most to least”; Record selection on score sheet	
Data analysis	Frequency table for each photo to establish “most fit”	
Results	The highest rated photograph for each category retained for next stage; 4 images total (1 per category)	

PHASE I SORTING TASK IMAGES (C)

SORTING TASK EXPERIENCE PRATO

Now its your turn to select the image that best fits the category:

Prospect
Refuge
Hazard
Prospect + Refuge mixed

1: Receive a short orientation.
2. Select the image that best fits the category as you understand it.
3. Compare your selection with the students (C) and the subject expert committee (D).

… cont.

OPERATIONAL DEFINITION

PROSPECT

An environmental condition, situation, object, or arrangement that presents real or symbolic access to a view.

… cont.

SORTING TASK EXPERIENCE PRATO

PROSPECT	CHARACTERISTICS
Light	Sun; bright light & illumination
Atmosphere	Clear
Views	Raised elevation; falling ground Short or long views Secondary real or imagined viewing points
View enhancing objects or conditions	Horizon; hill tops; mountain tops Vertical trees; off shore islands Reflective surfaces; patterns of light reflected in water
Ground surface	Smooth, bare, carpeted; snow or water
Colors	Blue or sunrise and sunset colors rich in yellow-orange-red

… cont.

SORTING TASK EXPERIENCE PRATO

PROSPECT: SAMPLE IMAGES

… cont.

OPERATIONAL DEFINITION

REFUGE

An environmental condition, situation, object, or arrangement that presents real or symbolic situations for hiding or sheltering.

Refuges provide protection from hazards.

Hides provide concealment from animate hazards.

Shelters provide concealment from inanimate hazards.

… cont.

SORTING TASK EXPERIENCE PRATO

REFUGE	CHARACTERISTICS
Refuges: Hides, Shelters	Earth refuges: caves, rocks, hollows, ravines Vegetative refuges: trees, grasses, reeds, shrubbery, vine walls Artificial refuges: houses, ships Nebulous refuges: mist, smoke
Access to hides, shelters	Easy entry: openings such as windows, doors, overhangs, stairs Frayed or broken edges to woods
Ground surface	Concave surfaces: hollows; depressions Arboreal surfaces: trees, tall grasses, bamboo
Light	Dim or dark light

… cont.

SORTING TASK EXPERIENCE PRATO

REFUGE:SAMPLE IMAGES

… cont.

SORTING TASK EXPERIENCE PRATO

OPERATIONAL DEFINITION

HAZARD

Incidents or conditions that present real or symbolic threats to life and well-being.

… cont.

SORTING TASK EXPERIENCE PRATO

HAZARD	CHARACTERISTICS
	Human animate hazards: wars, robbery, simple avoidance of another person. Non-human animate hazard: domestic or wild animals
	Inanimate hazard: wind, cold, rain, hail, snow, storms, fire, dense fog
	Instability hazards: earthquakes, volcanoes, avalanches
	Aquatic hazards: rapids, storm waves, floods
	Locomotion hazard: falling off cliffs or chasms
	Natural impediment hazards: dense vegetation, cliffs, ravines, water bodies that impede movement
	Deficiency hazards imply chronic condition that threatens well-being such as hunger, thirst, or shelter

… cont.

SORTING TASK EXPERIENCE PRATO

HAZARD:SAMPLE IMAGES

… cont.

SORTING TASK EXPERIENCE PRATO

OPERATIONAL DEFINITION

MIXED PROSPECT + REFUGE

PROSPECT

An environmental condition, situation, object, or arrangement that presents real or symbolic access to a view.

REFUGE

An environmental condition, situation, object, or arrangement that presents real or symbolic situations for hiding or sheltering.

An equal balance of each (50%) is shown in image.

… cont.

SORTING TASK EXPERIENCE PRATO

MIXED PROSPECT REFUGE: SAMPLE IMAGES

… cont.

SORTING TASK EXPERIENCE PRATO

PROSPECT IMAGES

72

37

69

52

51

Select the two that best fit the category

SORTING TASK EXPERIENCE PRATO

REFUGE IMAGES

34

6

45

56

25

Select the two that best fit the category

SORTING TASK EXPERIENCE PRATO

HAZARD IMAGES

35

33

38

58

28

Select the two that best fit the category

SORTING TASK EXPERIENCE PRATO

MIXED PROSPECT + REFUGE

16

41

63

15

40

Select the two that best fit the category

SORTING TASK EXPERIENCE PRATO

What are your top choices?

Now, lets compare today's selections with students (C) + subject experts (D)

Prospect
Refuge
Hazard
Prospect + Refuge mixed

RESEARCH RESULTS PHASE I(C)

PROSPECT sorting task results

Prospect		
Image #	Avg.Score	Score
51	6.00	576
69	5.90	555
52	4.62	458
37	4.22	351
72	3.93	327

51

69

52

37

72

RESEARCH RESULTS PHASE I(C)

REFUGE sorting task results

Refuge		
Image #	Avg.Score	Score
25	5.26	500
56	5.51	463
45	4.59	446
6	5.66	425
34	4.89	362

25

56

45

6

34

RESEARCH RESULTS PHASE I(C)

HAZARD sorting task results

Hazard		
Image #	Avg.Score	Score
38	6.86	686
35	4.77	439
33	4.85	422
28	4.72	411
58	4.37	359

38

35

33

28

58

RESEARCH RESULTS PHASE I(C)

MIXED sorting task results

Mixed		
Image #	Avg.Score	Score
63	5.03	458
15	5.17	445
16	4.83	445
40	4.82	391
41	4.79	355

63

15

16

40

41

RESEARCH DESIGN PHASE 1 (D)
Sequential Model for Image Selection

	A Investigator select	B Focus groups	C Sorting task	D Content validity
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RESEARCH RESULTS PHASE I(D)

CONTENT VALIDITY sorting task results

Prospect	Refuge	Hazard	Mixed Prospect & Refuge
# 69	# 56	# 38	# 41

69 Prospect

56 Refuge

38 Hazard

41 Mixed Prospect + Refuge

RESEARCH DESIGN PHASE II
Sequential Model for Image Effect on Health

	Phase II Experiment
Who	100 students
	controlled
What	Test effect of nature image on health
Where	Simulated in-patient hospital room
How	Psychological & physiological health data correlations with nature images
Results	Most therapeutic image(s) category

RESEARCH DESIGN PHASE II EXPERIMENT

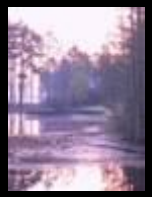
Independent Variables

Type of view (Appleton, 1975,1996)

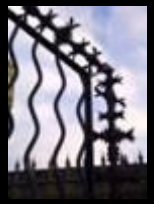
Examples

Prospect View [being away]: distant views; multiple vantage or viewing points.

Refuge View [safety]: Images allow the viewer to see without being seen.



Prospect/Refuge Mixed [view & safety]:



Hazard View [alarming]: sources of danger; exposure; no place to hide; impediments to movement.

No View [control]: The LCD digital screen will be blank.

Dependent Variables

Health status & perceived well-being: Psychological and physiological responses

Perceived well-being – therapeutic aspects developed by Cooper Marcus (1995, 1999).

Health Status – Physiological measures: continuous vital signs- blood pressure, heart rate.

Health Status – Psychological measures: McGill's Pain Questionnaire; Profile of Mood States (POMS); Satisfaction with Life Survey; Hope Scale; Zuckerman's Thrill Seeking Scale; Visual analog for pain & presence.

RESEARCH CONTINUUM

NEXT STEPS	PHASES	POPULATION	TIME
Experiment	Phase II	Test images on healthy student population	2008
Replicate study in hospital	Phase I- Sorting task Phase II- Experiment	In-patient	2009
Replicate study in multiple hospitals	Phase I- Sorting task Phase II- Experiment	In-patient	2010-2011

RESEARCH DESIGN LIMITATIONS

External generalization to other populations not possible with one study.

C O N T R I B U T I O N S

(1) Contributions to restorative/therapeutic environments research methodology & literature.

- Developing replicable photo selection process
- Developing experimental methods to test images effect on health indicators
- Adding empirical research data to interdisciplinary field

(2) Informs future study with patient population in the hospital setting.

(3) Introduce nature into healthcare settings to reduce stress and pain.

(4) Evidence based outcomes for designers and hospital personnel responsible for selecting art work for the healthcare setting.

THANK YOU