1. Neural Correlates of Nature Stimuli: An fMRI Study (Best International Research Project Award, 2014)

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5. An Empirical Examination of Patient Room Handedness in Acute Medical-Surgical Setting (Best International Research Project Award, 2010)
Neural Correlates of Nature Stimuli: An fMRI Study

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Best International Research Project Award 2014.

OBJECTIVE:
Examine whether there are unique patterns of brain activation associated with exposure to photographic sky compositions (representing nature stimuli) as compared with other positive/negative, and neutral images.

BACKGROUND:
The positive impact of nature images on health outcomes traditionally has been measured using behavioral and physiological indicators. However, there is a lack of understanding of the underlying neural mechanism that explains this positive influence.

KEY WORDS:
- Evidence-Based design
- Healing environments
- Outcomes
- Patient-Center care

METHOD:
A combination of behavioral responses and functional magnetic response imaging (fMRI) technology was used to address research questions. Ten participants belonging to five age groups were subjected to short (25 seconds) exposure of 32 images while their brain activation was monitored via the BOLD response. In a separate run, participants were subjected to extended exposure (12 minutes) of a sky composition and an image of a traditional ceiling.
RESULT:
The results show that the activation patterns produced by sky compositions and positive images were quite similar as compared to negative or neutral images. However, sky compositions also produced some unique areas of activation, including those associated with spatial cognition, the expanse of space, circadian rhythm and perceived motion. In the extended exposure condition, sky compositions tended to uniquely activate regions associated with dreaming, while traditional ceiling image uniquely activated regions that are related to face processing and potentially, visual hallucinations.

CONCLUSIONS:
Photographic sky compositions may provide considerable and meaningful benefits to the healing process. Future studies should examine the association between stress and anxiety, and activation of Cerebellar tonsil, Pyramid gray matter, Tuber cinerum, Lingual gyrus, and Cuneus regions in human brain.
Physical Design Correlates of Falls

Identifying and Examining Micro Physical Environment Factors Contributing to Patient Falls.

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Texas Tech PI: Debajyoti Pati, Ph.D.

OBJECTIVE:
The specific aim of this study is to identify and examine micro elements in the physical environment along a patient’s trip to the bathroom that are associated with incidents of patient falls, and develop design recommendations.

STUDY DESCRIPTION:
This study will examine patient falls from a micro-level physical design perspective. While it is generally accepted that fall events are costly and painful for patients, family members and the providers, most scientific studies have focused on intrinsic factors. That the physical design plays a vital role is intuitively accepted by all stakeholders, but not widely researched.

RESEARCH QUESTIONS:
The specific study questions are:
1. What are the specific design decisions pertaining to patient room design that may contribute to fall events during a patient’s trip to the bathroom? and,
2. What are their relative orders of importance?

METHOD:
This proposal adopts a multi-method approach involving motion capture experiments, video capture, and interviews, to triangulate study data. Worst case profiles of fall events will be systematically captured from the Covenant Hospital, a large tertiary care system serving West Texas. The identified scenarios will be recreated in the state-of-science Human-Centric Design Research (HCDR) Lab at Texas Tech University.
Curved versus Sharp: An fMRI-Based Examination of Neural Reactions to Contours in the Built Healthcare Environment  
Summer 2013

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Robyn Bajema  
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**OBJECTIVE:**
This study explores neural activation in adult brains in response to one fundamental attribute of the designed environment - “contours” - and explores it within the theoretical paradigm of neuroarchitecture to generate specific hypotheses for architecture and neuroscience.

**BACKGROUND:**
Based on earlier studies in non-design contexts, we hypothesize that images with sharp contours will be associated with greater magnitude of activation in the amygdala (the region of the brain associated with fear response) as compared to curved contours. However, we expect that the degree of amygdala activation associated with sharp contours will be different for objects, interiors, exteriors and landscape.

**METHOD:**
In this study 36 subjects living in Texas (18 males and 18 females) in 3 different age groups (20-29, 40-49, and 60-69), underwent an anatomical scan and a functional scan while a random sequence of images of healthcare settings (exterior, interior, landscape, objects, and control) were projected by a computer controlled visual presentation system. Additionally, each image was presented in Black and White, Sketch, High Spatial Frequency (HSF), and Low Spatial Frequency (LSF) filters. Since the purpose of the study is to focus on the pre-cognitive response judgment of the images, each image was displayed for 2 seconds in random sequence.

fMRI analysis identifies the judgments of subjects about curve or sharp objects.
FINDINGS:

- Previous study, Bar and Neta (2007) has shown that sharp object contours activate amygdala more than curve images.
- This study replicates Bar and Neta study and extends it to natural environments (landscape) and built environments (interior and exterior).
- The results of this study indicate that exposure to different kinds of curved and sharp images for 150 ms (precognitive judgment process) activate amygdala in response to sharp images for objects and landscapes, while curved images showed more activations in amygdala in interior and exterior categories.

Pictures with different filters were shown to subjects.
Inpatient Unit Flexibility: Design Characteristics of a Successful Flexible Unit

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Environment and Behavior Journal
Volume 40 Number 2 March 2008, 205-232

Best International Research Project Award 2009.

OBJECTIVE:
This study explored flexibility needs in adult medical-surgical inpatient care with the objective to understand its meaning from an end-user perspective and identify characteristics of the physical environment that promote or impede stakeholders’ requirements.

BACKGROUND:
Flexibility in healthcare design is typically addressed from an architectural perspective without a systematic understanding of its meaning from the end-user viewpoint. Moreover, the architectural perspectives have been generally focused on expandability and convertibility.

The six units with varying unit configurations

KEY WORDS:

Inpatient unit
Flexibility
Adaptability
Convertibility
Expandability
Efficiency

METHOD:
We used a qualitative design and conducted semi-structured interviews with 48 stakeholders in nursing and nursing-support services at 6 hospitals across the United States. Data was collected during September-November 2006.
McKay-Dee Hospital Center, in Ogden, Utah, with its centralized service elevators and back corridor facilitates ease of movement between units allowing service expansion options.

**FINDINGS:**
Findings suggest that adaptability influences more aspects of unit operations than convertibility or expandability. Further, physical design characteristics impact nine critical operational issues where flexibility is required, spanning nursing, environmental services, materials management, dietary services, pharmacy, and respiratory therapy.

Corner location of nurse station at Laredo Medical Center assures enhanced peer lines-of-sight at multiple caregiver workstations around it.
An Empirical Examination of Patient Room Handedness in Acute Medical-Surgical Settings

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Health Environments Research & Design Journal
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Best International Research Project Award 2010.

OBJECTIVE:
The study objective was to examine whether standardized same-handed configurations contribute more to operational performance in comparison to standardized mirror-image configurations. Based on a framework that physical environment standardization supports process and workflow standardization, thus contributing to safety and efficiency, the study examined the comparative effectiveness of the standardized same-handed configuration and the standardized mirror-image configuration.

BACKGROUND:
Patient room handedness has emerged as an important issue in inpatient unit design with many hospitals adopting the standardized same-handed room concept at all levels of patient acuity. While it is argued that standardized same-handed rooms offer greater levels of safety and efficiency in comparison to standardized mirror-image rooms, there is little empirical evidence to either support or refute the contentions.

The nine physical configurations included in the study.

KEY WORDS:
Evidence-based design
Standardization
Same-handed room
Medical-surgical unit
METHOD:
An experimental setting was developed where elements of the physical environment and approach related to the caregiver zone was systematically manipulated. Twenty RNs (10 left-handed and 10 right-handed) provided three types of care to a patient-actor across nine physical design configurations, which were videotaped in 540 separate segments. Structured interviews of the subjects were conducted at the end of each individual set of simulation runs to obtain triangulation data. Video segments were coded by nursing experts. Statistical and content analysis of the data was conducted.

RESULTS:
Study data show that standardized same-handed configurations may not contribute to process and workflow standardization, and hence safety and efficiency, any more than standardized mirror-image configurations in acute medical-surgical settings. Data suggest that a global view of the patient care environment upon entry is the most sought after familiarization factor to reduce cognitive load.